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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED BARNADIVANE WIND FARM & SUBSTATION, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 10 – POPULATION, HUMAN HEALTH & MATERIAL ASSETS

Prepared for: Barna Wind Energy (BWE) & Arran Windfarm Ltd

Date: **March 2023**

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10. POPULATION, HUMAN HEALTH & MATERIAL ASSETS

10.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) examines the potential effects of the Proposed Project on Population, Human Health and Material Assets. The Proposed Project includes both the Proposed Substation and the Proposed Wind Farm, and accompanying infrastructure, subject to separate planning consents but considered together for the purposes of this EIAR. Where differing impacts are identified for the Proposed Substation and the Proposed Wind Farm, they will be highlighted throughout the chapter i.e. if the Proposed Wind Farm is not constructed the Proposed Substation will not be constructed.

The chapter includes a description of the existing environment in respect of population, human health and material assets and considers the likely effects arising from the Proposed Project during construction, operation and decommissioning under the following elements:

- Population;
- Employment and Economic Activity;
- Land Use;
- Recreation, Amenity and Tourism;
- Human Health and Safety (including vulnerability of the project to Major Accidents and Natural Disasters; and
- Renewable Resources, Non-renewable Resources and Utility Infrastructure.

The Proposed Development potentially poses a wide range of sources of effects from which subsequent potential impacts may arise for the elements listed above. These aforementioned elements focus on human interaction with the Proposed Development. The assessment presented in this chapter draws upon the findings of other chapters throughout the EIAR, including air quality, noise, traffic & transport, landscape and visual impacts and telecommunications & aviation. These EIAR chapters are addressed separately in Chapters, 8, 9, 11, 13 and 14 of Volume 2 of this EIAR respectively. Potential effects associated with lands, soils and geology are discussed in Chapter 6 and potential effects associated with hydrology and water quality are discussed in Chapter 7 of this EIAR. In addition, other assessments are set out including those relating to potential effects on population statistics, socio-economics, changes to land use, facilities, human perception, human safety and potential effects on resources.

Material assets relating to transport infrastructure are dealt with in Chapter 11: Traffic and Transportation. Material assets with respect to natural resources are considered in Chapter 6: Lands, Soil and Geology, Chapter 7 Hydrology and Water Quality, Chapter 5: Biodiversity, and Chapter: 14 Air Quality and Climate. Assets of Archaeological, Architectural, and Cultural Heritage are considered in Chapter 12 of Volume 2 of this EIAR. The findings of these chapters in terms of the potential and residual effects on population and human health are drawn upon in this chapter.

Throughout this chapter the 'Proposed Development' refers to the elements of the project for which consent is being sought as set out in Chapter 2. The Proposed Development includes the wind turbines, internal access tracks, hard standings, permanent meteorological mast, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm and the separate onsite substation subject to a consent by An Bord Pleanála (Case reference: PL04.308208).

A separate application for an onsite 110kV substation which will form part of the Proposed Development is currently under consideration by An Bord Pleanála (Case reference: PL04.308208). The substation is also considered as part of this project and is considered within the wind farm site. The substation is a loop in -loop out substation which is proposed to connect to the overhead 110kv electrical infrastructure which traverses the site.

An alternative grid connection is also considered as part of the project. This alternative connection will be a tail-fed underground grid connection which has already been consented by Cork County Council and An Bord Pleanála (CCC Pl. Ref. 05/5907 and 11/6605; ABP Pl04.219620). The underground cable would travel from the wind farm site in a southwest direction and connect to the internal underground Carrigarierk Wind Farm cable. The Carrigarierk Wind Farm will connect to the Carrickdangan 110kV substation, which in turn will connect to the Dunmanway ESB substation (CCC reference: 17/431; ABP reference: 301563-18). This AGCR will only be constructed in the event that the Proposed Substation is not consented or is deemed unviable.

The Site includes lands in the townlands of Lackareagh, Garranereagh and Barnadivane (Kneeves). The 'project' refers to all elements including the Proposed Development and works involving the Turbine Delivery Route (enabling TDR works) which have already been permitted separately.

For assessment purposes within this chapter, the Proposed Project is separated into four distinct elements. The Proposed Wind Farm itself, the Proposed Substation, the area of the proposed alternative grid connection route cable infrastructure will be referred to as the 'AGCR' and any enabling works required for the Turbine Delivery Route will be referred to as the 'TDR'. Enabling works for the TDR have been previously consented under Cork County Council planning ref. 14/6803. These will be referred to as the enabling TDR works. There will also be enabling works required as part of changes to the site entrance. As both the AGCR and enabling TDR works are consented these will be considered for cumulative effects.

Turbines will be delivered along the TDR via the N22 Cork-Killarney road, as far as the junction with the R585 at Inchirahilly. From here, the route will follow the R585 road (Crookstown-Bantry) as far as the junction with the local road L6008, at Bengour West. From here it will follow the local road network through Lackareagh, as far as the proposed entrance to the site.

10.2 Methodology

This chapter of the EIAR which assesses potential effects on population, human health and material assets has been prepared following a review of the National Planning Framework, The Regional Spatial and Economic Strategy for the Southern Region, and the Cork County Development Plan 2022-2028.

This chapter of the EIAR has been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA), in particular, the Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, May 2022), The Government of Ireland's Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August, 2018) and the European Union's guidance document: Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report as per Directive 2011/92/EU as amended by 2014/52/EU. The determination of significance of effects is in line with the EPA's Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, May 2022).

Population

Demographic data has been sourced from the Central Statistics Office (CSO)'s Census of Ireland (2006 to 2016) records. Demographic information relating to the State, County Cork, and the 'Study Area' has been assessed to establish the existing demographic trends. The demographic analysis of the Study Area as set out in this Chapter is defined in terms of Electoral Divisions (EDs), within which the Proposed Development boundary is contained. .

The Study Area for the Proposed Development is identified in Figure 10-1.

Eircode data (2020), Geodirectory data, and planning application lists sourced from Cork County Council, An Bord Pleanála and the Department of Housing and Local Government's EIA Portal have been assessed to identify any commercial or residential receptors in proximity to the Proposed Development.

These sources were assessed in October 2022. Eircode and Geodirectory data provides locations (geographic coordinates) for registered addresses. This information was ground-proofed with a house survey where a surveyor travelled the site and identified locations of all residential receptors in proximity to the Proposed Development. A planning search was conducted to identify permitted unbuilt dwellings and planned dwellings which do not appear on Eircode or Geodirectory Databases and are not visible from ground proofing exercises.

The data gathered has informed the consideration of effects on the existing population within the immediate environs of the Proposed Development and allows for a comprehensive assessment of the potential effects on population trends which may occur during the construction, operational, and decommissioning phases of the Proposed Development.

Socio-Economics

A socio-economic profile of the existing environment was established using live register data (2019 to 2022) and Census (2016) data to outline an employment profile of the Study Area. Peer reviewed research from the Institute for Sustainable Futures and the European Wind Energy Association was referred to in order to estimate the employment which the Proposed Development has the potential to create through the construction, operation and decommissioning phases of the Proposed Development, and the effect this employment will have on the Study Area.

Land Use

Land use in the area was examined to determine potential effects on existing land use patterns which may arise as a result of the Proposed Development. According to the Corine 2018 landcover data, land use within the site comprises predominantly of 'Pastures' (category 231). There are other land use categories located on the extremities of the site with 'Coniferous Forest' (category 312) located in the north west sliver of the site. The effect of the Proposed Development was then considered with regard to these land uses.

Recreation, Amenity & Tourism

With regard to Recreation, Amenity and Tourism, Fáilte Ireland published 'Guidance on how to assess impact on tourism as part of an Environmental Impact Assessment.' This document has been considered and is referred to in Section 10.6 of this Chapter. The document informed the methodology used in assessing potential 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 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. Potential effects as a result of the Proposed Development were then considered in relation to the tourism profile, amenity and recreation facilities and attractions of the area.

Human, Health & Safety

The assessment on human health and safety has regard to the Environmental Protection Agency's (EPA US) Human Health Risk Assessment process which provides information on potential human health impact. CSO data (2016) and reports published by the Department of Health were examined to establish a baseline health profile of the Study Area. Criteria of potential effects on human health was extracted from this literature in order to assess potential effects on human health as a result of the Proposed Development. A desktop examination of potential 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. The assessment was further informed by field surveys and assessments which were completed as part of the EIA process. Potential effects to human health as described throughout this EIAR are detailed in this Chapter, including potential effects on air quality, noise and traffic and potential effects on human safety including potential for flood risk and slope failure.

Renewable Resources, Non-renewable Resources and Utility Infrastructure

An examination of material assets was carried out which includes renewable and non-renewable resources and utility infrastructure. Infrastructure and various telecommunications companies were contacted during the scoping process to identify infrastructure in the area. Potential effects on the identified material assets as a result of the Proposed Development were then examined.

As outlined in Chapter 4: EIA Scoping, Consultation, and Key Issues, prior to updating the EIAR, statutory authorities and other relevant bodies were consulted. Key items of relevance to Population, Human Health and Material Assets, as raised by these parties have been addressed and referenced within this Chapter of the EIAR where relevant.

Cumulative Effects

In relation to cumulative effects for Population, Human Health, and Material Assets, the potential effect of the Proposed Development 'in combination' with other projects, constructed or permitted has been assessed. The cumulative impact assessment provides a baseline from which a full environmental assessment of the potential effects arising from the project in combination with other plans and projects can be considered comprehensively. A search for consented and existing projects was conducted within 20km of the Proposed Development to identify developments in proximity.

20km distance was considered a reasonable zone of influence for the purpose of assessing potential cumulative effects on population, human health and material assets, considering the limited size and extent of the project, the nature of the impacts and the relatively non-sensitive receiving environment. The geographic extent of the cumulative assessment is considered on a case-by-case basis, in line with the Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission, 1999).

The 20km radius from the proposed turbines is considered relevant in line with the recommended Study Area for the zone of theoretical visibility of Proposed Wind Farm projects as set out in the Wind Energy Development Guidelines (2006) which cites the use of a 20 km radius for blade tips greater than 100m. This represents a visual Study Area for potential cumulative projects but also represents an appropriate Study Area for other potential cumulative effects including traffic, noise, water quality and air quality. It is considered that potential impacts beyond this distance are imperceptible.

Other less significant projects were also examined in close proximity to the Proposed Development where construction and operation of consented or existing projects may be effected by the construction activities of the Proposed Development. All development within 500m of the Proposed Development was examined. It is considered that potential impacts posed by small scale projects beyond this distance will be imperceptible.

Monthly planning searches from October 2022 to February 2023 were carried out to identify Proposed Development in proximity to the Proposed Development. This included a search for major infrastructure projects in the zone of influence; large residential, renewable energy or commercial developments in the zone of influence; existing and consented development within the immediate environs of the Proposed Development; as well as an examination of relevant plans and policies for the area as detailed in Chapter 3 Policy. Cumulative impact is further detailed in Section 10.10.

Mitigation Measures

Where potential significant effects have been identified, mitigation measures have been proposed. Residual impact is then considered which details potential effects following implementation of mitigation measures.

Do-nothing Scenario

A do-nothing scenario is outlined, in line with requirements of the EIA Directive 2014 which states: *"The environmental impact assessment report to be provided by the developer for a project should include a description of …. an outline of the likely evolution of the current state of the environment without implementation of the project"*. This section details the receiving environment as it would be in the future should the Proposed Development not be carried out.

References

Finally, all material which contributed to the establishment of the baseline conditions and assessment of potential impacts are referenced in Section 10.2, in line with requirements set out in the EIA Directive 2014.

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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Legend

- Development Planning Boundary
- Study Area Boundary
- Proposed Substation
- Turbine Hardstandings
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Tracks-Existing
- Tracks-Proposed
- Alternative Grid Connection Route
- Turbine Delivery Route

Kilometers
0 0.25 0.5 1

TITLE: Site Location			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	10-1		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:30000	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

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10.3 Population

Population relates to the people living in an area. Assessing the demographic makeup of an area can reveal insightful information to guide environmental considerations of a Proposed Development. This section provides an overview of the population profile for the Study Area, County Cork and the State between the Census years of 2006 and 2016 in order to create a baseline demographic profile of the receiving environment and identify potential effects on demographic trends arising as a result of the Proposed Project.

The Study Area for the purpose of assessing population has been chosen based on Electoral Divisions (EDs) within which the Proposed Project is located. As illustrated in Figure 10-1, this encompasses the EDs as set out in Table 10-1:

Table 10-1: Electoral Divisions Associated with the Study Area

Electoral Divisions of the Study Area
Teerleton (Cork) (Proposed Development)
Greenville (Cork) (Proposed Development)

10.3.1 Existing Environment - Population

Population Growth

The Proposed Development is located in the townlands of Lackareagh, Garranereagh and Barnadivane (Kneeves), near Teerelton, Co. Cork. The nearest national route, the N22, is the main arterial route for traffic commuting between Cork and Killarney and is located approximately 5 km to the north at its closest. The nearest regional route, the R585 between Cork and Bantry, passes 1 km to the south of the site. The R585 connects to the N22 at Crookstown, 5 km to the east of the site. The Proposed Development is located on a ridgeline within the Bride River valley.

According to Eircode data 2022, there are 100 no. receptors located within 1.5km of the turbine locations[1]. Of these 100 receptors, 19 no. are also registered as commercial (farmsteads). There are no permitted dwellings yet to be constructed within 1.5km of the proposed turbine locations. Figure 10-2 illustrates the residential receptors within the vicinity of the Proposed Development according to Eircode (2022) and Geodirectory data. This information is supported by the ground proofing survey and planning application search.

Population statistics for the State, Cork and the 'Study Area' are set out in Table 10-2.

[1] Based on straight line distance from centre of the proposed turbine locations

Table 10-2: Population Statistics 2006-2016

Area	Population			% Population Change		
	2006	2011	2016	2006-2011	2011-2016	2006-2016
State	4,239,848	4,588,252	4,761,865	8.2%	3.8%	12.3%
Cork	361,877	399,802	417,211	10.5%	4.4%	15.3%
Study Area	3,430	3,757	3,879	9.5%	5.9%	16.0%

The data presented in Table 10-2 demonstrates that the population of the Study Area increased by 9.5% between the 2006 and 2011 census years, with stronger growth in comparison to the State. This growth greatly reduced between 2011 and 2016, in line with both the State and County figures, however the population growth rate of the Study Area remained higher than the State and County averages between 2006 and 2016.

Population Density

The population density recorded within the State, County Cork and the Study Area during the 2006, 2011 and 2016 Census are set out hereunder in Table 10-3. Overall, the Study Area has a low population density associated with sparse rural settlement. This is in contrast to the State-wide and County-wide population densities which show greater figures, with the Cork population density over double that of the Study area and the State population density approximately 2.9 times that of the Study Area.

Table 10-3: Population Density between 2006 – 2016 (Persons per square kilometre)

Area	Population Density (Persons per square kilometre) 2006	Population Density (Persons per square kilometre) 2011	Population Density (Persons per square kilometre) 2016
State	62	67	70
Cork	48.2	53.3	55.6
Study Area	22.8	27.4	26.5

Population - Existing Environment

As demonstrated above, the Study Area of the Proposed Development is a rural area, with low population numbers and low population density when compared to the averages of the State and County Cork. Overall, the Study Area has a low population density associated with its rural nature.

The baseline population statistics presented above do not show any substantial rise or fall in population trends and therefore the Study Area is considered stable with respect to population growth and population density.

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\P21-143_GIS_Fig10_2_Nearby_Residential_Receptors_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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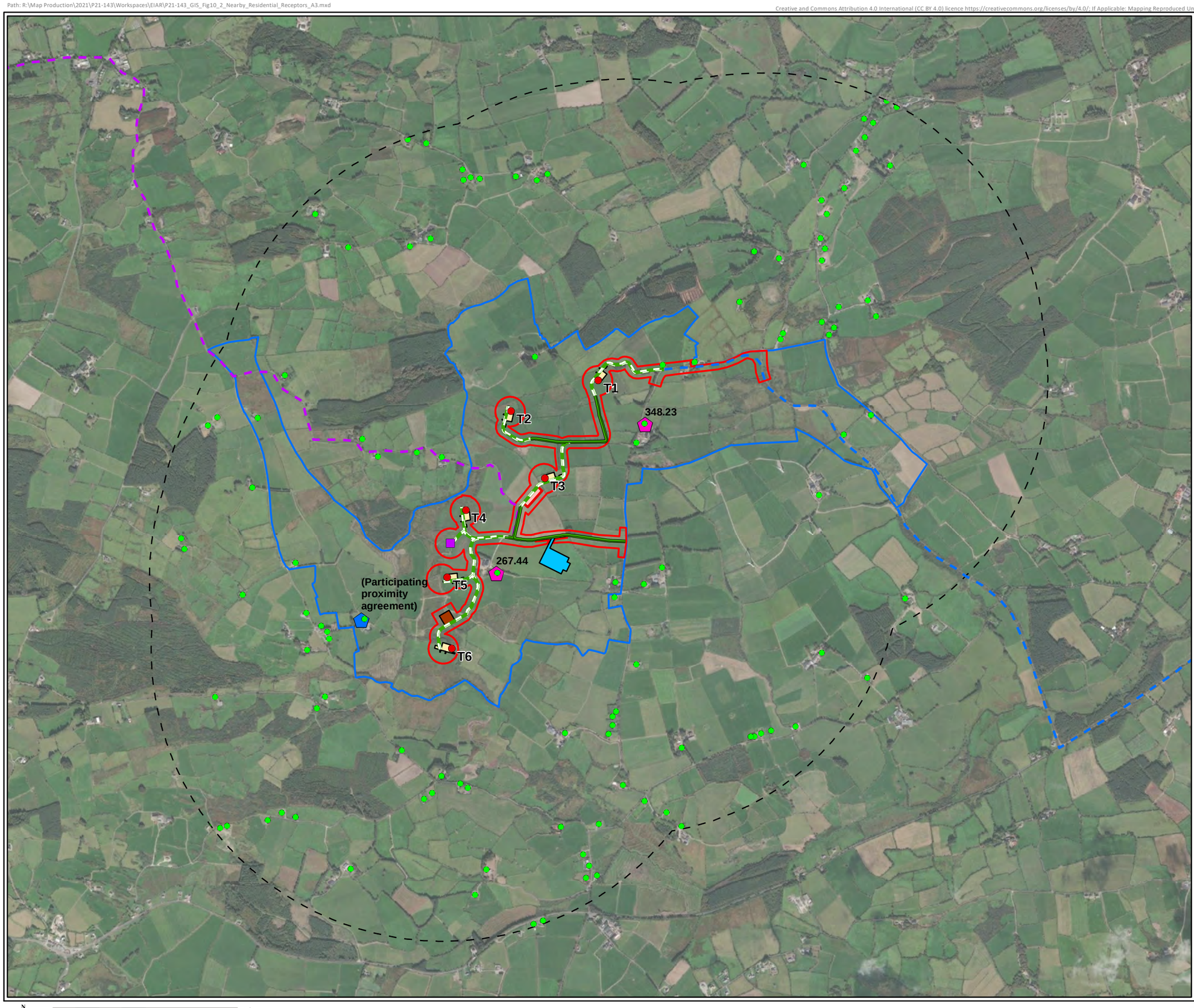

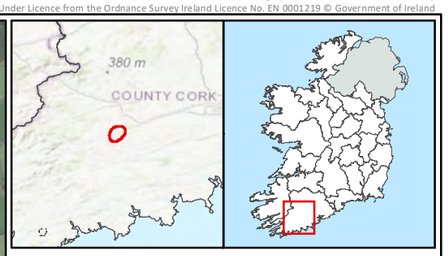

Legend

- Development Planning Boundary
- Study Area
- Proposed Substation
- Turbine Hardstandings
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- Proposed Turbine Layout
- 1.5km Planning Boundary Buffer Zone
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- Tracks-Proposed
- Alternative Grid Connection Route
- Turbine Delivery Route
- Receptors within 1.5km of Development Boundary

