BALLYKETT GREEN ENERGY LIMITED

BALLYKETT WIND FARM

CO. CLARE

VOLUME II

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

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11 LANDSCAPE AND VISUAL AMENITY

11.1 INTRODUCTION

11.1.1 Background and Objectives

This chapter of the EIAR assesses the effects of the Project on the landscape and visual amenity of the receiving environment. Although closely linked, landscape and visual impacts are assessed separately. Where significant effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment will consider the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project (final phase)

The Project refers to all elements of the application for the construction and operation of the proposed Ballykett Wind Farm (see **Chapter 2: Project Description**).

Common acronyms used throughout this EIAR can be found in the **Appendix 1.4**.

This Chapter of the EIAR is supported by a portfolio of photomontages, which is provided as a separate booklet in the following Appendix document within **Volume IV** of this EIAR:

- **Appendix 11.1**: Visual Impact Assessments

In accordance with relevant guidance listed in **Section 11.2.2**:

Landscape Impact Assessment (LIA) relates to changes in the physical landscape brought about by the Development, which may alter its character, and how this is experienced. This requires a detailed analysis of the individual elements and characteristics of a landscape that go together to make up the overall landscape character of that area. By understanding the aspects that contribute to landscape character, it is possible to make judgements in relation to its quality (integrity) and to identify key sensitivities. This, in turn, provides a measure of the ability of the landscape in question to accommodate the type and scale of change associated with the Development without causing unacceptable adverse changes to its character.

Visual Impact Assessment (VIA) relates to assessing effects on specific views and on the general visual amenity experienced by people. This deals with how the surroundings of individuals or groups of people may be specifically affected by changes in the content and character of views as a result of the change or loss of existing elements of the landscape

and/or introduction of new elements. Visual impacts may occur from: visual obstruction (blocking of a view, be it full, partial or intermittent) or Visual Intrusion (interruption of a view without blocking).

Cumulative landscape and visual impact assessment is concerned with additional changes to the landscape or visual amenity caused by the Development in conjunction with other developments (associated or separate to it)

11.1.2 Assessment Structure

In accordance with the 'Guidelines for Landscape and Visual Impact Assessment (2013)' (Reference no. 3 from Section 11.8), the structure of this chapter will consist of separate considerations of landscape effects and visual effects in the following order:

- Assessment of landscape value and sensitivity
- Assessment of the magnitude of landscape effects within the Study Area
- Assessment of the significance of landscape impacts
- Assessment of visual receptor sensitivity
- Assessment of visual impact magnitude at representative viewpoint locations (using photomontages)
- Assessment of visual impact significance
- Assessment of cumulative landscape and visual impacts

11.1.3 Statement of Authority

This Landscape and Visual Impact Assessment was prepared by Jamie Ball, Senior Landscape Architect at Macro Works Ltd, and was reviewed by Richard Barker, Principal Landscape Architect at Macro Works Ltd, in Cherrywood, Dublin. Macro Works is a specialist LVIA company with over 20 years of experience in the appraisal of effects from a variety of energy, infrastructure and commercial developments. Relevant experience includes LVIA work on over 140 on-shore wind farm proposals throughout Ireland, including six Strategic Infrastructure Development (SID) wind farms. Macro Works and its senior staff members are affiliated with the Irish Landscape Institute.

11.1.4 Description of the Proposed Development

Planning permission is being sought by the Developer for the construction of 4 no. wind turbines, permanent Met Mast, Onsite substation and Control Building and all ancillary works. The Proposed Development will comprise of the following main components:

- Erection of 4 no. 4-5MW wind turbines with an overall ground to blade tip height of 150m. The candidate wind turbine will have a rotor diameter of 136m and a hub height of 82m.
- Construction of site access tracks, Turbine Hardstand areas and Turbine Foundations.
- Construction of new site entrance with access onto the adjoining local road network (L6132).
- Construction of one no. Temporary Construction Compound with associated temporary site offices, parking areas and security fencing
- Installation of 1 no. permanent Met Mast of 82m overall height.
- Construction of new internal site access tracks and upgrade of existing site track, to include all associated drainage including new clear span bridge crossing of the Moyasta 27 stream.
- Development of a site drainage network
- Construction of one Electrical Substation.
- All Wind Farm Internal Cabling connecting the wind turbines to the Electrical Substation.
- Ancillary forestry felling to facilitate construction of the Development.
- All works associated with the permanent connection of the wind farm to the national electricity grid comprising a 38 kV underground cable in permanent cable ducts from the proposed, permanent, on-site substation and to the existing Tullabrack 110kV ESBN Substation.
- Vertical realignment of an existing crest curve on the L6132 local road in order to prevent grounding of abnormal load vehicles during delivery of turbine components.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought. For a more comprehensive project description, please refer to **Chapter 2: Project Description.**