TITLE: Nearby Residential Receptors			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	10-2		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:20000	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

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N W E S

Kilometers
0 0.25 0.5 1

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\P21-143_GIS_Fig10-3_PopDensityofProjectArea_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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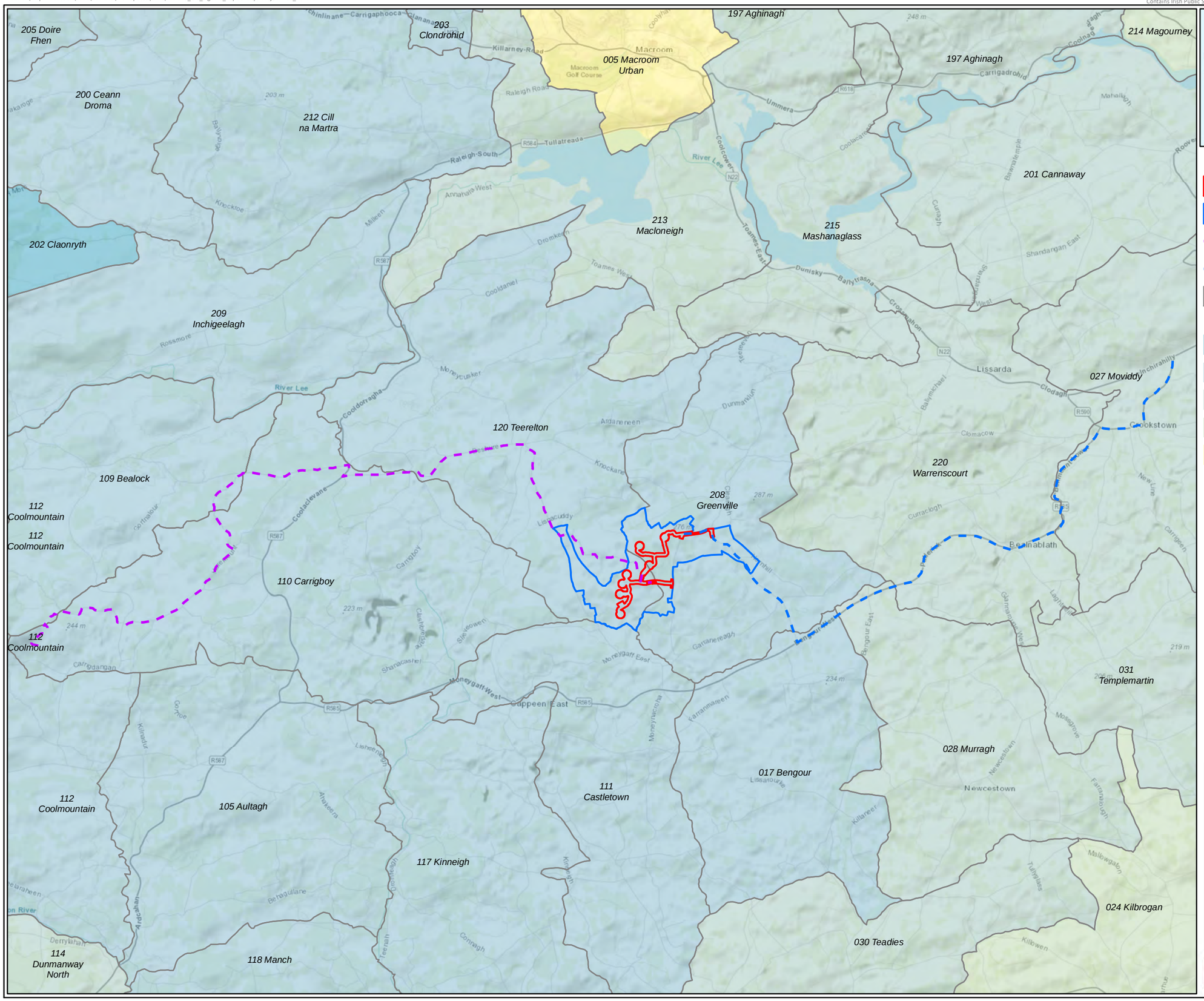

Legend

- Development Planning Boundary
- Study Area Boundary
- Alternative Grid Connection Route
- Turbine Delivery Route
- Electoral Divisions

Population Density 2016 by ED (sqkm):

- 1 - 10
- 11 - 25
- 26 - 50
- 51 - 75
- 251 - 500

TITLE:	Population Density of the Project Area (2016)
PROJECT:	Barnadivane Wind Farm and Substation, Co. Cork
FIGURE NO:	10-3
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.
SCALE:	1:70000
REVISION:	0
DATE:	23/02/2023
PAGE SIZE:	A3

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10.3.2 Potential Impacts on Population - Construction

The potential effects on population and demographic trends arising from the Proposed Development during its construction phase relate to potential population increase or decrease.

During the construction phase of the project, it is likely that many of the workers travelling to the site will do so from outside of the area. This is due to the large numbers expected to be employed at the project site. It is expected that workers from the locality within the immediate area will also be employed, however, the relatively low population available in the area, combined with a high percentage of employed persons, as identified in Table 10-5 in the following section, indicates that there is a limited available work force in the project area and therefore many workers employed at the construction site are likely to travel from the surrounding catchment of County Cork.

This will give rise to short-term/brief population growth at the site during working hours. This is associated with the direct employment of construction workers, trades people, labourers and specialised contractors. The construction phase of the Proposed Development has potential to create between approximately 27-30 jobs. In a best-case scenario, the Proposed Development has the potential to create between approximately 40-70 jobs. The employment projections are set out in Section 10.4.2.

The population of the Study Area recorded in the 2016 Census was 4,663 persons. An estimate of between 27 and 70 jobs associated with the construction works has potential to increase the population of the Study Area by between 0.5% and 1.5%. However, this increase is associated with daily construction works and therefore the population of the Study Area will increase daily during construction hours and return back to normal outside of working hours resulting in a brief increase to population numbers on a daily basis over the 12-18 month construction period. As construction work is temporary, it is unlikely that workers will take up residence in the area of the Proposed Development, however, it is likely that some workers will stay in accommodation within the Study Area or at nearby towns. Overall, this will result in a slight, short-term increase in population resulting in a slight, short-term neutral impact.

It is proposed to construct the Proposed 110kV Substation and connect to the overhead 110kV line via a loop in-loop out connection. The AGCR may be utilised if the overhead option is considered unviable and the Proposed Substation will not be built. The proposed AGCR will be considered cumulatively as the works relating to the AGCR pertain to an existing permission.

In relation to the works along the TDR, the only works that will be carried out are those that were granted permission under P.A. Ref. No. 14/6803 (the enabling TDR works). This permission was for construction of a private roadway, approximately 150 metres long, from the R585 to the L6008 and all associated works. These works are to be considered as a cumulative impact of the Proposed Development and not as part of the Proposed Development.

It is unlikely that permanent effects to population at the Proposed Development site will occur, in terms of changes to population trends or population density as a result of the construction phase.

10.3.3 Potential Impacts on Population - Operational

Once constructed, it is envisaged that there will be direct and indirect employment associated with the operational phase of the Proposed Development. Opportunities for mechanical-electrical contractors and craftspeople to become involved with the operation and maintenance of the project will arise.

As set out in Section 10.4.3 it is expected that the operational phase of the Proposed Development could create between 8 and 10 long term jobs (with an installed capacity of approximately 25MW). These jobs include operations and maintenance, back-office support and indirect jobs created by other activities related to installed turbines including IPP/utilities, consultancy firms, research institutions, universities and financial services.

Although only a small proportion of these jobs are likely to be based in the site, the operational phase will give rise to temporary, slight population increase at the Proposed Development site during working hours as a result of operations and maintenance occurring at the site. This effect is expected to be brief and imperceptible.

10.3.4 Potential Impacts on Population - Decommissioning

The decommissioning phase of the Proposed Development is described in Section 2.7 of this EIAR and provides for the removal of turbines and associated infrastructure from the site. The potential effects associated with the decommissioning phase in relation to population trends will be similar to those associated with construction phase but of a reduced magnitude.

A construction crew will be required for dismantling the infrastructure and carrying out remediation where necessary. As the decommissioning of the development is expected to be less intensive than the construction phase, it is likely that less construction workers will be required for this phase. During the decommissioning phase, the population of the Site will increase daily during working hours and return back to normal outside of working hours.

As removal works will be of relatively short duration, it is unlikely that workers will take up residence in the Study Area, however, it is likely that some workers will stay in accommodation within the area of the Proposed Development Site or nearby towns, resulting in potential brief to temporary population increases. The decommissioning phase is therefore likely to result in a slight, brief/temporary increase in population at the Proposed Development Site and nearby towns, producing a slight temporary impact on population trends. It is not likely that the decommissioning phase will result in any permanent impact to population in terms of changes to population trends and density.

As mentioned previously, it is It is proposed to construct the 110kV Substation and connect to the overhead 110kV line via a loop in-loop out connection. The AGCR may be utilised if the overhead option is considered unviable and the substation will not be built. The proposed AGCR will be considered cumulatively as the works relating to the AGCR pertain to an existing permission.

10.3.5 Mitigation Measures - Population

As there are no significant effects predicted on population trends and population density, no mitigation measures are required.

10.3.6 Residual Impacts - 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, neutral impact on population statistics due to population increase in Study Area during working hours.

As per the assessment of operational impacts, any impact to the population of the Proposed Development site in terms of changes to population trends 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 Project.

10.4 Socio-economics, Employment and Economic Activity

This section provides a comprehensive overview of the socio-economic, employment and economic activity associated with the receiving environment, including the Study Area, together with County Cork and the State as a whole. This provides an understanding of the overall socio-economic profile of the receiving environment and the potential effects arising from the Proposed Project.

10.4.1 Existing Environment – Socio-economic, Employment and Economic Activity

Live register data (CSO, 2019-2022) provides information relating to the number of people registering for Jobseekers Benefit, Jobseekers Allowance, or for various other statutory entitlements. The figure is useful to gauge unemployment estimations for an area; however, it is noted that the Live Register data includes part-time workers (working up to three days per week), seasonal workers and casual workers who are entitled to Jobseekers Benefit or Jobseekers Allowance and therefore, cannot be relied upon entirely for conclusive employment data. Furthermore, 2020 saw a significant increase in unemployment throughout the country due to the COVID-19 pandemic and 2022 saw an increase in use of Department of Social Protection supports due to the conflict in Ukraine. Live register data is presented below in Table 10-4 for the State and County Cork.

Table 10-4: Live Register Data for County Cork and the State September 2019– September 2022

	September 2019	September 2020	September 2021	September 2022
County Cork	15,142	16,580	13,516	14,784
State	183,783	211,492	162,898	179,055

Source: CSO & data.gov.ie

Between 2019 and 2022 unemployment trends in County Cork and the State as a whole experienced a reduction, where numbers recorded on the live register dropped by 3% throughout the State and 2% in County Cork. Likely part-due to the negative economic impact associated with COVID-19, numbers of people on the live register increased from 2019 to 2020 by 15% across the State and by 10% across County Cork. These numbers have since decreased by 23% across the State and by 19% across County Cork between September 2020 and September 2021.

Taking account of 2016 Census population figures as detailed in section 10.3.1, this represents an unemployment rate of 3.8% across the State, and an unemployment rate of 3.5% across County Cork, indicating a greater average unemployment for the State as a whole compared to County Cork.

The Census (2016) has published figures of Ireland's working population aged 15 to 64 for Electoral Divisions, allowing for a greater insight into the Study Area's socio-economic profile.

The basic indicator for employment is the proportion of the working-age population aged 15-64 who are employed. Table 10.5 sets out the percentage of the total population aged 15+ who were in the labour force during the 2016 Census. Table 10.5 also sets out those who were not in the labour force, this includes students, retired people, those unable to work, persons performing home duties etc.

Table 10-5: Economic Status of the Total Population Ages 15+ in 2016

	Status	State	County Cork	Study Area
% of Population aged 15+ which are:	At Work	53%	56%	56%
	First time job seeker	1%	1%	0%
	Unemployed	7%	5%	4%
	Student	11%	11%	13%
	Home duties	8%	9%	10%
	Retired	15%	14%	14%
	Unable to work	4%	4%	3%
	Other	0%	0%	0%

As set out in Table 10-5, overall, the principal employment status in 2016 across the State, County Cork and the Study Area is 'at work' with between 53% and 56% at work across the State, County Cork and the Study Area. The Study Area has the same percentage of persons 'at work' compared to County Cork, while the percentage of persons 'at work' within the Study Area is slightly higher than the State with 3 percentage point difference. Unemployed persons within the Study Area is lower than that of the State and County while the Study Area has similar percentage of retired persons compared to the State and County.

The Census (2016) also indicates the employment composition of Electoral Divisions, an important element of the socio-economic profile of an area. As detailed in Table 10-6, the employment sectors for each of the areas show similarities with professional services and commerce and trade being the largest share across the State, County and Study Area. The Study Area has a higher percentage of employment from the Manufacturing Industry compared to the State and County.

Overall, the economic profile of the Study Area does not show any major disparities when compared to the National and County-wide average socio-economic statistics. County Cork has a slightly lower unemployment rate compared to the State. This is reflected in the unemployment numbers recorded in the 2016 Census for the Study Area which are on average lower than the State. In general, the baseline conditions of the Study Area shows healthy socio-economic characteristics.

Employment activities within the Study Area consists mainly of agriculture and forestry as detailed in Section 10.5: Land Use., Manufacturing industries, commences and trades and professional services.

Table 10-6: Industry Distribution by Area

Persons at Work by Industry	State	County Cork	Study Area
Agriculture forestry & fishing	4%	16%	15%
Building & construction	5%	6%	6%
Manufacturing industries	11%	10%	15%
Commerce and trade	24%	21%	18%
Transport and communications	9%	6%	7%
Public administration	5%	6%	5%
Professional services	24%	24%	26%
Other	18%	12%	8%

10.4.2 Potential Impacts – Socio-economics, Employment and Economic Activity - Construction

The site preparation and installation of the Proposed Development will create temporary employment within the Study Area.

According to the European Wind Energy Association's (EWEA) Report 'Wind at Work' (2009), 1.2 jobs per MW are created during installation of wind energy projects. Using this figure, a projection of approximately 30 jobs could be created as a result of the construction of the Proposed Development (for an installed capacity of approximately 25MW).

The Sustainable Energy Authority of Ireland' 2015 report 'A Macroeconomic Analysis of Onshore Wind Deployment to 2020' puts direct construction jobs from wind farm developments at 1.07 jobs per MW. Using this figure, a projection of approximately 27 jobs could be created as a result of the construction of the Proposed Development (for an installed capacity of approximately 25MW). In addition, Chapter 11 of this EIAR identifies a best-case scenario of 70 jobs created

Therefore, considering the minimum and maximum figures, it is estimated that between approximately 27 and 70 staff/contractors could be employed during the construction phase of the Proposed Project. The employment of tradespeople, labourers, and specialised contractors for the construction phase will have a direct, short-term significant, positive effect on employment in the Study Area.

It is likely that there will be direct employment for people living in the Study Area who may be qualified for construction related roles. Materials will also be sourced in the general locality where possible. This will assist in sustaining employment in the local construction trade.

Furthermore, local businesses in the nearby villages of Kilmurry, Crookstown & Newscestown and the town of Macroom further north will likely receive a slight indirect positive economic impact due to the influx of workers to the area who will require services such as shops and food places.

As a result, the construction phase of the Proposed Development will have a short-term, significant positive effect on the employment profile of the Study Area and a short-term slight, positive effect on local businesses and services in the nearby towns and villages in proximity to the Study Area.

10.4.3 Potential Impacts – Socio-economics, Employment and Economic Activity - Operational

10.4.3.1 Economic Value & Employment Potential

The Proposed Project will contribute to achieving Ireland's energy targets as set out in the Climate Action Plan 2023, which has a target of 80% of electricity generated from renewable sources by 2030. With a target increase in onshore wind of 8.2GW by 2030, the Proposed Development has the potential to contribute to 0.3% of this total.

The Sustainable Energy Authority of Ireland's (SEAI) Energy in Ireland 2020 Report states that wind energy provided Ireland with 32% of its electricity in 2019, up 4% from 2018. The use of renewables in electricity generation reduced CO2 emissions by 4.8 million tonnes in 2019, avoiding approximately €297 million in fossil fuel imports for that year. It is estimated that wind energy alone resulted in the avoidance of approximately €248 million in fossil fuel imports and avoided 3.9 million tonnes of CO2 emissions in 2019. These savings will continue to rise with the installation of further wind energy and other renewable energy developments. Increased renewable electricity production as a result of the operational phase of the Proposed Development will likely have a positive medium to long-term economic effect due to the cost savings associated with the avoidance of fossil fuel imports. This will also act cumulatively with other consented and existing renewable energy projects throughout the country in providing cost savings, as discussed in section 10.10.

Once the Proposed Development is constructed, it is envisaged that there will be direct and indirect employment associated with the operational phase of the Proposed Development. Opportunities for mechanical-electrical contractors and craftspeople to become involved with the operation and maintenance of the project will arise.

According to the European Wind Energy Association's (EWEA) Report 'Wind at Work' (2009), 0.4 long-term jobs are created per MW of total installed capacity. These jobs include operations, maintenance, back office support and indirect jobs created by other activities related to installed turbines including IPP/utilities, consultants, research institutions, universities and financial services.

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 7 studies examined. SEAI's 2015 report 'A Macroeconomic Analysis of Onshore Wind Deployment to 2020' estimates 0.34 jobs per MW for operations and maintenance of new wind turbines and in the wider electricity supply sector.

Therefore, based on these estimates and considering an installed capacity of up to 25MW, the operational phase of the Proposed Development could produce between 8 and 10 jobs.

Although only a small proportion of these jobs are likely to be directly based at the Proposed Development Site, it is likely that the indirect jobs the operational phase will support, such as consultants, research institutions, universities and financial services, will provide an indirect, long-term slight, positive effect to the employment profile of the wider economy of County Cork.

It is likely that there will be direct employment available for people living in the Study Area who may be qualified for jobs associated with operation and maintenance. It is therefore considered that the operational phase of the Proposed Development has potential for an indirect, long-term slight, positive effect on employment in the Study Area, nearby towns and wider County Cork.

Rates and development contributions paid by the developer will contribute significant funds to Cork County Council which will likely be used to improve the services available to the people of the County. Business rates will also contribute significantly throughout the lifetime of the Proposed Wind Farm. General council services will benefit from rates and development contributions which include road upkeep, fire services, environmental protection, street lighting, footpath works etc., along with other local community initiatives and supports. This is likely to have a slight positive, long-term effect on resources of the Local Authority during the operational phase.

The terms of the Renewable Energy Support Scheme (RESS) states that all projects looking for support under the new RESS will need to meet pre-qualification criteria including the provision of a community benefit fund. This is discussed further in the following section.

10.4.3.2 Proposed Community Benefit Scheme

Based on the current Renewable Energy Support Scheme (RESS) guidelines it is expected that for each megawatt hour (MWh) of electricity produced by the wind farm, the project will contribute €2 into a community fund for the first 15 years of operation of the Proposed Development. If this commitment is changed in upcoming Government Policy, the fund would be adjusted accordingly. The value of this fund would be directly proportional to the electricity generated by the wind farm.

The Community Benefit Fund belongs to the local community. The premise of the fund is that it should be used to bring about significant, positive change in the local area. To make this happen, the first task will be to form a benefit fund development working group that clearly represents both the close neighbours to the project as well as nearby communities. This group will then work on designing the governance and structure of a community entity that would administer the Community Benefit Scheme.

Should the Proposed Wind Farm not be developed under RESS, a community benefit scheme is proposed to provide a fund of €40,000 per annum over the lifespan of the Proposed Wind Farm based on the current estimated generating capacity. This will equate to potential funding of €1 million to the local community which is a substantial contribution.