11.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

11.2.1 Assessment Methodology

Production of this Landscape and Visual Impact Assessment (LVIA) involved baseline work in the form of desktop studies and fieldwork comprising professional evaluation by qualified and experienced Landscape Architects. This entailed the following:

11.2.1.1 Desktop Study

- Establishing an appropriate Study Area from which to study the landscape and visual impacts of the Development.
- Review of a Zone of Theoretical Visibility (ZTV) map, which indicates areas from which the Development is potentially visible in relation to terrain within the Study Area.
- Review of relevant County Development Plans, particularly with regard to sensitive landscape and scenic view/route designations (**Section 11.3.4**).
- Selection of potential Viewshed Reference Points (VRPs) from key visual receptors to be investigated during fieldwork for actual visibility and sensitivity.

11.2.1.2 Fieldwork

- Recording of a description of the landscape elements and characteristics within the Study Area.
- Selection of a refined set of VRP's for assessment. This includes the capture of reference images and grid reference coordinates for each VRP location for the visualisation specialist to prepare photomontages.

11.2.1.3 Appraisal

- Consideration of the receiving landscape with regard to overall landscape character as well as the salient features of the Study Area including landform, drainage, vegetation, land use and landscape designations.
- Consideration of the visual environment including receptor locations such as centres of population and houses, transport routes, public amenities and facilities and designated and recognised views of scenic value.
- Consideration of design guidance and planning policies.
- Consideration of potentially significant construction stage and operational stage effects and the mitigation measures that could be employed to reduce such effects.
- Assessment of the significance of residual landscape impacts.
- Assessment of the significance of residual visual impacts aided by photomontages prepared at all of the selected VRP locations.
- Assessment of cumulative landscape and visual effects in combination with other surrounding developments that are either existing or permitted.

11.2.2 Relevant Legislation and Guidance

This LVIA uses methodology that is in accordance with that prescribed in the following guidance documents:

- Environmental Protection Agency (EPA) publication 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022) and the accompanying Advice Notes on Current Practice in the Preparation of Environmental Impact Assessment Reports (2022).
- Landscape Institute and the Institute of Environmental Management and Assessment publication entitled Guidelines for Landscape and Visual Impact Assessment – Third Edition (2013). This is the principal guidance for LVIA in Ireland and the UK and will be referenced hereafter as **GLVIA3**
- NatureScot (formerly SNH) Guidance: Assessing the cumulative landscape and visual impact of onshore wind energy developments (2018).
- Department of the Environment, Heritage and Local Government Wind Energy Development Guidelines (2006)
- Scottish Natural Heritage (SNH) Visual representation of wind farms: Best Practice Guidelines (version 2.2 - 2017).

11.2.3 Definition of Study Area

The Wind Energy Development Guidelines published by the Department of the Environment, Heritage and Local Government (2006) specify different radii for examining the zone of theoretical visibility of proposed wind farm projects (ZTV). The extent of this search area is influenced by turbine height, as follows:

- 15km radius for blade tips up to 100m
- 20km radius for blade tips greater than 100m
- 25km radius where landscapes of national and international importance exist.

In the case of this project, the blade tips are 150m high and, thus, the minimum ZTV radius recommended is 20km from the outermost turbines of the scheme. There are not considered to be any sites of national or international importance between 20 – 25km and thus, the radius of the Study Area will remain at 20km. Notwithstanding the full 20km extent of the LVIA Study Area, there will be a particular focus on receptors and effects within the Central Study Area where there is higher potential for significant impacts to occur. When referenced within this assessment, the 'Central Study Area' is the landscape within 5km of the Site. Relevant guidance does not require a Central Study Area to be defined, but it has become standard / best practice to highlight the distinction between the immediate context of the site and the wider context of the study area.