The number and size of grant allocations will be decided by a Community Fund liaison committee with various groups and project benefiting to varying degrees depending on their funding requirement.

The provision of the Community Benefit Scheme will have a significant long-term, positive effect on the socio-economic profile of the Study Area and wider area, providing a regular payment to near neighbours of the project and providing for projects which will benefit the community as a whole, bringing long-term socio-economic benefits.

10.4.3.3 Property Values

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

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

The main conclusion of this study is as follows:

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

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

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

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

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

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

A relatively new study issued in October 2016 'Impact of wind Turbines on House Prices in Scotland' (Heblich, et al. 2016) was published by Climate Exchange, Scotland's independent centre of expertise on climate change which exists to support the Scottish Governments policy development on climate and the transition to a low carbon economy.

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

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

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

10.4.4 Potential Impacts – Socio-economics, Employment and Economic Activity - Decommissioning

The potential impacts associated with the decommissioning phase in relation to socio-economics, employment and economic activity will be similar to those associated with the construction phase but of a reduced magnitude.

A construction crew will be required for dismantling the infrastructure and carrying out remediation where necessary. As the decommissioning of the project is expected to be less intensive than the construction phase, it is likely that less construction workers will be required for this phase. During the decommissioning phase employment opportunities will be available at the Proposed Wind Farm Site and outlying areas. The influx of construction workers to the Site will have a temporary to short-term indirect positive impact on local businesses and services contributing to the local economy, similar to that of the construction phase but of lesser magnitude.

There will be a temporary to short-term slight, positive impact to socio-economics, employment and economic activity in the site associated with the employment of construction workers within the vicinity of the Proposed Development during the decommissioning phase.

10.4.5 Mitigation Measures – Socio-economics, Employment and Economic Activity

Given that potential effects of the Proposed Development at construction, operation and decommissioning phases are predominantly positive in respect of socio-economics, employment and economic activity, no mitigation measures are considered necessary.

10.4.6 Residual Impacts – Socio-economics, Employment and Economic Activity

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

As detailed in section 10.4.3.2, the Community Benefit Fund associated with the Renewable Energy Support Scheme (RESS) will provide a significant long-term, positive impact to the socio-economic profile of the Site and greater community.

The terms of the Community Benefit Fund will also promote social-inclusion across the community as a minimum of 40% of the funds shall be paid to not-for-profit community enterprises, focusing on UN Sustainable Development Goals, 4, 7, 11 and 13 which include education, energy efficiency, sustainable energy and climate action.

Rates payments and development contributions have potential to improve service provision throughout County Cork and in the local area. This will likely have a slight positive, residual effect on resources of the Local Authority.

A positive residual effect is also envisaged in that wind energy decreases the cost of electricity. A cost benefit analysis of wind energy in Ireland was published by Baringa in association with IWEA in January 2019 (Baringa, 2019). The study indicates that the more renewable energy (low-cost) produced, the less dependency on fossil fuels is required which costs more per MW. The report states that the savings involved with wind energy outweigh the amount of funding provided to support wind energy through the public service obligation levy, therefore the more wind power produced, the less electricity will cost. The Proposed Project will result in a slight long-term positive impact for electricity users throughout the country.

Overall, the residual effect associated with socio-economics, employment and economic activity as a result of the Proposed Development is considered long-term significant and positive.

10.5 Land Use

This section assesses the compatibility of the land use of the Proposed Development with the current land use. The determination of the potential effects on the existing land use is assessed for the construction, operation and decommissioning phases of the Proposed Project. Potential impacts on sensitive land uses in the area of the Proposed Development have been examined in this section.

10.5.1 Existing Environment – Land Use

The Proposed Development site is located in an area of private agricultural lands. The lands of the site are accessed by existing agricultural entrances. The site has existing agricultural tracks currently used for farming activities. The primary agricultural activity at the site is pasture farming. The greater area of the site consists of pastoral lands, one-off housing and farmsteads. There are 113 dwellings located within 1.5km of the proposed turbines.

There are thirteen wind farms located within 20km of the site. These consists of:

1. Garranereagh Wind Farm 1km (E) – 4 wind turbines
2. Cleanrath Wind Farm 14km (W) – 9 wind turbines
3. Carrigarierk Wind Farm 11km (W) – 5 wind turbines
4. Derragh Wind Farm 17.6km (W) - 6 wind turbines
5. Shehymore Wind Farm 16km (W) – 11 wind turbines
6. Knockeenboy Wind Farm 18km (SW) – 7 wind turbines
7. Kilpatrick Wind Farm 18km (SE) – 1 wind turbine
8. Kilvinane Wind Farm 11.5km (SW) – 3 wind turbines
9. Currabwee Wind Farm 18km (SW)– 7 wind turbines
10. Coomatallin Wind Farm 19km (SW) – 4 wind turbines
11. Bawnmore Wind Farm 14km (N) – 5 wind turbines
12. Dromleena Wind Farm 17km (SW) – 9 wind turbines
13. Carriganimma Wind Farm 19km (NW) – 6 wind turbines

According to the Corine Landcover Database (2018) and confirmed by investigation surveys carried out during environmental assessment, the site consists of the following landcover:

- 231 – Pastures.
- 312 – Forest and semi-natural areas.

The Corine Landcover mapping for the Proposed Development, TDR and AGCR is illustrated in Figure 10-4.

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\P21-143_GIS_Fig10-4_CorineLandCover_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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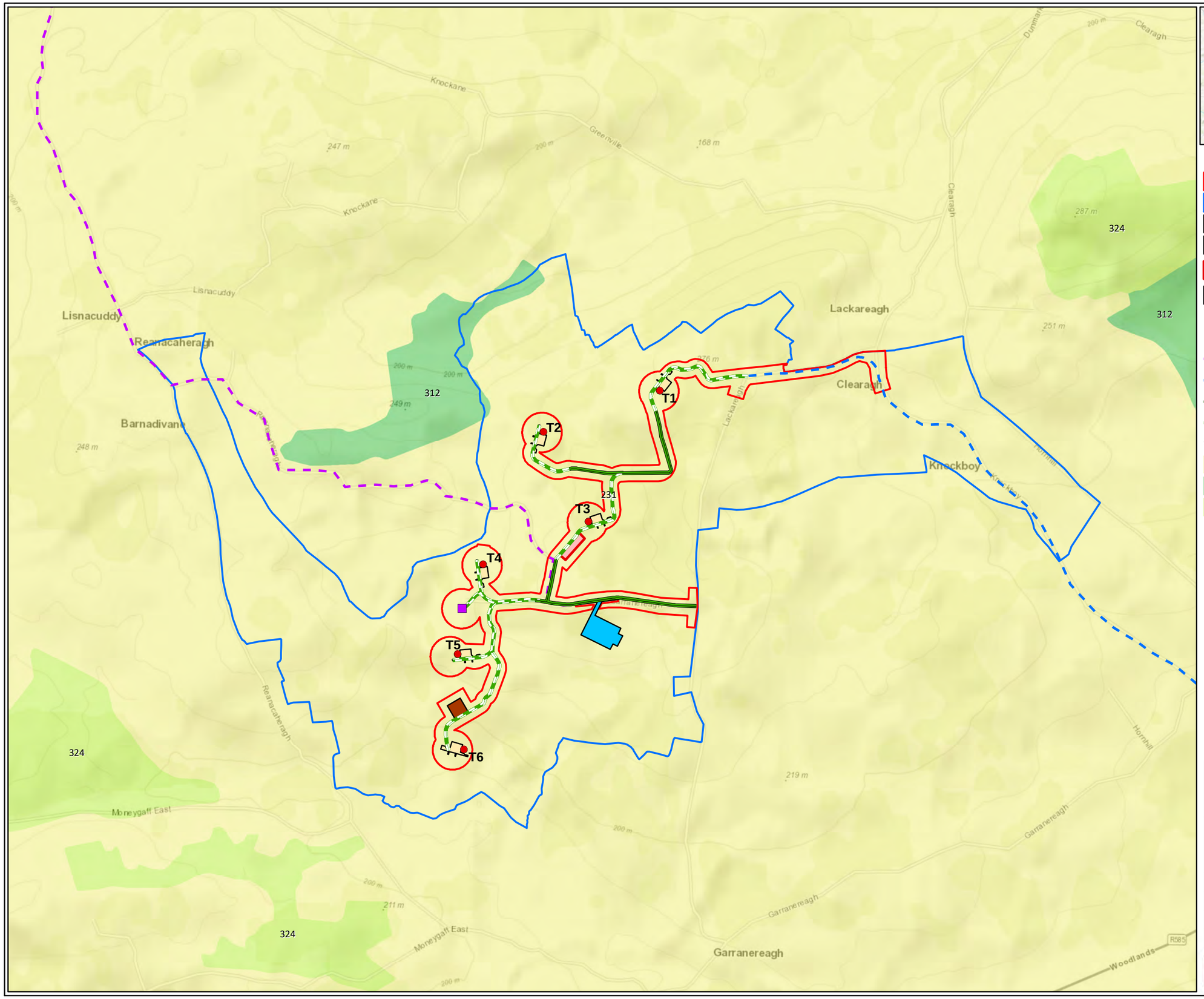

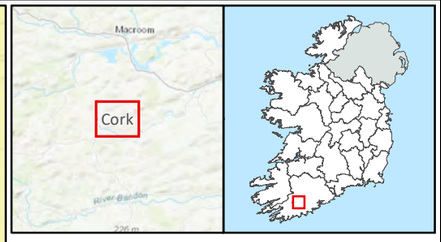

Legend

- Development Planning Boundary
- Study Area Boundary
- Proposed Substation
- Turbine Hardstandings
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Alternative Grid Connection Route
- Turbine Delivery Route
- Tracks-Existing
- Tracks-Proposed

CORINE Land Cover 2018

- 231 Pastures
- 312 Coniferous forest
- 324 Transitional woodland scrub

TITLE: Corine Land Cover			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	10-4		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:15000	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

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10.5.2 Potential Impacts – Land Use - Construction

The existing land-uses in proximity to the Proposed Development will remain broadly unchanged during the construction phase of the project, however, some land use in close proximity to the site will be temporarily disrupted during the construction phase as a result of construction activity. The land uses located within the footprint of the Proposed Development will be disrupted in the long-term due to the presence of the Proposed Wind Farm. This will occur on the agricultural lands and treelines where turbines and associated infrastructure are proposed.

There are 6 no. proposed wind turbines and associated hardstandings located on agricultural lands. The access track associated with the met mast at the south of the site passes adjacent an active farmyard.

Approximately 1.38km of existing agricultural access tracks will be upgraded and utilised during the construction phase. Approximately 2.35km of new site access tracks are proposed at the development site. All access tracks will be a minimum of 6m wide along straight sections but wider at bends as required. This will result in temporary interruption to these land uses during the construction phase. Agricultural practice can continue during the construction phase, however, sections of lands adjacent the proposed infrastructure may be temporarily inaccessible due to construction activities. For example, cut and fill operations across the Proposed Development site will disturb the soil and are likely to impact agriculture practices during construction. The temporary compound area will be utilised during the construction phase for construction activity, storage, parking and welfare facilities. This is likely to have a temporary slight negative effect on agricultural practice at the site. This will occur on involved landowners' lands only.

TDR node upgrade activity has potential for slight, brief to temporary impacts to land use in proximity to each node. The majority of works have potential to cause non-significant brief impacts where street furniture and wall removal, temporary load bearing surfaces and vegetation trimming is required. Brief impact may also occur to the supply of electricity and telecommunications to homes and businesses as a result of temporary removal of services to accommodate turbine delivery. Turbine delivery may effect land use temporarily or briefly due to the transportation of oversized loads on the public road. This is likely to have a brief to temporary slight, negative impact on residential land-use due to noise nuisance as a result of use of machinery. The effects of noise is further considered in Chapter 9 – Noise and Vibration.

10.5.3 Potential Impacts – Land Use - Operation

Given that the footprint of the Proposed Development will occupy a small proportion of the development site area when operational, as illustrated in Figure 10-2, it is anticipated that there will be minimal impact on existing land uses arising from the operational phase.

The operational phase of the Proposed Development will result in a change of land use in areas where access tracks, turning heads wind turbine bases, hardstanding areas, met mast, substation, and drainage infrastructure will be located. The Proposed Substation, if constructed, will result in the loss of approximately 9,288m^2/0.9ha of agricultural land. The Proposed Wind Farm and accompanying infrastructure will occupy approximately 16,620m^2/1.6ha of land, and the proposed upgraded access tracks will occupy approximately 2.35km of land. The lands affected are currently in use for agriculture.

The area of lands which will change use from open field agricultural use to wind farm use will be approximately 2.7 hectares. This will consist of turbine hardstands, access tracks, turning heads and meteorological mast. This will result in a long-term slight negative impact on available agricultural lands, however, the proposed upgraded and new access tracks can be utilised for the ongoing agricultural activity on the site and therefore is likely to result in a slight positive impact to agricultural land use at the site.

The operational phase of the Proposed Development will not negatively impact on agricultural practices on lands adjacent to the site. There are no peer reviewed studies which indicate that wind energy development has a negative impact on the health of livestock. There are numerous examples of renewable energy developments throughout the country and internationally where livestock coexist and routinely graze in the same fields as wind turbines (AWEA, 2019). This includes the Boolard Wind Farm and Rathnacally Wind Farm. Existing land-use, such as grazing livestock or crops can continue on the site as normal. As such, there will be no likely significant negative impact to agricultural practice as a result of the Proposed Development.

It is unlikely that the TDR route will be required during the operational phase of the project, unless in the unlikely event a turbine component requires to be transported for replacement or repair. In this case, there is potential for slight temporary negative impact on residential land-use due to noise nuisance as a result of the use of machinery.

10.5.4 Potential Impacts – Land Use – Decommissioning

The decommissioning phase of the Proposed Development is described in Section 2.7 of this EIAR and provides for the removal of turbines and associated infrastructure from the site. The potential effects associated with the decommissioning phase in relation to land use will be similar to those associated with construction phase but of a reduced magnitude.

Decommissioning works will include removal of all above ground structures including the turbines and met mast. The on-site substation will be taken in charge by ESB/EirGrid and therefore will remain in situ to become part of the electricity network. The turbine foundations will be covered over and allowed to re-vegetate naturally and access tracks will be left in situ to continue to be used for agricultural and forestry land uses. This will result in a direct benefit from the new and upgraded access tracks left in situ throughout the site resulting in a long-term slight, positive impact on forestry and agricultural uses at the site.

The decommissioning works will require a construction crew on-site and may cause temporary disruption to surrounding land uses. Removal of infrastructure from the site may temporarily affect agricultural practices. During decommissioning works agricultural access tracks within the site may be in use by construction crews which may temporarily hinder access to areas of agricultural pasture. Impact to these land uses during the decommissioning phase is expected to be temporary to short-term slight, negative.

10.5.5 Mitigation Measures – Land Use

Mitigation measures for land use are primarily related to preliminary design stage, which has allowed for the prevention of unnecessary or inappropriate ground works or land use alterations to occur. The construction and operational footprint of the Proposed Development has been kept to the minimum necessary to avoid negative effects on existing land uses as so far as possible.

Existing agricultural tracks have been incorporated into the design in order to minimise the construction of new tracks and roads and minimise the removal of agricultural and forested areas. Where new access tracks are required, these have been sensitively designed in order to minimise impact on agriculture so far as possible. Electricity cables will be installed underground in or alongside access tracks to avoid negative effects on agricultural practices.

The construction and decommissioning works will be planned and controlled by a Construction and Environmental Management Plan (CEMP). The CEMP for the construction phase is included in Appendix 2.2 of Volume 2 of this EIAR.

This provides details on day to day works and methodologies. As part of these works, the public and other stakeholders will be provided with updates on construction activities which will affect access to lands. This will be communicated to members of the public through a community liaison officer employed for the duration of the construction period.

10.5.6 Residual Impacts – Land Use

Once mitigation measures are in place and the appropriate design measures are incorporated, as proposed, there will be no significant adverse negative residual effects arising from the project on land use.

Benefits to agricultural practices as a result of the upgrading of access tracks throughout the site will cause a slight, positive impact for agriculture at this location.

Other infrastructure that will remain in situ includes turbine foundations and hardstands which will be covered over and re-vegetated. The on-site substation will be taken in charge by ESB/EirGrid. The residual impact on land use as a result of the in-situ hardstands, foundations and substation following decommissioning is likely to be permanent, imperceptible and neutral due to the small extent of land affected.

10.6 Recreation, Amenity and Tourism

This section provides a comprehensive overview of the recreation, amenity and tourism value for the Study Area, County Cork and the State in order to assess the potential effects arising from the Proposed Development. As 2020 and 2021 experienced an unprecedented negative impact on international tourism due to the COVID-19 epidemic, this section focuses on statistics from 2018 and 2019 as a reasonable scenario for tourism potential for the County. The preparation of this section had regard to Fáilte Ireland's 'EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects'.

10.6.1 Existing Environment – Recreation, Amenity and Tourism

Tourism is one of the major contributors to the national economy and is a significant source of full time and seasonal employment. As 2020 and 2021 have experienced an unprecedented negative impact on international tourism due to the COVID-19 epidemic, this section focuses on statistics from 2018 and 2019 as a reasonable scenario for tourism potential for the County. Tourism statistics for 2019 as published by Fáilte Ireland (March 2021) state that overseas tourism grew by 0.7% on 2018 figures with over 9.7 million visitors. Expenditure from overseas tourism was estimated to be down by -0.8% remaining strong at €5.1 billion. Fáilte Ireland's 2019 survey results indicate the top 5 most popular recreation activity for tourists in Ireland:

1. Hiking and cross-country walking
2. Cycling
3. Golf
4. Equestrian
5. Angling

Fáilte Ireland's Regional Tourism performance figures for 2018 and 2019 are set out in Table 10-7 and 10-8 for the Southwest Region which includes Counties Cork and Kerry. As demonstrated in the tables, tourism numbers for the Southwest Region for both over-seas and domestic trips fell by 6% between 2018 and 2019, however, maintaining a similar revenue with a fall of 0.8% revenue between 2018 and 2019.

Table 10-7: Southwest Regional Performance (Tourists in 2018)

Region		Britain	Mainland Europe	North America	Other Areas	All Overseas	Northern Ireland	Domestic Trips
South West[2]	Tourists (000s)	616	924	803	169	2,512	72	2,401
South West	Tourist Revenue (€mn)	179	347	384	77	987	48	474

Table 10-8: Southwest Regional Performance (Tourists in 2019)

Region		Britain	Mainland Europe	North America	Other Areas	All Overseas	Northern Ireland	Domestic Trips
South West	Tourists (000s)	541	877	751	166	2,335	38	2,316
South West	Tourist Revenue (€mn)	166	371	335	98	970	25	511

Tourism is considered an important industry for County Cork. Chapter 10: Tourism, of the Cork County Development Plan (2022), identifies that:

'Tourism in County Cork is based on its rich natural and built heritage. The principle features of the area's tourism product include mountains and upland habitats; rivers and lakes, over 1100 km's of scenic rugged coastline and peninsulas with long stretches of sandy beaches, fertile agricultural land and many upland peatlands and forest/woodland areas. These natural assets combined with a rich heritage of archaeological and historical sites, built environment including manor homes and gardens, attractive towns and villages offer a unique tourism product.' [Section 10.5.2: Tourism Product in County Cork].

Top attractions in the Cork area in 2019, listed by Fáilte Ireland, include Blarney Castle, Doneraile Park and Fota Wildlife Park, which are 42km, 67km and 58km from the Proposed Development, respectively. Other recreation and tourism amenities located in the area of the Proposed Development include:

- Michael Collins Memorial, c. 12.4km from the Proposed Development.
- Absolute Airsoft Cork, c. 13.3km from the Proposed Development.

[2] County Cork and County Kerry

- Kilmichael Ambush Site, c. 9.3km from the Proposed development.
- Warrenscourt Forest Recreational Area, c. 9.1km from the Proposed Development.
- Independence Museum Kilmurry, c.11.4km from the Proposed Development.
- Lee Valley Equestrian Centre, 13.8km from the Proposed Development.
- Castlemore Riding School, c.16.8km from the Proposed Development.
- Cloughduv GAA Club, c. 17km from the Proposed Development.
- Carrigaphooca Castle, c. 16km from the Proposed Development.
- Macroom Town Park, c. 13.5km from the Proposed Development.
- Macroom Playground (Clós Sugratha Maigh Chromtha, c. 13km from the Proposed Development.
- Macroom Golf Club, 14.4km from the Proposed Development.
- Kinneigh round tower, c. 9.6km from the Proposed Development.
- St Oliver Plunketts (Cork) GAA Club, c. 18.6km from the Proposed Development.

Overall, the most significant recreation activity/attractions in proximity to the Proposed Development is trail walking, historical areas, equestrian activity and sports grounds. The Proposed Development situated in proximity to an area of historical significance with Michael Collins Memorial located c.12.4km from the site.

There are three recorded archaeological monuments located within the Study Area (Ringfort – rath CO083-078, Ringfort – rath CO083-078 and Enclosure CO094-036). The ringfort in the northern section of the site is not located near to any proposed structures such as turbines and therefore its immediate setting will not be impacted. Due also to the intervening hill between the ringfort and the nearest proposed turbine (T2), it is highly unlikely that all of the turbine will be visible. The worst-case scenario is that some of the blade tip will be visible from the monument. In accordance with the general policies of the County Development Plan, no direct impact on the monument will take place and the zone of archaeological potential of the monument will be maintained.

The enclosure in the southern end of the site is now located within a mature forestry plantation and no access to the site is currently possible. The setting of the monument has been compromised as a result of the forestry plantation and is not currently visible in the landscape. No visual impacts on this monument are therefore likely as a result of the Proposed Development.

A high density of recorded archaeological monuments occurs within the 2km study zone surrounding the Proposed Development site. The majority of the monuments, both outside and within the site boundary date to the Early Medieval Period and primarily consist of ringforts, souterrains and enclosures.

The presence of the former monuments is indicative of the use of the surrounding landscape in the Early Medieval period and for settlement purposes. The prehistoric period is also represented by megalithic tombs, standing stones and fulachta fia, albeit fewer in number.

It is highly likely that the proposed turbines will be visible from many areas within the 1.5km Study Area although any significant impact will be negated by distance alone and also by the small scale of the Proposed Development. The Zone of Theoretical Visibility (ZTV) would also suggest that 5-6 turbines will be seen from most areas within the 1.5km Study Area.

The ZTV model assumes the worst-case scenario in that only bare earth topography is taken into account. All vegetation, boundaries, tree cover, buildings are excluded from the model.

Community Facilities & Services

Community facilities and services in proximity to the Proposed Development are centred on towns and villages in the area. The closest settlement to the Proposed Development is the village of Kilmurry, located 9km to the east, Crookstown, located 12km to the east, Macroom, located 15km to the north and Newcestown located 12km to the southeast. Facilities and services within the settlements include food places, public houses, convenience stores, guest houses, national schools, churches, GAA Clubs, nursing home, and a golf club etc.

10.6.2 Potential Impacts – Recreation, Amenity and Tourism - Construction

There are no significant tourism attractions located in proximity to the Proposed Development, and as such, the construction phase of the Proposed Development is not expected to impact on major tourism attractions, tourism numbers or tourism revenue.

The proposed works associated with the site and will avoid negative impact on nearby community facilities, town centre services and amenities due to lack of proximity. The proposed works do not interact with nearby recreation and tourism amenities as listed in section 10.6.1 and therefore there are no expected direct impacts on these features.

The TDR passes the existing Garranereagh Windfarm and through the village of Crookstown County Cork. During turbine delivery there is potential for indirect impact to town/village centre services due to the transportation of large and bulky loads through the settlements. This will likely be as a result of traffic calming measures during the escorting of the turbine components. Temporary accommodation works will not be required in these settlements and therefore impact is likely to be temporary to brief, negative and non-significant. Mitigation is set out in Chapter 11: Traffic and Transportation in order to avoid indirect impact so far as possible on town and village centre facilities and services during turbine delivery.

10.6.3 Potential Impacts – Recreation, Amenity and Tourism - Operation

In relation to tourism and wind energy development, the Wind Energy Development Guidelines for Planning Authorities (2006) states the following:

"Wind Energy developments are not incompatible with tourism and leisure interests, but care needs to be taken to ensure that insensitively sited wind energy developments do not impact negatively on tourism potential. The results of survey work indicate that tourism and wind energy can co-exist happily"

The Draft Revised Wind Energy Development Guidelines (2019) also maintain that wind energy development "can co-exist happily" with tourism and go on to detail the survey results as also cited in the 2006 guidelines.

The survey results referred to in the guidelines is Sustainable Energy Ireland's (SEI's) Attitudes towards the Development of Wind Farms in Ireland (2003). The SEI (now SEAI) report found that the overall attitude towards wind farms is positive.

"*The overall attitude to wind farms is very positive, with 84% of respondents rating it positively or very positively (Chart 2.6). Only 1% rate it negatively ('fairly bad'), with 14% not having an opinion either way, and no one rating wind farms 'very negatively'. Interestingly, this time it is those from Dublin who are most positively disposed; this could arise from the fact that Dubliners are less likely than others to have a wind farm built in their locality."*

Where negative attitudes were voiced towards wind farms, the visual impact of the turbines on the landscape was the strongest influence. The report also notes however that the findings obtained within wind farm catchment areas showed that impact on the landscape is not a major concern for those living near an existing wind farm (SEI, 2003).

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

"Over 8 in 10 recognise wind as a non-polluting source of energy, while a similar number believe it can make a significant contribution to Ireland's energy requirements. People therefore seem to have little difficulty with the concept of wind energy".

This report concludes that based on the detailed study of attitudes, it is clear that there is *"widespread goodwill towards wind farm developments".*

More recent independent research conducted by BiGGAR Economics in 2016 entitled 'Wind Farms and Tourism Trends in Scotland', assessed the relationship between wind farm developments and the tourist industry in Scotland. An analysis was carried out on eight local authorities which had witnessed a higher increase in wind energy developments than the Scottish average. Of the eight local authorities, five also witnessed a greater increase in sustainable tourism employment than that of the National Average with just three witnessing less growth than the Scottish average. The research concluded that at local authority level, no detrimental impact occurred on the tourism sector as a result of wind energy development, rather that, in the majority of cases, sustainable tourism employment performed better than other areas.

Fáilte Ireland conducted research titled "Visitor Attitudes on the Environment", which was first published in 2008 and updated in 2012. The research surveyed both domestic (25%) and overseas (75%) holidaymakers to Ireland to determine their attitudes to wind farms. The survey results indicate the following:

- Most visitors are broadly positive towards the idea of building more wind farms on the island of Ireland. A minority (one in seven) were negative towards wind farms in any context.
- Despite the fact that almost half of the tourists interviewed had seen at least one wind farm on their holiday, most felt that their presence did not detract from the quality of their sightseeing.
- The largest proportion (45%) said that the presence of the wind farm had a positive impact on their enjoyment of sightseeing, with 15% claiming that they had a negative impact.
- Almost three quarters of respondents claimed that potentially greater numbers of wind farms would either have no impact on their likelihood to visit or would have a positive impact on future visits to the island of Ireland.

The updated survey, 2012, found that over half of tourists surveyed had seen a wind turbine while travelling the country. The survey results were as follows:

- 32% said that the wind turbines enhanced the surrounding landscape.
- 47% said that it made no difference to the landscape.
- 21% claimed wind turbines had a negative impact on the landscape.
- 71% of respondents claimed that potentially greater numbers of wind farms would either have no impact on their likelihood to visit or have a positive impact on future visits to the island of Ireland.

In 2011, Fáilte Ireland's guidelines on tourism and environmental impacts stated in Chapter 4 titled 'Project factors affecting tourism' that *'some types of new or improved large scale infrastructure – such as roads – can improve the visitor experience – by increasing safety and comfort or can convey a sense of environmental responsibility – such as wind turbines.'*

Further research has been undertaken in Scotland in 2011 by Visit Scotland who have produced a Wind Farm Consumer Research report which showed that 83% of those surveyed said a wind farm would not affect their decision about where to stay when on a holiday or short break in Scotland. Also, against a backdrop of increased wind farm deployment, Visit Scotland's statistics showed the number of visits to Scotland last year and the amount of spending by visitors both increased while their 'Scotland National Visitor Survey 2011' made no mention of the issue of wind farms affecting tourism in Scotland.

From a review of literature as detailed above, it is concluded that the majority of tourists surveyed had a generally positive view on wind energy development in the landscape. Further analysis of the potential visual impact of the Proposed Development is described in Chapter 15 – Landscape and Visual.

One of the more notable areas of outdoor recreation within the Study Area is the Gearagh Nature Reserve, which is situated south of Macroom along the banks of the River Lee. The proposed turbines will be revealed to varying degrees along the distant ridge and are viewed adjacent to the existing Garranereagh turbines, which are only partially visible here. Nonetheless, whilst the Proposed Development will marginally increase the intensity of built development in the local surrounds of the Gearagh, the Proposed Development will not result in any notable detraction in the scenic amenity afforded here, which is currently influenced by a range of other anthropogenic land uses such as major route corridors, a large industrial manufacturing facility and the existing Garranereagh turbines. Visual impact on Gearagh Nature Reserve as outlined in Chapter 15 is therefore likely to be 'Slight'.

View Point (VP) 3 as detailed in Chapter 15 shows the view of the Proposed Development and its surroundings taken from R584 east of the Gearagh at Sleveen West. Whilst the turbines will increase the intensity of built development in this view, they will not appear incongruous, especially in the context of the existing Garranereagh turbines and other anthropogenic features. Considering the research on perception of wind energy projects as set out above, it is unlikely that the Proposed Development will negatively impact on the enjoyment of the amenity trails at the Gearagh Nature Reserve. As set out in Chapter 15, the potential visual impact on the Ballyhoura Way trail is considered to be slight negative long term.

In relation to community facilities and amenities, the small villages of Copeen and Teerelton are the most proximate settlements to the Proposed Development. As detailed in Chapter 15: Landscape & Visual, a 'slight' impact of significance is associated with the settlement of Copeen which will have no potential for views of the Proposed Development due to a low ridge located to the north/northwest of the small village. Furthermore, even from the eastern outskirts of the town along the R585 regional road (represented by VP19), the Proposed Development will be heavily screened by stacked dense vegetation in the direction of the site. The settlement of Teerelton will be almost entirely screened from the Proposed Development, even from the near distance of under c.2.8km. This is not expected to negatively impact on the amenity of the community facilities and services in the village. If consented, a community benefit fund will be associated with the project, as detailed in Section 10.4.3.2. There is potential for the community facilities of the villages of Copeen and Teerelton to benefit from the community fund if the Proposed Development is consented, potentially resulting in a long-term moderate, positive impact to recreation and amenity in the villages.

Overall, it is expected that the operational phase of the Proposed Development will have a non-significant neutral impact on recreation and tourism in the area due to the distance of the proposed turbines from significant features. The provision of the community benefit fund will likely have a moderate positive long-term impact on the amenities of the nearby residents.

10.6.4 Potential Impacts – Recreation, Amenity and Tourism - Decommissioning

The decommissioning phase of the Proposed Development is described in Section 2.7 of this EIAR and provides for the removal of turbines and associated infrastructure from the site. The potential impacts associated with the decommissioning phase in relation to recreation, amenity and tourism will be similar to those associated with construction phase but will likely be of a reduced magnitude.

Decommissioning works will include removal of above ground structures including the turbines, mountings and fencing and will see increased traffic in the area of the Proposed Development. The decommissioning works will not interact with nearby recreation and tourism amenities and therefore it is expected that the decommissioning phase of the Proposed Development will have a non-significant impact on recreation, amenity and tourism.

10.6.5 Mitigation Measures – Recreation, Amenity and Tourism

Mitigation measures for recreation, amenity and tourism are primarily related to the preliminary design stage of the Proposed Development, which has allowed for the prevention of unnecessary or inappropriate development to occur that would significantly affect any recreational or tourist amenity. In designing the Proposed Development, careful consideration was given to the potential impact on landscape amenity. The magnitude of visual impact on the landscape is assessed in Chapter 8 – Landscape and Visual.

The most significant potential for tourism and recreation activity at the site and surrounding area was identified as trail walking, historical areas, equestrian activity and sports activities (sports grounds). During the construction, operation and decommissioning phases it is unlikely that the Proposed Development will impact on these activities as the proposed site and works do not directly interact with any facilities or trails associated with these tourism and recreation activities, therefore mitigation is not required.

Chapter 11: Traffic and Transportation sets out mitigation measures for potential effects associated with increased traffic volumes of the construction and decommissioning phases of the Proposed Development which may have an indirect impact on recreation and amenity in the area of the Proposed Development and also potential indirect impact on town centre and village centre facilities and services along the TDR during transportation of turbine components.

10.6.6 Residual Impacts – Recreation, Amenity and Tourism

There are no expected significant, adverse impacts to recreation, amenity and tourism in the surrounding area as a result of the Proposed Development due to the distance from major tourism attractions and the short-term/temporary nature of the construction works.

The community benefits gained during the operational phase due to the capital investment in the area are expected to last beyond the decommissioning phase resulting in a likely residual permanent significant, positive impact on the amenities of the area of the wind farm site.

10.7 Human Health & Safety

This section provides a comprehensive overview of the health profile of the receiving environment and the State, in order to provide for the assessment of potential impacts that the Proposed Development may have on human health. An assessment of peer reviewed literature has been carried out to provide a sound, scientific basis for the potential impacts arising from the Proposed Development.

10.7.1 Existing Environment – Human Health & Safety

Human health in relation to this assessment refers to the nature and possibility for adverse health effects on humans. In the context of existing human health, The Department of Health (2019) has published a report entitled 'Health in Ireland, Key Trends 2019' which provides statistics relating to human health in Ireland over a 10 year period (2009 to 2019). Generally speaking, Ireland's population has a high level of good health as demonstrated in self-evaluation statistics included in Census data (see Table 10.9 below).

From analysis of the health statistics below, the general health of the Study Area is recorded as very good or good. This is in line with State and County-wide averages. The Study Area has approximately the same averages, as County Cork with 88% and 91% of respondents of the 2016 Census indicating that their health was 'good' or 'very good' and 1% indicating their health was 'bad'. Less than 0.5% of respondents indicated their health was 'very bad' for these areas. This shows a slight greater percentage of persons 'very good' general health when compared to the State which has 7 percentage points lower than that of the Study Area. Overall, the Census data indicates that the population of the Study Area is generally in good health.

Table 10-9: Population by General Health (Census, 2016)

General Health (Census 2016)	State	County Cork	Study Area
Very Good	59%	61%	66%
Good	29%	27%	25%
Fair	8%	8%	6%
Bad	1%	1%	1%
Very Bad	0%	0%	0%
Not Stated	3%	3%	2%

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. The closest Seveso site is located approx. 15km south at Carberry Food Ingredients Balineen, Co. Cork.

From a review of the GSI Landslide Susceptibility database, the Proposed Development and infrastructure locations are mainly located within areas of 'Low' susceptibility with some areas to the west located in areas of 'Moderately Low' and 'Moderately High' susceptibility. No historical records of landslide activity have been identified within or close to the site, according to the GSI database. According to the OPW (floodinfo.ie), no major flood incidents are recorded at the site.

There is no record of wildfires at the Proposed Development.

10.7.2 Potential Impacts – Human Health & Safety - Construction

The construction phase of the Proposed Development has potential to create health and safety hazards for both construction workers and the general public. This is as a result of construction activities and the associated impacts including increased traffic, transport of heavy or bulky materials, noise emissions, dust emissions, construction activities on public roads, excavation and general site-safety.

Aspects of the construction works that may present health and safety issues, are as follows:

- General construction site safety (e.g., slip/trip, moving vehicles etc.);
- Lifting of heavy loads overhead using cranes;
- Working at heights;
- Working in confined spaces;
- Ground conditions and soil stability;
- Road safety due to increased traffic numbers and transport of oversized loads to the site along turbine delivery routes and proposed haul routes;
- Pedestrian safety;
- Installation of electrical cables on-site and in the public road corridor;
- Potential emissions impacting air quality and noise;
- Substation construction involving high voltage electricity;
- Working with electricity during commissioning.

The works proposed as part of the Proposed Development will pose a risk to construction workers on-site especially during adverse weather conditions. This has potential to cause significant impact on human health in the short term during the 12-18-month construction period throughout the construction site if proper construction and safety protocols are not followed. Construction and accommodating works taking place on the public road and the delivery of heavy/bulky goods (TDR) and machinery on narrow roads may lead to temporary limited access to farmlands, forestry lands and residential properties creating a potential hazard. This may cause a potential temporary moderate, negative impact to public safety along the TDR route during the construction phase.

The delivery of turbine components will require transport of heavy/bulk goods via the N22, R585 before entering the L6008 local road on approach to the Proposed Wind Farm site. Due to the abnormality of the turbine components, there is potential human safety risks associated with their delivery including traffic safety and pedestrian safety at special manoeuvring points. This has potential for temporary significant, negative impacts to human safety during the delivery of turbine components if unmitigated.

Potential impacts on air quality has the potential to affect human health. This has been assessed in Chapter 14: Air and Climate Change. No significant impacts on air quality have been identified with regard to the emissions of construction related traffic. The impact on air quality due to emissions from construction works (construction machinery) has been identified as not significant.

Therefore, the construction phase of the Proposed Development would not have a significant impact on air quality.

The potential impacts from noise during the construction phase at the Proposed Development site is expected to have a temporary slight, negative impact on nearby residential receptors. The works will remain below the construction noise limit of 65dB as detailed in Chapter 9: Noise and Vibration. Vibration is not expected to be perceived at nearby residences.

Potential impacts on human health associated with land, soils and geology during the construction phase relate to potential contamination of ground water which can be caused by hydrocarbon spills, siltation and landslide. Furthermore, landslides have the potential to cause injury and fatality. As set out in Chapter 6: land, Soils and Geology, the site is mainly within an area of 'Low' susceptibility to slope failure with 'Moderately Low' and Moderately High' areas to the west. Following implementation of mitigation the risk of slope failure at the site is considered to have little risk. The site shows no history of landslides.

Potential impacts on human health associated with hydrology during the construction period relate to standing water caused by blocked drains, water collecting in excavated areas or diverted water resting in an undrained area. This has potential to cause drowning with particular risk to on-site staff. There is also potential for blockage of roadside drains causing potential hazard to traffic. A flood risk identification for the site has been prepared and has assessed that the site is not in any flood zone, as detailed in Chapter 7: Hydrology and Water Quality. As a result, the Proposed Development is expected to have a non-significant impact on flood risk in the surrounding area of the site. The increased surface water runoff due to addition of hardstanding areas is not significant and these flows are further reduced with the proposed drainage system. The likely impact of flooding on human health and safety as a result of construction activities is therefore temporary and imperceptible.

Overall, if unmitigated, the construction phase of the Proposed Development has potential for temporary significant, negative impact to human health and safety for construction workers and members of the public in proximity to the site, if proper construction safety protocols and traffic management are not applied. Mitigation measures to prevent potential impact to human health and safety are set out in Section 10.7.5. Once mitigation is put in place, impacts to human health and safety during the 12 – 18-month construction period are unlikely.

10.7.3 Potential Impacts – Human Health - Operation

10.7.3.1 Site access and usability of lands

During the operation phase of the Proposed Development, there is potential for impact to human health and safety if appropriate mitigation measures are not put in place.

Potential human safety issues can occur due to the falling ice as a result of the icing of turbine blades in cold weather conditions. This is unlikely to present safety problems as wind turbines are fitted with anti-vibration sensors. These sensors detect any imbalance caused by the icing of the blades. The sensors will cause the turbine to shut down until the blades are de-iced prior to beginning operation again.