11.2.4 Computer Generated Images, Photomontages and Wireframes

This LVIA is supported by a variety of computer generated maps and graphics as well as verifiable photomontages that depict the Development within the views from a range of represented visual receptor locations. These maps, graphics and visualisations consist of the following:

- Zone of Theoretical Visibility (ZTV) maps.
- Photomontages consisting of existing views, wireframe views and proposed views.

11.2.5 Assessment Criteria for Landscape Effect

The classification system used by Macro Works to determine the significance of landscape and visual impacts is based on the IEMA Guidelines for Landscape and Visual Impact Assessment (2013). When assessing the potential impacts on the landscape resulting from a wind farm development, the following criteria are considered:

- Landscape character, value and sensitivity
- Magnitude of likely impacts
- Significance of landscape effects

The sensitivity of the landscape to change is the degree to which a particular landscape receptor (Landscape Character Area (LCA) or feature) can accommodate changes or new features without unacceptable detrimental effects to its essential characteristics. Landscape Value and Sensitivity is classified using the following criteria:

Table 11.1: Landscape Value and Sensitivity

Sensitivity	Description
Very High	Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are high value landscapes, protected at an international or national level (World Heritage Site/National Park), where the principal management objectives are likely to be protection of the existing character.
High	Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national or regional level (Area of Outstanding Natural Beauty), where the principal management objectives are likely to be considered conservation of the existing character.
Medium	Areas where the landscape character exhibits some capacity and scope for development. Examples of which are landscapes which have a designation of protection at a county level or at non-designated local level where there is evidence of local value and use.
Low	Areas where the landscape character exhibits a higher capacity for change from development. Typically, this would include lower value, non-designated landscapes that may also have some elements or features of recognisable quality, where landscape management objectives include, enhancement, repair and restoration.

Sensitivity	Description
Negligible	Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value.

The magnitude of a predicted landscape impact is a product of the scale, extent or degree of change that is likely to be experienced as a result of the Development. The magnitude takes into account whether there is a direct physical impact resulting from the loss of landscape components and/or a change that extends beyond the Site Boundary that may have an effect on the landscape character of the area.

Table 11.2: Magnitude of Landscape Impacts

Sensitivity	Description
Very High	Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
High	Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
Medium	Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality.
Low	Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements.
Negligible	Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable.

The significance of a landscape impact is based on a balance between the sensitivity of the landscape receptor and the magnitude of the impact. The significance of landscape impacts is arrived at using the following matrix:

Table 11.3: Landscape Impact Significance Matrix

	Sensitivity of Receptor				
Scale/Magnitude	*Very High*	*High*	*Medium*	*Low*	*Negligible*
Very High	Profound	Profound-substantial	Substantial	Moderate	Slight
High	Profound-substantial	Substantial	Substantial-moderate	Moderate-slight	Slight-imperceptible
Medium	Substantial	Substantial-moderate	Moderate	Slight	Imperceptible
Low	Moderate	Moderate-slight	Slight	Slight-imperceptible	Imperceptible
Negligible	Slight	Slight-imperceptible	Imperceptible	Imperceptible	Imperceptible

Note: Judgements deemed 'substantial' and above are considered to be 'significant effects' in EIA terms.

11.2.6 Assessment Criteria for Visual Effect

As with the landscape impact, the visual impact of the Development will be assessed as a function of receptor sensitivity versus magnitude. In this instance, the sensitivity of visual receptors, weighed against the magnitude of visual effects.

11.2.6.1 Visual Sensitivity

Unlike landscape sensitivity, visual sensitivity has a human basis. Visual sensitivity is a two-sided analysis of receptor susceptibility (people or groups of people) versus the value of the view on offer at a particular location.

To assess the susceptibility of viewers and the amenity value of views, the assessors use a range of criteria and provide a four-point weighting scale to indicate how strongly the viewer/view is associated with each of the criterion. Susceptibility criteria are extracted directly from the IEMA Guidelines for Landscape and Visual Assessment (2013), whilst the value criteria relate to various aspects of a view that might typically be related to high amenity including, but not limited to, scenic designations. These are set out below:

Susceptibility of receptor group to changes in view. This is one of the most important criteria to consider in determining overall visual sensitivity because it is the single category dealing with viewer susceptibility. In accordance with the IEMA Guidelines for Landscape and Visual Assessment (3rd edition 2013) visual receptors most susceptible to changes in views and visual amenity are:

- *"Residents at home*

- *People, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focussed on the landscape and on particular views*
- *Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience*
- *Communities where views contribute to the landscape setting enjoyed by residents in the area*
- *Travellers on road rail or other transport routes where such travel involves recognised scenic routes and awareness of views is likely to be heightened".*

"Visual receptors that are less susceptible to changes in views and visual amenity include:

- *People engaged in outdoor sport or recreation, which does not involve or depend upon appreciation of views of the landscape*
- *People at their place of work whose attention may be focussed on their work or activity, not their surroundings and where the setting is not important to the quality of working life".*

Recognised scenic value of the view (County Development Plan designations, guidebooks, touring maps, postcards etc.). These represent a consensus in terms of which scenic views and routes within an area are strongly valued by the population because in the case of County Development Plans, at least, a public consultation process is required.

Views from within highly sensitive landscape areas. Again, highly sensitive landscape designations are usually part of a county's Landscape Character Assessment, which is then incorporated with the County Development Plan. Viewers within such areas are likely to be highly attuned to the landscape around them.

Intensity of use, popularity. Whilst not reflective of the amenity value of a view, this criterion relates to the number of viewers likely to experience a view on a regular basis and whether this is significant at county or regional scale.

Connection with the landscape. This considers whether or not receptors are likely to be highly attuned to views of the landscape i.e. commuters hurriedly driving on busy national route versus hill walkers directly engaged with the landscape enjoying changing sequential views over it.

Provision of elevated panoramic views. This relates to the extent of the view on offer and the tendency for receptors to become more attuned to the surrounding landscape at locations that afford broad vistas.

Sense of remoteness and/or tranquillity. Remote and tranquil viewing locations are more likely to heighten the amenity value of a view and have a lower intensity of development in comparison to dynamic viewing locations such as a busy street scene.:

Degree of perceived naturalness. Where a view is valued for the sense of naturalness of the surrounding landscape it is likely to be highly sensitive to visual intrusion by obvious human interventions.

Presence of striking or noteworthy features. A view might be strongly valued because it contains a distinctive and memorable landscape feature such as a promontory headland, lough or castle.

Historical, cultural or spiritual value. Such attributes may be evident or sensed at certain viewing locations that attract visitors for the purposes of contemplation or reflection heightening the sense of their surroundings.

Rarity or uniqueness of the view. This might include the noteworthy representativeness of a certain landscape type and considers whether other similar views might be afforded in the local or the national context.

Integrity of the landscape character in view. This criterion considers the condition and intactness of the landscape in view and whether the landscape pattern is a regular one of few strongly related components or an irregular one containing a variety of disparate components.

Sense of place. This criterion considers whether there is special sense of wholeness and harmony at the viewing location.

Sense of awe. This criterion considers whether the view inspires an overwhelming sense of scale or the power of nature.

Those locations where highly susceptible receptors or receptor groups are present and which are deemed to satisfy many of the view value criteria above are likely to be judged to have a high visual sensitivity and vice versa.

11.2.6.2 Visual Impact Magnitude

The magnitude of visual effects is determined on the basis of two factors; the visual presence of the proposal and its effect on visual amenity.

Visual presence is a somewhat quantitative measure relating to how noticeable or visually dominant the proposal is within a particular view. This is based on a number of aspects beyond simply scale in relation to distance. Some of these include the extent of the view as well as its complexity and the degree of existing contextual movement experienced such as might occur where turbines are viewed as part of / beyond a busy street scene. The

backdrop against which the Development is presented and its relationship with other focal points or prominent features within the view is also considered. Visual presence is essentially a measure of the relative visual dominance of the proposal within the available vista and is expressed as such i.e. minimal, sub-dominant, co-dominant, dominant, highly dominant.

For wind energy developments, a strong visual presence is not necessarily synonymous with significant effects. Instead, the 2012 Fáilte Ireland survey entitled 'Visitor Attitudes on The Environment – Windfarms' found that:

"Compared with other types of development in the Irish landscape, windfarms elicited a positive response when compared to telecommunication masts and steel electricity pylons"

…. and that

"most (tourists) *felt that their presence did not detract from the quality of their sightseeing, with the largest proportion (45%) saying that the presence of the windfarm had a positive impact on their enjoyment of sightseeing…*".