Potential impacts to the safety of operation and maintenance staff are associated with working at heights, working at steep gradients or uneven ground, moving vehicles and machinery and working with high-voltage electricity. Properly qualified staff will be employed at the site and safety protocol will be followed at all times. Therefore, impact to the safety of operation and maintenance staff is unlikely.

Under normal conditions, operational wind turbines do not pose a threat to public safety or the safety of animals. Section 5.7 of the Wind Energy Development Guidelines (2006) states the following:

> *"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. There is a very remote possibility of injury to people or animals from flying fragments of ice or from a damaged blade."*

There are no expected works to take place along the TDR during the operational phase of the Proposed Development. If maintenance works are required in these areas or bulk equipment is required to be delivered, proper safety protocols will be put in place in line with the mitigation measures set out in section 10.7.5. Therefore, impact to human safety on public roads during the operation phase is unlikely, as a result of the Proposed Development.

10.7.3.2 Health and Safety Standards and Procedures

As part of the human health assessment of the Proposed Development, an analysis of peer-reviewed literature on potential health impacts arising from wind energy projects was undertaken. Anecdotal reports were identified of negative health impacts in people living in close proximity to wind turbines, however, the literature review demonstrates that peer-reviewed research generally does not support these statements.

The review of literature did not find any published, credible scientific sources that link wind turbines to adverse health effects. The key documents that have been taken into consideration with respect of potential effects on human health are as follows:

- 'Wind Turbine Sound and Health Effects - An Expert Panel Review', American Wind Energy Association and Canadian Wind Energy Association, December, 2009.
- '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.
- 'A Rapid Review of the Evidence', Australian Government National Health and Medical Research Council (NHMRC) Wind Turbines & Health, July 2010.
- 'Position Statement on Health and Wind Turbines', Climate and Health Alliance, February 2012.
- 'Wind Turbine Health Impact Study - Report of Independent Expert Panel' – Massachusetts Departments of Environmental Protection and Public Health, 2012.
- '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.
- 'Wind Turbine Noise and Health Study', Health Canada, 2014.
- 'Wind Turbines and Human Health', Front Public Health, 2014
- 'Position paper on wind turbines and public health', Health Service Executive, February 2017
- 'Environmental Noise Guidelines for the European Region', World Health Organisation, 2018

'Infrasound' has been cited as a cause of potential health impacts as a result of wind turbine development. This is discussed in detail in Chapter 9: Noise and Vibration, Section 9.2.4. It states that infrasound is noise occurring at frequencies below that at which sound is normally audible, that is, less than about 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. In this frequency range, for sound to be perceptible, it must be at very high amplitude, and it is generally considered that when such sounds are perceptible then they can cause considerable annoyance. However, wind turbines do not produce infrasound at amplitudes capable of causing annoyance as outlined in the following paragraphs.

The UK Department of Trade and Industry study, 'The Measurement of Low Frequency Noise at Three UK Windfarms' (2006) , concluded that:

> *"infrasound noise emissions from wind turbines are significantly below the recognised threshold of perception for acoustic energy within this frequency range. Even assuming that the most sensitive members of the population have a hearing threshold which is 12 dB lower than the median hearing threshold, measured infrasound levels are well below this criterion."*

It goes on to state that, based on information from the World Health Organisation, *'there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects'* and that *'it may therefore be concluded that infrasound associated with modern wind turbines is not a source which may be injurious to the health of a wind farm neighbour'*.

In terms of noise, operational wind farm noise levels meet the derived night and daytime noise limits at all Noise Sensitive Locations (NSLs) surrounding the Proposed Wind Farm, bar receptor H34 and H36[3] which exceed the daytime and night-time noise levels. Also, for some NSLs a new source of noise will be introduced into the soundscape and it is expected that there will be a long-term moderate significance of impact on the closest dwellings to the Proposed Wind Farm. This is for properties west of the Proposed Wind Farm.

Following a review of literature regarding the potential impact of operational wind farms on human health, it is concluded that there is no scientific consensus to support an association between negative health impacts and responsible wind turbine development. The operational phase will therefore likely have a long-term, imperceptible, neutral impact on human health in proximity to the site.

With respect to safety, only trained and licenced employees will be permitted to access the turbines. Appropriate training will be provided for potential emergencies; therefore, the operational phase of the Proposed Development will have a negligible impact on public health and safety.

10.7.3.3 Potential Health and Safety Impacts from Shadow Flicker

The assessment has been undertaken by Colum Breslin and reviewed by Jim Singleton, both of TNEI Group. Colum Breslin has experience of shadow flicker modelling in Ireland and the UK and has worked on both pre-construction (feasibility and planning applications) and complaints investigations. He is skilled in shadow flicker prediction and the specification of appropriate mitigation measures.

[3] Both H34 and H36 owned by participating landowners and will be decommissioned prior to construction.

Jim Singleton is the Team Manager of TNEI's Environment and Engineering Team. He has 15 years environmental consultancy experience and has worked on wind turbine developments ranging from single turbines to over 300 MW developments, including feasibility studies, authoring of ES chapters, compliance surveys, due diligence and appeals.

Shadow Flicker Background

Under certain combinations of geographical position, wind direction, weather conditions and times of day and year, the sun may pass behind the rotors of a wind turbine and cast a shadow over the windows of nearby buildings. When the blades rotate and the shadow passes across a window, to a person within that room the shadow appears to 'flick' on and off; this effect is known as 'shadow flicker'. The phenomenon occurs only within buildings where shadows are cast across a window aperture, and the effects are typically considered up to a maximum distance of 10 times the rotor diameter from each wind turbine.

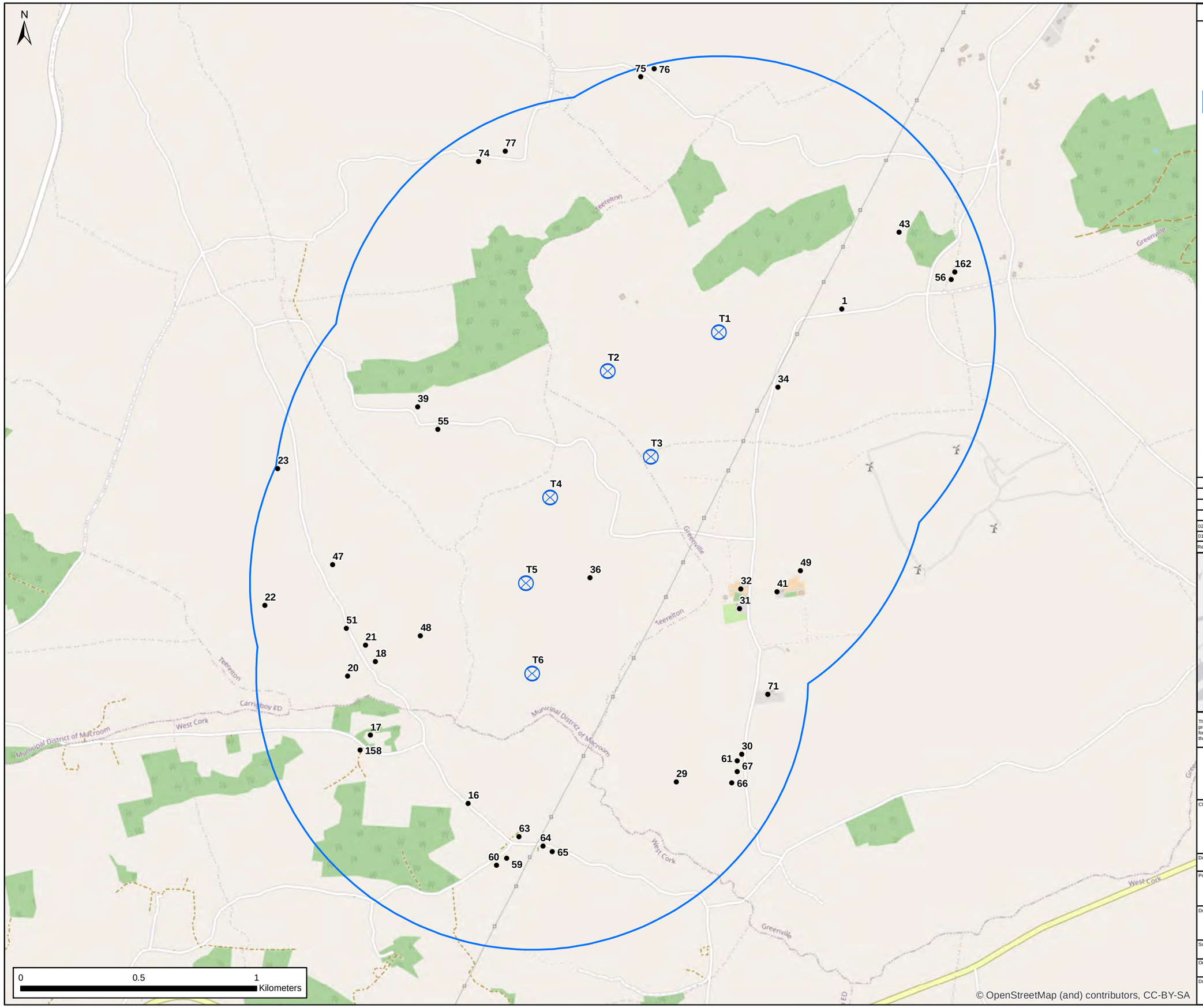
The 10 times rotor diameter criterion, which effectively sets the size of the Shadow Flicker Study Area, is detailed in several international publications including the German '*Guideline for Identification and Evaluation of the Optical Emissions of Wind Turbines*' (2002), the UK's '*Update of UK Shadow Flicker Evidence Base*' (Parsons Brinkerhoff for DECC, 2011) and Ireland's own '*Wind Energy Development Guidelines'* (WEDG 2006).

Specifically, the WEDG 2006 states "At distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low".

Shadow Flicker Study Area

The Proposed Wind Farm consists of 6 turbines, each with a maximum rotor diameter of 117 m. Accordingly, a Study Area of 1,170 m from each of the turbines was selected for this assessment i.e. ten times the maximum rotor diameter.

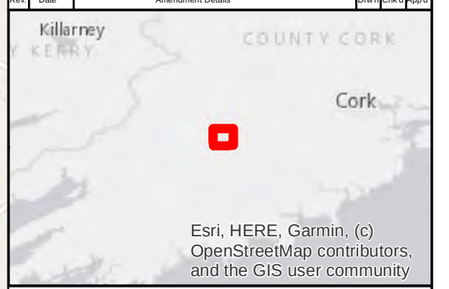
The assessment considers all potential shadow flicker sensitive receptors identified within the Shadow Flicker Study Area, which includes habitable residential buildings and buildings that are mixed residential and commercial. The identified receptor locations are detailed on Figure 10.5 and presented in tabulated format in Appendix 10.1.



Legend

- Receptors within 10 Rotor Diameters of Proposed Wind Farm
- Proposed Wind Farm
- Shadow Flicker Study Area (10 Rotor Diameters from Proposed Wind Farm)

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
02	24/02/23	Second Issue	CB	MT	JS
01	20/10/22	First Issue	CB	JC	JS



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Drawing Status: FOR PLANNING

Project Title: Barnadivane Wind Farm

Drawing Title: Figure 10.5 Shadow Flicker Study Area and Receptors

Scale	Designed	Drawn	Checked	Approved
1:15,000	CB	CB	JC	JS
Original Size	Date	Date	Date	Date
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The suns path in the sky starts in the morning from the eastern horizon, continues to increase in elevation until it is at its highest in the sky in the afternoon, and then decreases in elevation and sets in the western horizon in the evening. This path differs depending on the time of the year, and the suns angle (or azimuth) and elevation are higher during the summer months and lower in the winter months. The general path of the sun across the sky will not change, however, and due to the latitude of the Proposed Wind Farm, the suns azimuth relative to the turbines and receptors is such that shadow flicker in some of the southern areas of the Study Area will never have the potential to occur. As such, whilst all residential receptors within the Study Area have been included in the assessment, this does not necessarily mean that all identified receptors will have shadow flicker predicted to occur. The 'Maximum Extent of Shadow Coverage', where there is the *potential* for shadow flicker to occur, is detailed in Figure 10.6.

N

75 76 77 74 43 162 56 1 T1 T2 34 39 55 T3 23 T4 47 T5 36 49 32 41 31 22 51 48 21 18 20 T6 71 17 158 30 61 67 66 29 16 63 64 65 60 59

0 0.5 1 Kilometers

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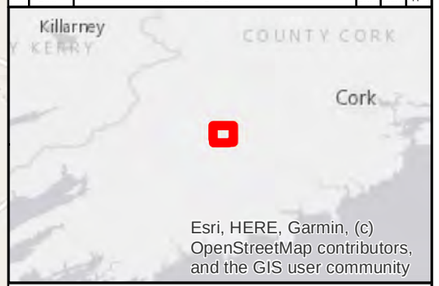
Legend

- Receptors within 10 Rotor Diameters of Proposed Wind Farm
- Proposed Wind Farm
- 500 m from Proposed Wind Farm
- Shadow Flicker Study Area (10 Rotor Diameters from Proposed Wind Farm)
- Maximum Extent of Turbine Shadows Within 10 Rotor Diameters of Proposed Wind Farm

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
02	24/02/23	Second Issue	CB	MT	JS
01	20/10/22	First Issue	CB	JC	JS



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Client: FEHILY TIMONEY

Drawing Status: FOR PLANNING

Project Title: Barnadivane Wind Farm

Drawing Title: Figure 10.6 Shadow Flicker Assessment of Barnadivane Wind Farn 117 m rotor diameter , 72.5 m hub height

Scale	Designed	Drawn	Checked	Approved
1:15,000	CB	CB	JC	JS
Original Size	**Date**	**Date**	**Date**	**Date**
A3	24/02/2022	24/02/2022	24/02/2022	24/02/2022

Drawing Number: 15517-001

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Shadow Flicker Assessment Methodology

It is possible to predict the total theoretical number of hours per year that shadow flicker may occur in a building from the relative position of the turbines to the building, the geometry of the wind turbines, the latitude of the wind turbine site and the size & orientation of the windows potentially affected. The predictions can be used to identify the times when curtailment may be required in order to mitigate the effects of shadow flicker. The predictions assume that during daylight hours the sun is shining all day, every day.

The potential for shadow flicker to occur and the intensity and duration of any effects depend upon the following factors:

1. the location and orientation of the window relative to the turbines;
2. whether the window has a direct, unobstructed line of sight to the turbine rotor;
3. the distance of the building from the turbines;
4. the turbine geometry;
5. the time of year (which impacts the trajectory of the sun's path across the sky);
6. the frequency of cloudless skies (particularly at low elevations above the horizon); and,
7. the wind direction (which impacts on turbine orientation).

Several specialist software packages are available that can take account of variables 1-5 listed above to determine the maximum theoretical number of shadow flicker hours that could occur at each window under worst-case conditions. Weather conditions, however, (as detailed in items 6-7), cannot be accounted for accurately. Therefore, the software model assumes cloudless skies 100% of the time and that all turbines are face on to all receptors. In reality this cannot happen so the output from the model will be inherently conservative, although estimates of typical weather conditions can be factored into the assessment at a later stage to provide a more realistic estimate of the likely occurrence of shadow flicker.

Where obstructions are present between a window and turbine due to terrain, this is accounted for within the software model, however, the model does not consider other obstructions that may be present, such as walls, buildings, trees etc.

For this assessment, predictions of shadow flicker have been undertaken using the industry standard software package ReSoft WindFarm, based on the proposed turbine locations and turbine dimensions.

Field Assessment

Building location data was supplied by Fehily Timoney & Company, derived from a combination of site surveys and supplementary GIS data. The supplied dataset covered an area 10 rotor diameters from the turbines. The dataset was refined through the use of aerial imagery to identify any additional buildings omitted from the dataset, as well as identifying building condition (habitable, derelict etc.), and building dimensions; the building centre-point co-ordinates were also refined where required. Buildings were also checked using the aerial images to identify any that were uninhabitable (such as a farm outbuilding) or derelict,, however none were positively identified as such, and all buildings in the supplied dataset were assessed.

Two receptors (receptors 36 and 34) have been identified within the WEDG 500 m assessment area, and in total 38 receptors have been identified within the 1,170 m shadow flicker Study Area, as shown on Figure 10.5.

Appendix 10.1 contains the model input data for all of the receptors and their windows.

Extent of Shadow Flicker Assessment

The shadow flicker model calculates the total theoretical occurrence of shadow flicker at all receptors per year based on a theoretical worst-case scenario that assumes the sky is always clear, the turbines are always aligned face-on to each window and that there is a clear and undisturbed line of sight between the windows and all of the turbines (except where this is prevented due to topography). In reality, the turbines will not always be orientated as described, clouds will obscure the sun and line of sight may be obscured (for example, from leaves on trees). Accordingly, the theoretical worst-case scenario details the predictions of all possible shadow flicker occurrences, however the actual shadow flicker effects that will occur, will only be possible for some of this time.

To provide a more realistic prediction of potential shadow flicker effects, historical weather data can be used to apply a correction factor, which considers the frequency of clear skies when shadows may be cast. Data compiled by Met Éireann from the nearest long-term weather station to Barnadivane Wind Farm (Cork) has been used to determine the average sunshine hours; this data is presented in Table 10.10.

Table 10-10: Average Monthly Sunshine Hours at Cork Airport Weather Station (1978-2007)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Sunshine Hours: Mean Daily Duration[i]	01:48	02:24	03:18	04:18	05:12	05:48	05:24	05:12	04:18	03:00	02:18	01:42	**03:54**
Daylight Hours[ii]	08:48	09:54	11:54	13:54	15:36	16:36	16:6	14:30	12:36	10:36	08:48	07:48	**12:12**
% Sunshine	23%	24%	28%	38%	40%	35%	34%	36%	34%	28%	26%	22%	32%

i Based on meteorological data from Cork 1981-2010 (https://www.met.ie/climate-ireland/1981-2010/cork.html)
ii Based on sunrise and sunset times for Cork 2022 (https://www.sunrise-and-sunset.com/en/sun/ireland/cork/2021)

The annual average percentage of sunshine hours is 32%, therefore a correction factor of 32% can be applied to the theoretical annual predicted levels of shadow flicker to account for the time when the correct meteorological conditions are present for shadows to be cast. It is worth noting that this correction does not account for any additional reductions that would occur as a result of variations in wind speed, wind direction, or by determining whether there is line of sight between a turbine and receiver. These 'likely' levels of shadow flicker are, therefore, still considered to be a conservative estimate.

Potential Impacts

There is the potential for shadow flicker to occur at 28 of the 38 receptors considered within the Study Area. At the remaining 10 receptors there is no potential for shadow flicker effects to occur because the suns angle relative to the turbines and receptors never reaches the required position.

A full listing of the worst-case total theoretical instances of shadow flicker by receptor can be found in Appendix 10.2. The calculated area over which shadows from the turbines may be cast (resulting in the potential for shadow flicker to occur) is shown on Figure 10.6.

The shadow flicker model for annual impacts sets out the total theoretical hours per year that each receptor can potentially receive shadow flicker. To consider a more realistic 'likely' scenario, the annual average sunshine hours for the region have also been taken into account. The predicted 'likely' levels of shadow flicker have been checked against the WEDG criteria of 30 hours per year, as detailed in Table 10.11.

It is not appropriate to apply the annual average sunshine hours correction to the predicted daily totals as the data is based upon monthly averages, which cannot be applied to daily levels with sufficient accuracy. Furthermore, the infrequency of clear skies is more likely to reduce the overall number of instances of shadow flicker over the year, rather than reduce the length of each individual instance. As such, the assessment of daily impacts considers the maximum theoretical amount of shadow flicker only and is inherently conservative.

The predicted maximum theoretical minutes per day of shadow flicker is detailed in Table 10.11. Further details, including the duration of individual shadow flicker events occurring at each receptor, are included in Appendix 10-2.