The purpose here is not to suggest that turbines are either inherently liked or disliked, but rather to highlight that the assessment of visual impact magnitude for wind turbines is more complex than just the degree to which turbines occupy a view. Furthermore, a clear and comprehensive view of a wind farm might be preferable in many instances to a partial, cluttered view of turbine components that are not so noticeable within a view. On the basis of these reasons, the visual amenity aspect of assessing impact magnitude is qualitative and considers such factors as the spatial arrangement of turbines both within the scheme and in relation to surrounding terrain and land cover. It also examines whether the Development contributes positively to the existing qualities of the vista or results in distracting visual effects and disharmony.

It should be noted that as a result of this two-sided analysis, a high order visual presence can be moderated by a low level of effect on visual amenity and vice versa. Given that wind turbines do not represent significant bulk; visual impacts result almost entirely from visual 'intrusion' rather than visual 'obstruction' (the blocking of a view). The magnitude of visual impacts is classified in the following table derived from the Guidelines for Landscape and Visual Impact Assessment:

Table 11.4: Magnitude of Visual Impacts

Sensitivity	Description
Very High	The proposal intrudes into a large proportion or critical part of the available vista and is without question the most noticeable element. A high degree of visual disorder or disharmony is also generated, strongly reducing the visual amenity of the scene.
High	The proposal intrudes into a significant proportion or important part of the available vista and is one of the most noticeable elements. A considerable degree of visual disorder or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene.
Medium	The proposal represents a moderate intrusion into the available vista, is a readily noticeable element and/or it may generate a degree of visual disorder or disharmony, thereby reducing the visual amenity of the scene. Alternatively, it may represent a balance of higher and lower order estimates in relation to visual presence and visual amenity.
Low	The proposal intrudes to a minor extent into the available vista and may not be noticed by a casual observer and/or the proposal would not have a marked effect on the visual amenity of the scene.
Negligible	The proposal would be barely discernible within the available vista and/or it would not detract from, and may even enhance, the visual amenity of the scene.

11.2.6.3 Visual Impact Significance

As stated above, the significance of visual impacts is a function of visual receptor sensitivity and visual impact magnitude. This relationship is expressed in the significance matrix in **Table 11.3** above.

11.2.6.4 Quality and Timescale of Effects

In addition to assessing the significance of landscape effects and visual effects, EPA Guidance for EIARs requires that the quality of the effects is also determined. This could be negative/adverse, neutral, or positive/beneficial. Landscape and Visual effects are also categorised according to their duration:

- Temporary – Lasting for one year or less;
- Short Term – Lasting one to seven years;
- Medium Term – Lasting seven to fifteen years;
- Long Term – Lasting fifteen years to sixty years; and
- Permanent – Lasting over sixty years.

Similarly, the duration of effects will typically be long term, where the average wind farm lifespan is between 20-40 years.

11.2.6.5 Assessment Criteria for Cumulative Effects

The Scottish Natural Heritage (SNH) Guidance relating to 'Assessing the Cumulative Effects of Onshore Wind Farms (2012) identify that cumulative impacts on visual amenity consist of combined visibility and sequential effects. The same categories have also been

subsequently adopted in the Landscape Institute's 2013 revision of the Landscape and Visual Impact Assessment Guidelines. The principal focus of wind energy cumulative impact assessment guidance relates to other wind farms - as opposed to other forms of development. This will also be the main focus herein, albeit with a subsequent consideration of cumulative impacts with other forms of notable development (existing, permitted or proposed), particularly within the Central Study Area.

> *'Combined visibility occurs where the observer is able to see two or more developments from one viewpoint. Combined visibility may either be in combination (where several wind farms are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various wind farms).*
>
> *Sequential effects occur when the observer has to move to another viewpoint to see different developments. The occurrence of sequential effects may range from frequently sequential (the features appear regularly and with short time lapses between, depending on speed of travel and distance between the viewpoints) to occasionally sequential (long time lapses between appearances, because the observer is moving very slowly and / or there are large distances between the viewpoints.)'*

Based on guidance contained within the SNH Guidelines relating to the Cumulative Effects of Wind Farms (2018) and the DoEHLG Wind Energy Guidelines (2006), cumulative impacts can be experienced in a variety of ways.

Table 11.5 below provides Macro Works' criteria for assessing the magnitude of cumulative impacts, which are in accordance with the SNH Guidelines (2018).

Table 11.5: Magnitude of Cumulative Impacts

Magnitude of Impact	Description
Very High	• The proposed wind farm will strongly contribute to wind energy development being the defining element of the surrounding landscape. • It will strongly contribute to a sense of wind farm proliferation and being surrounded by wind energy development. • Strongly adverse visual effects will be generated by the proposed turbines in relation to other turbines.
High	• The proposed wind farm will contribute significantly to wind energy development being a defining element of the surrounding landscape. • It will significantly contribute to a sense of wind farm proliferation and being surrounded by wind energy development. • Significant adverse visual effects will be generated by the proposed turbines in relation to other turbines.
Medium	• The proposed wind farm will contribute to wind energy development being a characteristic element of the surrounding landscape.

Magnitude of Impact	Description
	• It will contribute to a sense of wind farm accumulation and dissemination within the surrounding landscape. • Adverse visual effects might be generated by the proposed turbines in relation to other turbines.
Low	• The proposed wind farm will be one of only a few wind farms in the surrounding area and will be viewed in isolation from most receptors. • It might contribute to wind farm development becoming a familiar feature within the surrounding landscape. • The design characteristics of the proposed wind farm accord with other schemes within the surrounding landscape and adverse visual effects are not likely to occur in relation to these.
Negligible	• The proposed wind farm will most often be viewed in isolation or occasionally in conjunction with other distant wind energy developments. • Wind energy development will remain an uncommon landscape feature in the surrounding landscape. • No adverse visual effects will be generated by the proposed turbines in relation to other turbines.

11.3 BASELINE DESCRIPTION

11.3.1 Landscape Baseline

The landscape baseline represents the existing landscape context and is the scenario against which any changes to the landscape brought about by the Development will be assessed. This also includes reference to any relevant landscape character appraisals and the current landscape policy context (both are generally contained within County Development Plans). Relevant County Development Plans in this instance include County Clare, within which the development is located, as well as County Kerry and County Limerick, which both have areas that are contained within the wider study are to the south and southeast respectively.

A description of the landscape context of the proposed wind farm Site and Study Area is provided below under the headings of landform and drainage, vegetation and land use, centres of population, transport routes and public amenities and facilities as well as the immediate site context. Additional descriptions of the landscape, as viewed from each of the selected viewpoints, are provided under the detailed assessments later using a similar structure. Although this description forms part of the landscape baseline, many of the landscape elements identified also relate to visual receptors i.e., places and transport routes from which viewers can potentially see the proposed Development. The visual resource will be described in greater detail below. **Figure 11.1** in **Volume III** shows the Site in its landscape context and the immediate surrounds.

11.3.2 Landform and Drainage

The site is contained within a slightly-sloping, low lying area approx. 6km to the north of the mouth of the River Shannon (see **Plate 11.1**, below). This estuary serves as a transition between the intricate Atlantic coastline on the outer edge of the Study Area to the west and southwest, and the more elevated, upland areas to the north and east. The landscape within the Study Area is intermittently punctuated with small loughs and connecting waterways, as well as estuary bays such as Clonderalaw Bay and Poulnasherry Bay. Aside from the Shannon, there are multiple watercourses, the largest of which is the Doonbeg River, in the north of the Study Area.

Plate 11.1 Topography of the central study area

The landscape of the Study Area can be best described as a series of four distinct quadrants to the northeast, southeast, southwest and northwest. The north-eastern quadrant of the Study Area is dominated by gradually inclining topography, which rarely exceeds 200m AOD, of undulating commercial conifer plantations and peat bogs, backed by Slievecallan Mountain (a few kilometres outside the Study Area). The south-eastern and southwestern quadrants are dominated by the River Shannon Estuary, which defines the main boundary between County Kerry/County Limerick to the south and County Clare to the north of the estuary. Finally, the north-western quarter of the Study Area is contained in slightly undulating coastal bog and marginal farmland, backed by the rugged Atlantic coastline. The broad landscape of the Site and its immediate context serves as the dividing feature between the River Shannon Estuary to the south and the elevated upland area dominating the north-eastern quadrant of the Study Area.