Table 10-11: Shadow Flicker Predicted Levels by Receptor

Receptor ID	Easting (IRENET 95)	Northing (IRENET 95)	Total Theoretical Days Per Year	Maximum Theoretical Minutes Per Day	Total Theoretical Hours Per Year (Hours:Mins)	'Likely' Hours Per Year (Hours:Mins)
1	535011	563958	148	56	82:30	26:24
16	533407	561851	0	0	0:00	0:00
17	532991	562143	78	43	42:00	13:26
18	533015	562460	149	47	97:24	31:10
20	532903	562399	138	39	74:54	23:58
21	532974	562529	169	44	82:18	26:20
22	532555	562698	26	29	9:42	3:06
23	532593	563305	0	0	0:00	0:00
29	534309	561942	49	35	23:12	7:25
30	534581	562066	79	33	28:18	9:03
31	534579	562689	131	37	64:42	20:42
32	534590	562767	113	35	47:30	15:12
34	534739	563622	129	61	87:06	27:52
36	533935	562817	210	109	249:48	79:56
39	533191	563542	168	47	83:12	26:37
41	534733	562755	92	32	35:48	11:27
43	535249	564283	37	37	15:36	4:59
47	532835	562868	99	38	44:30	14:14
48	533205	562565	172	62	142:06	45:28
49	534832	562850	99	31	32:30	10:24
51	532892	562596	173	39	84:12	26:56
55	533276	563444	224	57	125:48	40:15
56	535470	564076	35	31	14:24	4:36

Receptor ID	Easting (IRENET 95)	Northing (IRENET 95)	Total Theoretical Days Per Year	Maximum Theoretical Minutes Per Day	Total Theoretical Hours Per Year (Hours:Mins)	'Likely' Hours Per Year (Hours:Mins)
59	533580	561627	0	0	0:00	0:00
60	533538	561596	0	0	0:00	0:00
61	534563	562040	62	34	27:30	8:48
63	533624	561705	0	0	0:00	0:00
64	533729	561670	0	0	0:00	0:00
65	533770	561645	0	0	0:00	0:00
66	534547	561945	92	35	41:30	13:16
67	534566	561987	74	35	31:54	10:12
71	534700	562325	88	33	35:18	11:17
74	533453	564592	20	16	4:30	1:26
75	534150	564943	0	0	0:00	0:00
76	534208	564976	0	0	0:00	0:00
77	533562	564624	0	0	0:00	0:00
158	532965	562089	88	41	44:18	14:10
162	535494	564122	34	31	13:18	4:15
TOTALS				**Number of Receptors which May Experience:**		
				> 30 Minutes/Day	**> 30 Hours/Year**	
				25	20	4

There are two receptors located within the WEDG 500 m assessment area and both of these exceed the daily 30 minutes and the annual 30 hours per year when considering the worst case predictions. Taking into account the 'likely' sunshine hours per day, one receptor (receptor 36) remains above the 30 hours per year limit. Accordingly, mitigation measures will be required reduce shadow flicker impacts for this location.

When considering the wider 1170 m Study Area, the number of receptors that exceed 30 minutes in a day is 25. 20 receptors exceed the annual limit of 30 hours per year, however, taking into account the 'likely' sunshine hours this is reduced to just 4 receptors.

Potential Cumulative Impacts

The IWEA Guidelines recommend that all existing and/or permitted wind farm developments within 2 km of a Proposed Wind Farm should be considered in a cumulative shadow flicker assessment. There is one wind farm located within 2 km of the Proposed Wind Farm, Garranereagh Wind Farm, which is located immediately to the east. Garranereagh Wind Farm consists of 4 no. of Enercon E-82 turbines with a rotor diameter of 82 m and a tip height of 119.3 m.

Due to the close proximity of Garranereagh Wind Farm to the Proposed Wind Farm, there is an overlap of shadow throw areas where shadow flicker from both developments has the potential to occur. This can be seen on Figure 10-7.

N

Legend

- Receptors within 10 Rotor Diameters of Proposed Wind Farm
- Proposed Wind Farm
- 500 m from Proposed Wind Farm
- Shadow Flicker Study Area (10 Rotor Diameters from Proposed Wind Farm)
- Maximum Extent of Turbine Shadows Within 10 Rotor Diameters of Proposed Wind Farm
- Garranereagh Wind Farm
- 10 Rotor Diameters from Garranereagh Turbines
- Maximum Extent of Turbine Shadows within 10 Rotor Diameters of Garranereagh

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02	24/02/23	Second Issue	CB	MT	JS
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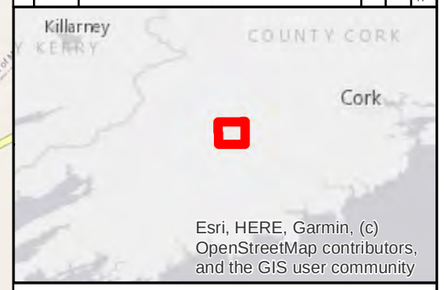

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Drawing Status: FOR PLANNING

Project Title: Barnadivane Wind Farm

Drawing Title: Figure 10.7 Barnadivane & Garranereagh Shadow Flicker Study Area and Receptors

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0 0.5 1 Kilometers

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Shadow flicker modelling of both turbine developments has been undertaken, with a 10 rotor diameter Study Area applied to all turbines. Shadow flicker effects from both the Proposed Wind Farm and Garranereagh Wind Farm are predicted to occur at six receptors. These receptors are located to the east of the Proposed Wind Farm and to the west of Garranereagh. It should be noted that shadow flicker from both developments would not occur at the same time, or upon the same facades/windows, however, the total number and duration of shadow flicker occurrences at the property would increase due to the cumulative operation of both developments.

The predicted maximum theoretical minutes per day and per year of shadow flicker from the combined operation of both developments is detailed below:

Table 10-12: Shadow Flicker in Combination of Barnadivane and Garraneragh Wind Farms

Receptor ID	Easting (IRENET95)	Northing (IRENET95)	Total Theoretical Days Per Year	Maximum Theoretical Minutes Per Day	Total Theoretical Hours Per Year	'Likely' Hours Per Year
1	535011	563958	178	56	91:24	29:14
31	534579	562689	152	58	82:36	26:25
32	534590	562767	130	55	62:54	20:07
34	534739	563622	209	86	168:12	53:49
36	534733	562755	127	49	62:42	20:03
49	534832	562850	99	31	32:30	10:24
TOTALS				**Number of Receptors that may experience:**		
				> 30 Minutes/Day	**> 30 Hours/Year**	
				6	6	1

The Cumulative Assessment, therefore, concludes as follows.

- Of the six receptors within 10 rotor diameters of both the Proposed Wind Farm and Garraneragh Wind Farm, five receptors are predicted to receive cumulative shadow flicker effects from the operation of both turbine developments. Calculated shadow flicker levels at the sixth receptor (49) are identical to those detailed in Table 10-11, therefore the potential shadow flicker effects at this receptor are from the Proposed Wind Farm only.
- The maximum theoretical minutes per day of existing shadow flicker at these receptors are above WEDG daily limits. Accordingly, mitigation measures are required.
- The theoretical maximum number of hours per year of shadow flicker at all receptors exceed the WEDG limits, however, when considering likely sunshine hours, only one receptor is above the WEDG limits.

Mitigation Measures

Shadow flicker control modules, consisting of light sensors and specialised software, will be installed on the turbines to prevent operation during periods when shadow flicker is predicted to exceed the exposure thresholds set out in WEDG 2006 at all sensitive receptors located within 10 rotor diameters of the Proposed Wind Farm i.e. 30 minutes per day and / or 30 hours per year. This is beyond the requirements of WEDG 2006, which recommends the limits apply only to properties located within 500 m of a development.

The calculated shadow flicker periods, which are detailed in Appendix 10-3, can be input into the turbine control software and when the correct conditions are met when the light intensity is sufficient, the turbine is operational and orientated towards the receptor, the event is within a calculated potential period of shadow flicker, and the thresholds identified in the WEDG 2006 have been exceeded individual turbines will cease operation (allowing for a short period for the control software to react and for the turbine blades to gradually slow down) until the conditions for shadow flicker are no longer present.

Residual Impacts

The proposed method of mitigation can be used to mitigate shadow flicker effects to all properties within the 10 rotor diameter Study Area to stay below the WEDG 2006 guidelines levels.

Do-Nothing Scenario

In the 'Do-Nothing' Scenario, Barnadivane Wind Farm would not be constructed and the potential impacts from shadow flicker on local receptors would not occur, except for receptors effected by Garranereagh Wind Farm, where if the conditions are met some shadow flicker effects can occur. No mitigation measures would be required.

Conclusion

A shadow flicker assessment has been undertaken on 38 receptors within 10 rotor diameters of the Proposed Wind Farm with a cumulative assessment caried out to include the neighbouring Garranereagh Wind Farm.

Based on the Wind Energy Development Guidelines 2006 (WEDG 2006) thresholds, the predicted 'Maximum Theoretical Minutes Per Day' of shadow flicker exceeds 30 minutes at 25 receptors.

When considering the 'Total Theoretical Hours Per Year', 20 receptors are predicted to exceed the WEDG 2006 threshold of more than 30 hours per year. However, when accounting for a more 'likely' scenario, where the average annual sunshine hours are considered, there are only 4 receptors that are predicted to exceed more than 30 hours per year.

Of the 38 receptors within 10 rotor diameters of the Proposed Wind Farm, six receptors are also within 10 rotor diameters of Garranereagh Wind Farm; of these, five receptors may experience cumulative shadow flicker effects. The cumulative assessment has identified that in addition to the conclusions stated in the paragraphs above, one additional receptor has the potential to exceed the threshold of 30 hours per year when considering a 'likely' scenario, resulting in a total of five receptors above this threshold.

A scheme of mitigation would be implemented into the turbine control software to cease turbine operation during periods when the WEDG 2006 thresholds are being exceeded. Turbine shutdowns would be applied automatically during periods of sunshine and after accounting for accumulated shadow flicker exposure, wind speed and wind direction, allowing for the reaction time of the shadow flicker control modules and also allowing for a short period of time for the turbine blades to slow down to a stop.

With the implementation of the proposed mitigation measures, no cumulative impacts with other proposed or operational wind farms in the area are predicted to occur on any receptors in the Study Area.

10.7.3.4 Potential Health and Safety Impacts from Proposed Cables and Electromagnetic Interference

Wind turbines, like all electrical equipment, produce electro-magnetic radiation. The provision of underground electricity cables similar to the proposed capacity is however commonplace throughout Ireland and the installation to the required specification does not give rise to health concerns. The following research outlines the potential for health impacts caused by electromagnetic interference.

The EirGrid document 'EMF & You: Information about Electric & Magnetic Fields and the electricity transmission system in Ireland' (EirGrid, 2014) provides information on studies which have been carried out on the health impact of electromagnetic fields (EMF). This report notes that since 1979, many scientific studies have been carried out on the possible effects of EMF on people. Agencies include the World Health Organisation (2006), the National Radiological Protection Board of Great Britain (2004), and the International Agency for Research on Cancer (IARC) (2002).

In 2009 the International Commission on Non-Ionising Radiation Protection (ICNIRP) issued guidelines for exposure for members of the public to DC magnetic fields. Other more recent reviews have been performed for the UK's Health Protection Agency (2012) and the European Union's Scientific Committee on Emerging and Newly Identified Health Risks (2015). The Eirgrid (2014) report notes that:

> *"These agencies concluded that exposure to only very strong DC magnetic fields can cause biological effects. The exposures required to produce such effects, however, are extraordinarily high relative to levels of DC magnetic fields produced by common sources."*

The Eirgrid (2014) report concludes that exposure to extremely low frequency (ELF)-EMF from power lines or other electrical sources is not a cause of any long-term adverse effects on human, plant, or animal health. A 2019 Eirgrid report titled 'The Electricity Grid and Your Health' states that:

> *"The consensus from health and regulatory authorities is that extremely low frequency EMFs do not present a health risk."*

To ensure such adverse effects do not occur, the WHO (World Health Organisation) monograph recommended that policy-makers establish guidelines for ELF-EMF exposure for both the general public and workers, and that the best source of guidance is the ICNIRP guidelines.

In 2010, ICNIRP issued updated guidelines, which reviewed the research since the 1998 report and replaced previous recommendations given by ICNIRP for this frequency range. The revised range is detailed in table 11-13. The underground cable to be installed complies with these ICNIRP guidelines.

> ICNIRP Guidelines for limiting exposure to time varying electric and magnetic fields (1Hz–100kHz) Health Physics 99(6):818-836; 2010.

Magnetic flux densities for Alternating Current (AC) magnetic fields are reported using units of microtesla (µt) and electric fields in kilovolts per meter (Kv/m). The ICNIRP guidelines formed the basis of the EU guidelines for human exposure to EMF (EU, 1999) and the EU Directive 2013/35/EU on the minimum health and safety requirements regarding the exposure of workers to the risks from EMFs.

Table 10-13: ICNIRP Guidelines

Exposure Characteristics	Electric Field Strength (kV/m)	Magnetic Flux Density (µT)
ICNIRP 2010 General Public Reference Level	5	100

The magnetic fields associated with underground cables decrease rapidly with distance. For underground cables, the fields decrease with the square of distance. The electric field emissions from underground cables are negligible as the ground absorbs the field.

As the proposed cable does not pass under housing, the exposure levels will be extremely low. Most homes have average magnetic field levels in the range 0.2 µT to greater than 0.4 µT. These magnetic fields are attributable to low voltage sources such as wiring, appliances, and distribution circuits (Mastanyi et al, 2007). In dwellings and other properties with electricity, the levels will not exceed the ICNIRP guidelines by a significant margin.

Based on the details of the Proposed Development, there will be no impact on residential properties at any distance from the Proposed Development as the ICNIRP guidelines are not exceeded at all relevant distances including directly above the cables. The magnetic field associated with an underground 110kV cable is 2.32 µT directly above ground and 0.15 µT at 10 meters from the cable (EirGrid, 2019), significantly below the ICNIRP Guidelines levels of 100 µT. The ESB state that exposure to electrical fields associated with underground cables are considered negligible (ESB, 2017).

The HSE, in their 2017 report 'Position paper on wind turbines and public health' state the following with regard to Electromagnetic radiation:

> *"There is no direct evidence from which to draw any conclusions on an association between electromagnetic radiation produced by wind farms and health effects. Extremely low-frequency electromagnetic radiation is the only potentially important electromagnetic emission from wind farms that might be relevant to health. Limited evidence suggests that the level of extremely low-frequency electromagnetic radiation close to wind farms is less than average levels measured inside and outside suburban homes."*

EU Directive 2013/35/EU on the minimum health and safety requirements regarding the exposure of workers to the risks from EMFs was transposed into Irish law on 1st July 2016 by the Safety, Health and Welfare at Work (Electromagnetic Fields) Regulations 2016 (S.I. No. 337 of 2016). The regulations impose a number of duties on employers to maintain safety during work procedures. This includes the carrying out of risk assessment, avoiding and reducing risk, employee information, training and consultation and health surveillance where appropriate. The Proposed Development will comply with both EU and Irish law and will result in a negligible impact to human health on employees at the Barnadivane Wind Farm during the operational phase.

10.7.3.5 Vulnerability of the Project to Major Accidents and Natural Disasters

EU Directive 2014/52/EU which amends Directive 2011/92/EU states the following in relation to vulnerability of a project to natural disaster:

> *In order to ensure a high level of protection of the environment, precautionary actions need to be taken for certain projects which, because of their vulnerability to major accidents, and/or natural disasters (such as flooding, sea level rise, or earthquakes) are likely to have significant adverse effects on the environment.*
>
> *For such projects, it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment.*

The following section considers the Proposed Project's vulnerability to major accidents and natural disasters, potential adverse impacts on human health and the environment, the magnitude of potential impacts, the likelihood of potential impacts and considers the preparedness of the project in case of accident, disaster or emergency.

Should a major accident or natural disaster occur, the potential sources of pollution onsite during the construction and operational phases of the Proposed Development are limited. The primary sources with the potential to cause significant environmental pollution and associated negative impacts on human health and the environment include the bulk storage of hydrocarbons, chemicals and wastes. In the case of the Proposed Development site, the storage of chemicals of this kind are strictly limited.

There is limited potential for significant natural disasters to occur at the site as Ireland does not suffer from extreme temperatures like that of many countries at a similar latitude due to the dominant influence of the Gulf Stream. This provides Ireland with a mild temperate climate. Potential vulnerabilities relevant to the Proposed Development are limited to:

- Flooding;
- Fire;
- Major incidents involving dangerous substances;
- Catastrophic events; and
- Landslides.

Flooding

In the event of extreme weather conditions there is potential for the Proposed Development to negatively impact on human health and safety and the surrounding environment due to increased surface water runoff as a result of additional impermeable surfaces such as wind turbine hardstands and new access tracks. This has potential to add to flood risk which may negatively impact on human safety (including traffic), water quality, biodiversity, soil stability, material assets and archaeological or architectural heritage. It is unlikely that potential increase in flood risk will impact on noise and vibration, air and climate, landscape and visual and telecommunication and aviation. The magnitude of these consequences has potential to be significant, resulting in potential injury or fatality, property damage, infrastructure damage and damage to ecosystems.

The risk of flooding is addressed in Chapter 7: Hydrology and Water Quality, which concludes that the Proposed Development will have a negligible impact on flood risk in the surrounding area.

In the event of extreme weather conditions, the proposed surface water drainage will manage storm water avoiding significant negative impact on the project's infrastructure. Therefore, it is unlikely that the Proposed Development will result in increased flood risk, and it is unlikely that flood risk would result in effects on human safety (including traffic), water quality, biodiversity, soil stability, material assets and archaeological or architectural heritage, as the increased flood risk is considered negligible.

Mitigation measures are set out in Chapter 7: Hydrology and Water Quality to avoid potential negative impacts during the construction stage with respect to flood risk.

Fire

In respect of fire, in May 2017 a major gorse/ground vegetation fire incident took place in proximity to the 169MW Galway Wind Park. This incident highlights fire as a potential significant negative impact for the Proposed Development as there is some forestry located to the north west of the site. It should be noted that a substantial number of wind farms are built within forestry in Ireland. In order to avoid negative impact from potential forest fires, buffers have been applied between the proposed infrastructure and tree lines. This is aimed at reducing potential impact on bat species but also acts as a fire break between treelines and proposed turbines.

In the event of electrical equipment catching fire at the Proposed Development site, there is potential for negative impact on human health and safety, air quality, water quality, biodiversity, soils, material assets, archaeological or architectural heritage and landscape and visuals. The magnitude of these consequences has potential to be significant and negative, resulting in potential injury or fatality, property damage, infrastructure damage, loss of forested lands and damage to ecosystems. It is unlikely that potential fire at the site will have an effect on noise and vibration and telecommunication and aviation.

The potential for fire at the Proposed Development site is mitigated against by design. Furthermore, the Proposed Wind Farm will be remotely monitored, and potential accidents will be quickly identified and reported.

In line with IWEA Health and Safety Guidelines for the Onshore Wind Industry (2011), Emergency Response Plans will include emergency response procedures for initial actions in the event of a fire. Records will be kept for testing of fire alarms and drills and maintenance/inspection of fixed and portable firefighting equipment. Information will be provided to employees on fire safety and fire prevention, including risks of and control measures to prevent fire outbreak, evacuation procedures and those responsible for their implementation, and the use of firefighting equipment, in line with HSA guidance.

During the construction phase of the Proposed Development, an emergency response plan will be in place as set out in Section 6 of the CEMP, included in Appendix 2.2 of Volume 2 of this EIAR.

Major Incidents Involving Dangerous Substances

Major industrial accidents involving dangerous substances pose a significant risk to human health and to the environment both on and off the site of an accident. The Health and Safety Authority (HSA) of Ireland list all upper and lower tier SEVESO establishments throughout Ireland.

The Proposed Development is not in proximity to any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e. SEVESO site, that would fall within the consultation radius distance from a SEVESO site as per County Development Plan Policy Objective EC 8-9. The most proximate SEVESO site located 15km south of the Proposed Development at Carberry Food Ingredients Balineen, Co. Cork (lower tier Seveso Site).

Given the nature of the Proposed Development, coupled with the lack of proximity to established Seveso sites, there is a negligible potential risk of negative impact to the Proposed Development and its receiving environment, as set out throughout this EIAR, arising from the occurrence of such a potential accident.

Catastrophic Events

According to the Health and Safety Authority (HSA), operational wind farms are still considered a workplace (albeit not permanently occupied). All persons who have control to any extent over the wind-farm have duties to ensure, so far as reasonably practicable, that the wind-farm does not pose a risk to those working there or to anyone not employed there but who may be affected by activities on the wind-farm.

Each wind-turbine, incorporating the tower, blades, gearbox and ancillary equipment in the tower and nacelle are considered to be machines under the European Machinery Directive [2006/42/EC]. The duties on designers and manufacturers of machinery are set out in the Machinery Directive, which has been transposed into national law by the 2008 European Communities (Machinery) Regulations [S.I.No.407/2008. All wind turbines will be CE marked, which is in effect, a mark of assurance that the wind-turbine complies with the essential health and safety requirements (EHSRs) of EU supply law. In all cases, the manufacturer or the manufacturer's authorised representative must compile information in a technical file confirming how the machine complies with these requirements.

The maintenance of turbines and ancillaries must only be carried out by competent, trained and qualified personnel. The system of work for operation and maintenance must be planned, organised, maintained and revised to ensure safety of personnel.

Potential catastrophic events associated with operational wind turbines include:

- Wind turbine toppling (due to foundation or tower failure);
- Wind turbine rotational failure in extreme wind conditions (due to control system or rotor break failure); and,
- Fire.

The primary mitigation against a catastrophic event that may endanger the health and safety of the public has been implemented at design stage through adequate siting of wind turbines which provide sufficient set back distances from occupied buildings and other infrastructure to avoid the risk of negative impact in the event of wind turbine collapse.

The proposed tip height for wind turbines at the Proposed Wind Farm is 131m. Two residential dwellings are located within 500m (267.44m and 348.23m). One receptor borders the Study Area near T6, this landowner is an involved landowner in the project. No turbines have been located within 1.5 x tip height of the proposed on-site substation. A minimum setback distance of 3.5 x rotor diameter has been imposed between wind turbines and existing HV overhead lines in accordance with EirGrid general functional specifications.

Turbines have been sited with consideration for existing ground conditions to minimise the risk of turbine foundation failure, toppling and landslide. Intrusive site investigations have been carried out to confirm ground conditions at turbine locations as well as slope stability analysis throughout the site. Other design mitigation measures employed for the siting of wind turbines include the following:

- Areas mapped by GSI as having a high susceptibility to landslides have been avoided;
- Turbine locations have been assessed by site investigation and visually by geotechnical engineers prior to confirmation of final siting;
- Care has been taken in design of road and hard standing alignments, cutting and filling and drainage;
- Given the absence of peat deposits across the site, and in accordance with the guidance in the Scottish Executive – Peat Landslide Hazard and Risk Assessments (2017), a peat stability analysis has not been carried out.

See Chapter 6: Land, Soil and Geology for more information on ground conditions.

Wind turbines are fitted with sophisticated remote monitoring and control systems to manage rotational speed. Turbines also have the capability to shut down in storm conditions through adjustment of blade pitch. Turbines are also fitted with emergency power supply (EPS) units to provide backup power in the event of a loss of mains power supply that could impact the control system.

Wind turbines shall be fitted with fire suppression systems and will have emergency escape procedures in place for operational staff in the event of fire in a wind turbine. An emergency response plan is contained in the CEMP included in Appendix 2.2 of Volume 2 of this EIAR.

Landslides

Landslides pose a risk to a range of environmental receptors including human safety (including traffic), hydrology and water quality, biodiversity, land, soil, geology and hydrogeology, material assets and archaeological and cultural heritage. The negative impacts associated with landslides can have a significant to profound effect on environmental sensitivities, depending on the scale of the landslide and the receiving environment.

As detailed in Chapter 6: Land, Soils and Geology, a slope stability assessment was carried out at the Proposed Development site to investigate the lands for potential slope failure. The Proposed Development and infrastructure locations are generally located within areas of 'Low' to 'Moderate Low' susceptibility with the exception of turbines T5 and T6, which are within an area of 'Moderately High' susceptibility.

An isolated area of 'High' landslide susceptibility is located to the north of the site; however, there is no infrastructure proposed here. No evidence of slope instability was observed at the site and there are no historical records of landslide activity within 1km of the site on the GSI database.

Mitigation by design has been incorporated into the project to avoid potential effects from landslides. Mitigation measures for potential landslide/slope failure are set out in Chapter 6: Land, Soils and Geology.

During the construction phase of the Proposed Development, an emergency response plan will be in place as set out in Section 6 of the CEMP in the unlikely event of a landslide/slope failure.

In relation to potential vulnerability of the project to major accidents and natural disasters it is concluded that the potential susceptibility to major accidents and natural disaster of the Proposed Development is negligible.

10.7.4 Potential Impacts – Human Health – Decommissioning

The decommissioning phase of the Proposed Development, as described in Section 2.7 of this EIAR, provides for the removal of turbines and associated infrastructure from the site. The potential impacts associated with decommissioning phase in relation to human health will be similar to those associated with construction phase as detailed in Section 10.7.2.

Decommissioning works will include removal of above ground structures including the turbines, mountings, and fencing. The proposed on-site substation will become an ESBN/EirGrid asset following construction and become a part of the electricity grid network. During the decommissioning works there is potential for significant impact to human health and safety for construction workers on site. These impacts are similar to those set out in Section 10.7.2. Potential impacts to human health and safety on-site will be prevented through best practice methods as per the construction phase CEMP and will include staff training and knowledge of the site-specific decommissioning plan.

Once mitigation measures and best practice construction site methods are followed, potential negative impact on human health and safety is expected to be imperceptible and temporary.

During the decommissioning works there is potential for negative impact on health and safety of the public. Similar to Section 10.7.2, impacts are associated with the presence of a construction crew, increased traffic, presence of heavy goods vehicles and machinery and potential obstructions on the public road. Potential impact to public health and safety during the decommissioning phase is considered temporary moderate and negative. However, a Construction and Environmental Management Plan for decommissioning works will be followed, clear signage will be utilized on public roads and walkways and the community will be informed of works prior to commencement to avoid any potential negative impact to public health and safety. Once good practice is followed, the potential for negative impact on public health and safety is expected to be temporary and not significant.

10.7.5 Mitigation Measures – Human Health & Safety

10.7.5.1 Mitigation Measures – Construction & Decommissioning

To maintain safety and avoid health impacts on construction workers and the general public, best practice site safety and environmental management will be maintained. The Proposed Development will be designed, constructed, operated and decommissioned[4] in accordance with the following:

- Safety, Health & Welfare at Work (Construction) Regulations 2013
- Safety, Health & Welfare at Work Act 2005
- Safety, Health & Welfare at Work (General Applications) Regulations 2007

All construction staff will be trained to the correct Health and Safety standards in order to carry out their duties and will be informed and aware of potential hazards. A Construction and Environmental Management Plan is included in Appendix 2.2, will be circulated to all construction workers which will detail safety protocol and methodology. Furthermore, site investigation has been completed and mitigation has been proposed as detailed in Chapter 6: Lands, Soils and Geology and Chapter 7: Hydrology and Water Quality.

All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be established. The contractor will be obliged under the construction contract and current health and safety legislation to adequately provide for all hazards and risks associated with the construction phase of the project.

FÁS Safe Pass registration cards are required for all construction, delivery and security staff. Construction operatives will hold a valid Construction Skills Certificate Scheme card where required.

The developer is required to ensure a competent contractor is appointed to carry out the construction works. The contractor will be responsible for the implementation of procedures outlined in the Safety & Health Management Plan.

In relation to COVID-19, up to date HSE guidance will be consulted regularly in line with HSA recommendations and all reasonable on-site precautions will be taken to reduce the spread of COVID-19 on construction sites, should the virus be prevalent at the time of construction.

Once mitigation measures and health and safety measures are followed, the potential for impact on human health on the construction site during construction and decommissioning is expected to be not significant and temporary to short-term.

Appropriate warning signage will be posted at the construction site entrance, directing all visitors to the site manager. Appropriate signage will be provided on public roads approaching site entrances and along haul routes to maintain public safety.

In relation to the TDR, extra safety measures will be employed when large loads are being transported, for instance, Garda escort will be requested for turbine delivery and a comprehensive turbine delivery plan will be utilised to avoid potential impact to human safety for road users and pedestrians. A traffic and transport assessment has been completed and is detailed in Chapter 11: Traffic and Transportation.

[4] The Proposed Substation will not be decommissioned as it will become an ESBN/EirGrid asset following construction and become a part of the electricity grid network.

Once mitigation measures and health and safety measures are implemented and followed, the potential for impact on human health for members of the public during construction and decommissioning of the Proposed Project is expected to be not significant and temporary to short-term.

10.7.5.2 Mitigation Measures - Operational

For operation and maintenance staff working at the Proposed Wind Farm, appropriate site safety measures will be utilised during the operational phase by all permitted employees.

All personnel undertaking works in or around the turbines will be fully trained and will use appropriate Personal Protective Equipment (PPE) to prevent injury.

Equipment within high voltage substations presents a potential hazard to health and safety. The Proposed Substation will be enclosed by palisade fencing and equipped with intruder and fire alarms in line with ESB and EirGrid standards.

All electrical elements of the Proposed Development are designed to ensure compliance with EMF standards for human safety.

All on-site electrical connections are carried by underground cable and will be marked out above ground where they extend beyond the track or hardstanding surface. Details of cables installed in the public road will be available from ESBN.

Lightning conductors will be installed on each turbine as all structures standing tall in the sky require this protection. Turbines specifically require this to prevent power surges to electrical components.

Turbines will be fitted with ice detection systems which will stop the turbine from rotating if ice is forming on a turbine blade. This aims to prevent ice throw which can cause injury.

Rigorous statutory and engineering safety checks imposed on the turbines during design, construction, commissioning and operation will ensure the risk posed to humans is negligible. 24-hour remote monitoring and fault notifications are included as standard in the Turbine Operations and Maintenance Contracts.
In addition to scheduled maintenance, the maintenance contracts will allow for call out of local engineers to resolve any issues as soon as they are picked up on the remote monitoring system.

Access to the turbines inner structure will be locked at all times and only accessed by licenced employees for maintenance.

In line with the Health Service Executive's Emergency Planning recommendations, any incident which may occur at the site which requires emergency services, incident information will be provided in the 'ETHANE' format.

- Exact location;
- Type of incident;
- Hazards;
- Access and egress;
- Number of casualties (if any) and condition;
- Emergency services present and required.

The design of the Proposed Development has considered the susceptibility to natural disasters. The proposed site drainage will mitigate against any potential flooding risk with the use of swales as described in Chapter 7 – Hydrology and Water Quality.

A nominated competent person shall carry out checks and routine maintenance work to ensure the reliability and safe operation of fire-fighting equipment and installed systems such as fire alarms and emergency lighting. A record of the work carried out on such equipment and systems will be kept on site at all times.

Shadow flicker control modules, consisting of light sensors and specialised software, will be installed on the turbines to prevent operation during periods when shadow flicker is predicted to exceed the thresholds set out in WEDG 2006 at all sensitive receptors located within 10 rotor diameters of the Proposed Development. This is beyond the requirements of WEDG 2006, which recommends the limits apply only to properties located within 500 m of a development. This is further detailed in section 10.7.3.3.

In order to ensure the Proposed Wind Farm is compliant with the noise limits, some of the turbines may need to be operated in noise reduced modes of operation in order to protect residential amenity. Details of these mitigation measures are set out in Chapter 9: Noise and Vibration.

The wind farm system shall include a kill switch that can be operated at any time with an overriding manual shutdown system in case of an emergency.

10.7.6 Residual Impacts – Human Health

Through various aspects of the design process for the Proposed Development, negative residual impact on human health is expected to be imperceptible. This is due to the reduction of potential occurrence of shadow flicker on neighbouring dwellings through shadow flicker control modules, consisting of light sensors and specialised software and noise control measures to reduce potential noise impacts. Furthermore, the mitigation measures as set out throughout the EIAR will prevent any potential significant negative impacts on human health during the construction and decommissioning phases.

Long-term positive imperceptible residual impacts will occur due to the provision of clean, renewable electricity. The operation of the Proposed Wind Farm will result in the net displacement of between 24,522 and 34,331 tonnes of CO2 per annum which would otherwise be emitted through the burning of fossil fuels.

10.8 Renewable, Non-Renewable Resources and Utility Infrastructure

This section provides a comprehensive overview of the material assets (renewable and non-renewable resources, and utility infrastructure) of the receiving environment in order to provide an understanding of the potential effects which the Proposed Development may have on renewable and non-renewable resources, and utility infrastructure. The waste produced as a result of the Proposed Development is also considered in this section.

The Geological Survey of Ireland in their scoping response for the Proposed Development highlighted potential impacts to mineral resources in the area of the site as a result of the Proposed Development. This has been considered with respect to non-renewable resources in this section. The Felling Section of the Department of Agriculture, Food and the Marine also set out the need to consider removal of areas of forestry and the replanting of this forested area in a sustainable manner. This is considered in this section with regard to renewable resources.

10.8.1 Existing Environment – Renewable, Non-Renewable Resources and Utility Infrastructure

A number of active and historic quarries and mineral occurrences are located within 20km of the Proposed Development, as detailed in the GSI Online Minerals database shows no mineral (metallic and non-metallic) occurrences within the site. An iron deposit has been recorded within the Castlehaven Formation approximately 1km west of the site (ITM coordinates E 532335, N 562365).

The GSI Aggregates database indicates that there is predominantly a low crushed rock aggregate potential across most of the site (Chapter 6, Figure 6-8). Localised extents of 'moderate' to 'high' crushed rock potential can be found throughout the site with an area of 'very high potential' mapped along the northernmost extent of the site.

Wind resource is average at the site location. The 2013 Sustainable Energy Authority of Ireland (SEAI) Wind Speed Atlas identifies the site as having an average wind speed of between 7.4 m/s and 7.5 m/s at 100m above ground level.

An existing Wind Farm (Garranereagh Wind Farm) is located to the east of the Proposed Wind Farm. This existing Wind Farm consists of 4 no. turbines and has an overall output of 9.2MW.

As part of the scoping and consultation process for the Proposed Development, searches of existing utility services were carried out to identify areas where major assets exist such as high voltage electricity cables or gas mains. Private utility and telecommunications companies were also consulted during this period. The only major utility infrastructure that was identified at the Proposed Development site was the existing 110 kV Macroom to Dunmanway overhead line that traverses the site and which is proposed to loop into via the Proposed Substation.

These elements are identified in Section 3.5.6.1 of this EIAR and further detailed in Chapter 11: Traffic and Transportation.

10.8.2 Potential Impacts – Renewable, Non-Renewable Resources and Utility Infrastructure - Construction

10.8.2.1 Non-renewable Resources

It is anticipated that the stone required for the construction of the internal access roads, hardstands, temporary construction compound and the substation will be sourced from the on-site borrow pit. If suitable site won material is not available for the finishing layer on the access roads and hardstands, this material will be imported from quarries in the vicinity.

The likely off-site, source quarries for the supply of imported crushed rock aggregate during the construction phase of the development are presented in Table 10-14.

Table 10-14: Source Quarries for Imported Aggregate (Crushed Rock)

Name	Distance from site	Products	Rock type
Kilmichael Quarry	5km (W)	Series 600 crushed rock aggregate and Clause 803/4/5/6.	Sandstone
Castlemore Quarry	10km (E)	Series 600 crushed rock aggregate and Clause 803/4/5/6	Limestone

Existing tracks have been used where possible and the layout was designed to minimise the length of new track required in order to reduce the requirement for stone material. The use of imported materiel will have a slight, permanent negative impact on non-renewable stone resources of the source quarries. This impact is considered to be imperceptible in the long-term.

10.8.2.2 Renewable Resources

The Proposed Development is intended to capture the renewable wind resource at the site. There will be no negative effects on the renewable wind resource of the receiving environment.

It is considered that the Proposed Development will have an overall long-term positive impact in terms of carbon reduction and climate change. It will assist Ireland in meeting its target of producing 80% of electricity from renewable sources by 2030 as set out in the Climate Action Plan 2023.

No tree felling is required for the Proposed Development.

However, the overall effect of the Proposed Development on renewable timber resources at a national scale will be neutral.

10.8.2.3 Utilities Infrastructure

It is proposed to connect to the overhead 110kV line via a loop in-loop out connection. Apart from the 110Kv line, there is no major utility infrastructure located within the site.

Chapter 11 of this EIAR assesses the proposed Turbine Delivery Route (TDR). No utilities or road infrastructure is proposed to be removed in order to facilitate the TDR.

Turbine delivery could potentially cause traffic disturbance if not properly planned and assessed. Potential impact on road infrastructure is detailed in Chapter 11: Traffic & Transportation.

Potential effects on telecommunications are discussed in Chapter 13: Telecommunications and Aviation. As set out in Chapter 13, the Proposed Development will have no impact on the telecommunications signals during the construction of the project.

Importation of materials and equipment for the Proposed Development will also increase shipping traffic at the ports being used and increase freight on the motorway, national primary routes and local road network. This impact is assessed in Chapter 11: Traffic and Transportation.

10.8.2.4 Waste

During the construction phase of the Proposed Development, waste will be generated due to the various construction activities and materials required for the installation of infrastructure at the site.

In line with the National Waste Management Guidelines for the circular economy and European Waste Management Hierarchy, the developer and appointed contractor will aim to prevent, reduce, reuse and recover as much of the waste generated on site as practicable and to ensure the appropriate transport and disposal of residual waste off site.

Any waste generated during the development construction phase will be collected, source separated and stored in dedicated receptacles at the temporary construction compounds.

It is envisaged that the following categories of waste will be generated during the construction of the project:

- municipal solid waste (MSW) from the office and canteen;
- construction and demolition waste;
- waste oil/hydrocarbons;
- paper/cardboard;
- timber;
- steel.

A fully authorised waste management contractor will be appointed prior to construction works commencing. This contractor will provide appropriate receptacles for the collection of the various waste streams and will ensure the regular emptying/and or collection of these receptacles.

Waste will be reused onsite for other suitable purposes where possible. For example:

- re-use of shuttering etc. where it is safe to do so;
- re-use of rebar cut-offs where suitable;
- re-use of excavate materials for screening, berms etc.;
- re-use of excavated material etc. – will be used as suitable fill elsewhere on site for the new site tracks, the hardstanding areas and embankments where possible.

Receptacles will be provided for the separation and collection of dry recyclables (paper, cardboard, plastics etc.), biological waste (canteen waste) and residual waste. Receptacles will be clearly labelled, signposted and stored in dedicated areas. The following sourced segregated materials container will be made available on site at a suitable location:

- timber;
- ferrous metals;
- aluminium;
- dry mixed recyclables;
- packaging waste;
- food waste.

Residual waste generated on-site may require disposal. This waste will be deposited in dedicated receptacles and collected by the licensed waste management contractor and transported to an appropriate facility. Waste Facilities have been identified in Section 2.4.4 of Chapter 2 of the EIAR. All waste movements will be recorded, of which records will be held by the waste manager on-site.

Any contaminated soils will be handled, removed and disposed of in accordance with statutory requirements for the handling, transportation and disposal of waste.

Waste management during the construction stage is set out in the CEMP included in Appendix 2.2 of Volume 2 of this EIAR. Once these best practice measures are put in place, waste produced during the construction stage will have an imperceptible impact on the receiving environment. Waste created on site and disposed of in licenced facilities will have a slight negative impact on the capacity of the facilities identified.

10.8.3 Potential Impacts – Renewable, Non-Renewable Resources and Utility Infrastructure - Operational

Once the Proposed Development is operational, the potential for negative effects on material assets is minimal. Maintenance of access tracks and infrastructure may require small amounts of imported fill, however, the impact of this is likely to be slight/imperceptible.

The direct effect of electricity generated by the Proposed Development will give rise to a reduction in the quantity of fossil fuels required for electricity generation across the State. This will give rise to a long-term slight positive impact on renewable energy resource and will contribute to reducing Ireland's dependency on imported fuel resources.

A minimum setback distance of 3.5 x rotor diameter has been imposed between the proposed wind turbines and existing 110kV overhead lines in accordance with EirGrid general functional specifications. No impact on existing major utility infrastructure is expected at the wind farm site during the operational phase.

As set out in Chapter 13, following a telecommunications assessment on potential impact to existing infrastructure, the Proposed Development will have no significant impact on existing telecommunications signals during the operational phase of the project.

Significant volume of waste is not expected to be produced during the operation phase of the Proposed Development. In the event that maintenance works are required at the site during the operational phase, a CEMP will be in place, and waste management procedures as set out in section 10.8.2.4 will be followed. Any waste produced during the operational phase of the Proposed Development will have an imperceptible impact on the receiving environment.

10.8.4 Potential Impacts – Renewable, Non-Renewable Resources and Utility Infrastructure – Decommissioning

The potential impacts associated with decommissioning phase will be similar to those associated with construction but of a reduced magnitude.

Decommissioning works will include removal of above ground structures including the turbines and met masts. Turbine foundations and access tracks will be left in situ. The proposed on-site substation building will be taken in charge of by ESBN/EirGrid which will have a long-term slight positive impact on electricity infrastructure provision in the area. As mentioned previously, it is proposed to connect to the overhead 110kV line via a loop in-loop out connection. In this case there will be no connection to the AGCR.

There will be no significant negative impacts on renewable and non-renewable resources during the decommissioning phase. No likely negative impacts on utility infrastructure are expected during the decommissioning phase.

Increased traffic numbers on the local, regional and national roads will have a temporary slight negative impact on the road network due to increased traffic.

Waste will be produced as a result of the decommissioning activities. A decommissioning plan and associated CEMP, similar to that included in Appendix 2.2, will be followed during the decommissioning phase and waste management procedures as set out in section 10.8.2.4 will be followed. Decommissioned turbine components will be reused and recycled where possible and all non-reusable or recyclable materials will be disposed of in a licenced waste facility. Licenced waste facilities have been identified in Section 2.4.4 of Chapter 2 of the EIAR, however, decommissioning is expected to take place 25-years from commissioning of the Proposed Wind Farm and therefore it is uncertain if the identified facilities will remain operational at this time. Through the use of a waste management plan, similar to that as detailed in the CEMP contained in Appendix 2.2, waste produced during the decommissioning phase will have an imperceptible impact on the receiving environment. Waste produced during the decommissioning phase will likely have a slight negative impact on the capacity of the licenced waste facilities used at the time of decommissioning.

10.8.5 Mitigation Measures – Renewable, Non-Renewable Resources and Utility Infrastructure

Non-renewable resources of stone and fill will be sourced locally insofar as possible to minimise transportation distances.

Where services and street furniture are required to be removed temporarily to accommodate turbine delivery, residents and business in proximity to the works will be informed in advance.

No accommodation works will be required for the TDR . It is likely that turbine delivery will take place outside of regular travelling/commuting hours in order to avoid potential traffic impacts on major routes and will be supervised under Garda escort.

A Construction Waste Management Plan has been prepared for the Proposed Development and is included in the CEMP in Appendix 2.2, in line with the" Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects" (2006) as published by the Department of the Environment, Community and Local Government and supported by the Southern Region Waste Management Plan 2015-2021.

The Waste Management Plan will be finalised in accordance with the CEMP following the appointment of the contractor for the main construction works and will take cognisance of any newly published waste management policy.

10.8.6 Residual Impacts – Renewable, Non-Renewable Resources and Utility Infrastructure

Non-renewable resources such as aggregates and cement are required onsite during the construction phase. This will result in a permanent negative imperceptible residual impact on non-renewable resources.

The Proposed Development will result in a long-term slight positive residual impact on non-renewable resources by offsetting the use of fossil fuels in electricity generation over the lifetime of the project.

Residual waste from the construction, operation and decommissioning phases will be disposed of at a licenced waste facility. This will result in a permanent slight negative impact to capacity of licenced waste facilities in the area of the Proposed Development. The waste facilities currently in operation in proximity to the site are identified in Section 2.4.4 of Chapter 2 of the EIAR.

10.9 Do-Nothing Scenario

In the event that the Proposed Development does not proceed, the existing land use on the site will continue in its present form consisting of agricultural land for the foreseeable future.

In the absence of renewable energy development, it is likely that there will be a continuance of excessive greenhouse gas emissions and consumption of fossil fuels. The opportunity to harness the wind energy capacity of the site would be lost, further constraining the State from achieving its renewable energy targets of 70% by 2030. The net displacement of between 24,522 and 34,331tonnes of CO2 per annum as a result of the operational phase of the Proposed Development will not be achieved.

Overall renewable energy supply was 12% of gross final consumption in Ireland in 2019 (SEAI, 2020). The remaining 88% of energy came from fossil fuels indicating Ireland's heavy dependency on the importation of fossil fuels to meet its energy needs in transport, heat and electricity. This dependency on energy imports leaves Irish consumers exposed to fluctuating international oil and gas prices. Harvesting renewable, indigenous resources such as wind will help diversify the Irish generation portfolio and reduce Ireland's dependency on imported fuel resources. In the do-nothing scenario, the proposed 25 MW wind farm will not contribute to reducing fossil fuel dependency.

It is also envisaged that if the Proposed Development does not proceed, opportunity for employment relating to the construction, operation and decommissioning will be lost, resulting in a lost opportunity for potential economic activity in the County Cork Area. Development contributions and considerable commercial rates would not be made payable to Cork County Council by the developer, and no Community Benefit Fund Scheme will be put in place in the locality resulting in a lost opportunity for benefit to community infrastructure.

10.10 Cumulative Impacts

As part of the cumulative impact assessment included throughout this EIAR, consented and existing developments/projects in the area of the Proposed Development were considered for potential cumulative impacts on the receiving environment. Large Projects and Proposed Developments within 20km of the site and all other projects within 500m were considered for the purpose of this assessment.

As set out in Section 10.2, a 20km distance was considered a reasonable zone of influence for the purpose of assessing potential cumulative impacts on population, human health and material assets, considering the limited size and extent of the project, the nature of the impacts and the relatively non-sensitive receiving environment. Smaller projects were examined in closer proximity to the Proposed Development including development within 500m of the wind farm site.

The list of all projects considered for the cumulative assessment are included in Appendix 1.2 of Volume 2 of this EIAR. Each of the projects listed in Appendix 1.2 were considered with respect to potential cumulative impacts on Population, Human Health and Material Assets. Projects for which cumulative impacts were not identified were discounted from the impact assessment.

Developments in the planning system within the vicinity of the Proposed Development consisting of one-off housing and agricultural developments were identified for potential cumulative assessment, however, these developments are small in scale and will have an imperceptible cumulative impact with the construction and operation of the Proposed Development, in relation to population, human health and material assets.

This is due to the significant setback of the Proposed Development from nearby planned and existing projects. Therefore, potential cumulative impacts associated with small scale development were considered to be imperceptible.

There are a number of existing and permitted wind farm developments nearby. There is an existing wind farm, namely Garranereagh Wind Farm with 4 operational turbines adjacent to the site. The nearest turbine at Garranereagh is over 900m to the east of the nearest proposed turbine. This development, along with any other planned or permitted wind farms in the vicinity, will be considered in the environmental assessment to evaluate any cumulative impacts that may arise.

Another consented Wind Farm of relevance is the Carrigarierk Wind Farm (P.A. Ref. No. 17431, ABP Ref: ABP-301563-18). This Wind Farm is located to the south west of the Proposed Development and consists of a 10 year permission for 110kV electricity substation including 2 no. control buildings associated electrical plant and equipment, underground electricity cabling, fencing, alterations to a previously permitted borrow pit and temporary construction compound at the Carrigarierk Wind Farm, 110kV underground electricity cabling connecting the Proposed Substation to the existing Dunmanway ESB substation,) 33kV underground electricity cabling connecting the Proposed Substation to the permitted Carrigarierk Wind Farm, together with all ancillary works and apparatus.

The Proposed Wind Farm and the existing Garraneragh Wind Farm in combination will have a cumulative impact on land use in the area, additional renewable energy land use to an established agricultural uses in the area. The Proposed Development will reduce the overall agricultural land by approx. 2.7 hectares. This is expected to have a non-significant to slight long term negative impact on agricultural land availability in the area of the Proposed Development.

The cumulative impact of the Proposed Development in combination with the Gerraneragh and Carrigerierk Wind Farms and other wind farms within 20km on Landscape and Visuals is detailed in Chapter 8: Landscape and Visual. The cumulative visual impact of the Proposed Development is considered to contribute an additional cumulative effect that is in the order of medium-low within the central Study Area, which will reduce to Low in the wider surrounds of the Study Area where the proposed turbines will appear as an extension of the Garranereagh turbines. Overall, whilst the Proposed Development will notably increase the intensity of wind farm development by more than doubling the number of wind turbines in the central Study Area, the proposed and existing Garranereagh turbines are of a similar scale and are located in an almost identical landscape context. Thus, the proposed turbines will typically be viewed as an extension to the existing Garranereagh development in the local and wider surrounds of the Study Area.

Cumulative noise impacts have been assessed for the Proposed Wind Farm project cumulatively with the existing Gerraneragh Wind Farms, in relation to residential amenity. The cumulative predicted noise levels comply with the daytime and night-time noise limits derived using the Wind Energy Development Guidelines 2006, at all sensitive locations. However, for some receptors a new source of noise will be introduced into the soundscape and it is expected that there will be a slight to moderate significance of impact, with dwellings closest to the project with a long-term moderate significance of impact.

The AGCR option proposed is to pass through the townlands of Garranareagh, Barnadivane (Kneeves), Barnadivane, Reanacaheragh, Lisnacuddy, Teerelton, Deshure, Cooldorragha, Carrigboy, Coolaclevane, Dromleigh, Teeranassig, Clonmoyle, Gorteenadrolane, Haremont, Johnstown, Carrigdangan and Gortatanavally. This alternative connection will be a tail-fed underground grid connection which has already been consented by Cork County Council and An Bord Pleanála (CCC Pl. Ref. 05/5907 and 11/6605; ABP Pl04.219620). The underground cable would travel from the Proposed Development in a southwest direction and connect to the internal underground Carrigarierk Wind Farm cable. The Carrigarierk Wind Farm will connect to the Carrickdangan 110kV substation, which in turn will connect to the Dunmanway ESB substation (CCC reference: 17/431; ABP reference: 301563-18). The works associated with the AGCR are expected to take place over a 4-month period and will be a "rolling" construction site, meaning that these works will not be concentrated in any one area of the route for a long period of time. The population of the AGCR area will receive a slight increase in numbers during working hours. However, due to the transient nature of the grid route works, this is expected to have an insignificant temporary and neutral impact on the population of the AGCR area. The proposed AGCR will remain in situ following decommissioning. There would be no expected effect on population along the AGCR area as a result of the decommissioning phase. No major flood events are recorded along the route of the AGCR. Disseminated malachite has been recorded within the Gun Point Formation approximately 1.3km south-east of the AGCR (ITM coordinates E 525926, N 561214).

Construction works associated with the AGCR would have potential to impact on nearby dwellings with regard to air quality. Due to the nature of construction along the proposed AGCR, which works as a "rolling" construction site, meaning that these works would not be concentrated in any one area of the route, these effects are considered to be brief to temporary slight, negative. Impacts from noise along the AGCR during the construction phase would have potential to cause temporary significant, negative impact at nearby dwellings, however, given the nature of the grid connection works, construction activities would not occur over an extended period at any one location. During the construction phase the AGCR would be constructed beneath 110kv voltage powerlines. The construction works for the AGCR would not be likely to impact on these powerlines.

Existing services along the proposed AGCR route are not expected to be impacted. It would not be intended to divert existing services but instead, where possible, the cable will be laid above or below existing services. Communication with service providers will be maintained for the duration of the construction works where required.

Temporary effects on land use will arise as a result of the installation of the AGCR along the grid route which will be constructed within the public road corridor. However, in the event that the AGCR is constructed, the Proposed Substation will not be constructed thereby reducing the impact on land use. It is expected that full road closures will be put in place to facilitate cabling works in combination with lane closures, partial road closures and stop/go systems. This will enable the works to be completed as quickly and as safely as possible, with minimal disruption time for residents of the area. No works will be carried out on the cable route during the general bird breeding season from (the 1st of March to the 31st of August inclusive) to ensure there are no impacts on breeding birds. These works shall be undertaken on a rolling basis with short sections closed for short periods before moving onto the next section. This is described in more detail in Chapter 11 - Traffic and Transportation. The AGCR is expected to be installed over a C.4 month period. There would be potential for repair works along the AGCR to take place, however, these would likely be brief or temporary and insignificant. Prior to the AGCR installation works within public roads, it would be proposed that all access points (domestic, business, agriculture) are considered when finalising the temporary road closures and diversions, in order to maintain local access as much as possible and avoid impacts on various land uses.

For the installation of the AGCR in the public road, a detailed traffic management plan would be developed in discussion with locals who will be directly impacted by the works, and in agreement with the Local Authority. Public consultation be conducted along the AGCR to inform local residents ahead of construction works.

The electric and magnetic fields expected to be associated with the operation of the proposed cable would fully comply with the ICNIRP and EU guidelines on exposure of the general public to ELF EMF. Therefore, the potential impact to human health as a result of electromagnetic interference associated with the operational phase of the proposed AGCR would be negligible and imperceptible.

The AGCR would remain in situ following decommissioning and would form part of the national grid. Therefore, impact to land use along the grid route is unlikely during the decommissioning phase. The consented AGCR would be taken in charge of by ESB following decommissioning, providing a long-term slight positive residual impact on electricity infrastructure in the area of the site.

There is a separate permission for the consented temporary accommodation works associated with the Turbine Delivery Route to facilitate the delivery of turbine components (CCC Ref. 14/6803). These works include the construction of a private roadway, approximately 150 metres long, from the R585 to the L6008. Land use along this section of the TDR is similar to the AGCR. In addition to arable and pasture farmlands, one-off houses and farmsteads. Flood events have been recorded along or adjacent to sections of the TDR, however, no flood events have been recorded at the TDR node upgrades where works are required. Furthermore, any surface water flooding occurring along the turbine delivery route would cause only minimal disruption. The TDR is expected to have a non-significant impact on flood risk. There will be no significant impacts associated with population and human health. There is no expected effect on population trends along the TDR as a result of the decommissioning phase.

The land use in proximity to the proposed AGCR is primarily agriculture and one-off housing and the land use along the TDR is agriculture and town centre/village centre including commercial, residential and industrial premises. Slight, temporary impacts to the existing land use along the TDR is expected during the construction phase and slight temporary impacts to the existing land use along the alternative GCR if this option is brought forward. The proposed AGCR alternative does not pass by any significant community facilities.

The electricity generating capacity of the Proposed Development, in combination with the consented solar farms and existing wind farms in proximity to the site, will have a long-term significant positive cumulative impact on utility infrastructure and renewable energy resource in the greater area and will have a positive impact on national renewable energy resources as well as reduction in requirements for the use of non-renewable fossil fuels. This will increase national savings on fossil fuel imports. Please see Appendix 1.2 of this EIAR for projects considered for the cumulative assessment

10.11 Conclusion

The assessment of Population, Human Health and Material Assets has established the existing environmental conditions of the Study Area, including the Proposed Wind Farm, the Proposed Substation (together considered as part of the Proposed Development), the Alternative Grid Connection Route (AGCR), the enabling TDR works and the TDR Area. Potential impacts were considered for the construction, operational and decommissioning phases of the Proposed Development as well as potential residual and cumulative impacts. Mitigation measures have been proposed where relevant. The Population, Human Health and Material Assets Chapter has been subdivided into the following topics for the purpose of the assessment:

- Population Trends;
- Socio-Economics, Employment and Economic Activity;
- Land Use;
- Recreation, Amenity and Tourism;
- Human Health and Safety;
- Renewable, Non-Renewable Resources and Utilities Infrastructure.

The population of the Study Area was found to be of low density and dispersed when compared to averages of County Cork as a whole and the State. The construction and decommissioning of the project will likely result in a short-term/temporary population growth in the Study Area during working hours due to the influx of construction workers during the construction and decommissioning phases. However, permanent impact on the population of the Study Area is considered unlikely as a result of the Proposed Development due to the short-term nature of the construction works.

The economic profile of the Study Area does not show any major disparities when compared to the National and County-wide average socio-economic statistics. In general, the baseline conditions of the Study Area shows healthy socio-economic characteristics.

Positive direct and indirect benefits to economic activity are identified during the construction and decommissioning phases due to the creation of construction jobs based in the area which is likely to provide employment opportunities for those living in the Study Area and surrounding areas of County Cork. The construction and decommissioning phases are likely to have a temporary to short-term positive economic impact on local businesses and services.

The operational phase of the Proposed Development has been identified as having a positive economic and social impact on the area with the provision of a Community Benefit Fund which will contribute to social infrastructure in the area and financially benefit those in closest proximity to the Proposed Wind Farm. Other positive economic benefits as a result of the operational phase of the Proposed Development includes reducing the State's reliance on fossil fuels which will reduce electricity prices, economically benefiting the consumer in the long-term throughout the State. Rates and development contributions will also benefit the local authority.

The land use of the Site consists of agriculture. One existing wind farm is located in proximity to the site. The Garranareagh Wind Farm located approximately 1km to the east of the Proposed Development.

The Proposed Development will see approximately 2.7 hectares of agricultural fields change use to renewable energy land use. The operational phase is not expected to have a significant impact on land use in the area of the Proposed Wind Farm.

With respect to Recreation, Amenity and Tourism, trail walking, historical areas, equestrian activity and sports grounds are the main activities and attractions in the greater area of the Proposed Wind Farm site. There are no major tourist attractions in proximity to the site. It is expected that the construction, operational and decommissioning phases of the Proposed Development will have a non-significant neutral impact on recreation and tourism in the area due to the distance of the proposed turbines from significant features. The provision of the community benefit fund will likely have a moderate positive long-term impact on the amenities of nearby villages.

Potential effects on human health and safety have been identified for both construction workers and the general public as a result of the construction and decommissioning of the Proposed Development.

Best practice construction methods and improved safety measures on public roads have been identified as measures to prevent potential accidents during the construction and decommissioning works. Potential health effects from noise and electromagnetic fields during the operational phase are considered negligible. Furthermore, the Proposed Development's potential susceptibility to major accidents and natural disaster is considered negligible.

It is anticipated that the Proposed Development will avoid significant negative impact on renewable and non-renewable resources by sourcing local building materials where possible, therefore reducing the requirement of transport, reducing CO2 emissions.

Furthermore, the Proposed Development will have no expected impact on existing telecommunications signals during the operational phase of the project as confirmed through consultation with telecommunications providers and an assessment of potential impacts to service coverage as detailed in Chapter 13.

Cumulative impacts have also been considered in relation to proposed, consented and constructed projects located near the Proposed Development. No significant cumulative impacts were identified in relation to population, human health and materiel assets.

In conclusion, once mitigation measures set out throughout this EIAR are implemented, it is unlikely that significant negative effects to population, human health and material assets will occur as a result of development of the Proposed Development. Significant long-term positive socio economic effects have been identified through job creation and the provision of the community benefit fund as a result of the construction, operation and decommissioning of the Proposed Development.

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