11.3.3 Vegetation and Land use

The vegetation and land use follows the varied topography of the Study Area, which can be divided into quadrants for the purposes of describing it. Throughout the north-western coastal context, shoreline farmland mixes with riparian scrub and woodland and is dotted with rural residences and holiday homes vying for coastal views. The Slievecallan uplands in the north-eastern quadrant contain significant portions of mountain moorland on its elevated slopes and ridges, alongside dense patches of conifer plantations. Less commonly, there are some areas of upland grazing, which give way to valley farmland in lower-lying areas.

Of particular note is that this area has also become synonymous with wind energy developments in recent decades and numerous turbines are contained within predominantly the elevated moorland areas, between conifer plantations. A large portion of the south-eastern and south-western quadrants is dominated by the River Shannon Estuary. The south-eastern and south-western quadrant are therefore predominantly contained in coastal peat bog and marshy grassland towards the banks of the Shannon Estuary, with occasional patches of forest plantation and farmland further inland, where drainage allows.

The settlements of Kilrush, Kilkee, Doonbeg, Cooraclare and Tarbert account for the only notable urban land cover within the Study Area. Industrial and energy related land use is one of the defining features of this area due to its proximity to the River Shannon, which is used to access the busy Foynes Port and large Aughinish Alumina Plant, upriver to the east of the Study Area. The Tarbert and Moneypoint power stations, which lie on opposite sides of the Shannon within the Study Area, are the key electrical infrastructure nodes for the west of Ireland. Aside from being substantial industrial facilities in their own right, they provide hubs for numerous high voltage electricity lines which converge on them. At over 200m tall, the twin chimneys at Moneypoint are the second tallest structures in the country. Adding to this energy related land use, is a busy container shipping lane through the centre of the estuary that serves the industrial port of Foynes, east of the Study Area, as well as the presence of a number of operational wind farms which are situated throughout the central and Wider Study Area (see **Section 11.3.7**). The nearest of these, Moanmore Wind Farm and Tullabrack Wind Farm, are located within 2km to the northwest of the proposed wind farm.

The main wind farm Site area extends to approx. 60ha, much of which is on former exploited/cutaway bog that is most used for commercial forestry plantations in various stages of commercial cycle. Most of this forestry land has been clear-felled over the last 20-

25 years, aside from the periphery of the Site, where a 20-50m-wide thicket of forestry remains to most sides (see **Plate 11.2**, below). Thus, in clear-felled areas, there is considerable degree of transitional woodland scrub with patches of exposed peatland in areas where planting failed to establish. Aside from the transitional scrub and remaining thickets of forestry, there is an area of unplanted cutaway peatland toward the north-eastern portion of the Site.

Plate 11.2: Landcover of the Site surrounds

11.3.4 Landscape Policy Context and Designations

11.3.4.1 The Department of Environment, Heritage and Local Government Wind Energy Development Guidelines (2006)

The Wind Energy Development Guidelines (2006) provide guidance on wind farm siting and design criteria for a number of different landscape types. The site of the proposed Development is considered to be located within a relatively complex landscape setting that is more consistent with the 'Hilly and Flat Farmland' landscape type than other landscape types from the Wind Energy Development Guidelines. However, the wider context does encompass characteristics from a mix of the landscape types including, 'Transitional Marginal Land', 'Coast' and 'Flat Peatland'.

The most relevant recommendations for the 'Hilly and Flat Farmland' landscape type is set out below, but with consideration of the guidance relating to other relevant landscape types considered thereafter.

Hilly and Flat Farmland:

Location – *"Location on ridges and plateaux is preferred, not only to maximise exposure but also to ensure a reasonable distance from dwellings. Sufficient distance should be maintained from farmsteads, houses and centres of population in order to ensure that wind energy developments do not visually dominate them. Elevated locations are also more likely to achieve optimum aesthetic effect. Turbines perceived as being in close proximity to, or overlapping other landscape elements, such as buildings, roads and power or telegraph poles and lines may result in visual clutter and confusion. While in practice this can be tolerated, in highly sensitive landscapes every attempt should be made to avoid it."*

Spatial extent - *"This can be expected to be quite limited in response to the scale of fields and such topographic features as hills and knolls. Sufficient distance from buildings, most likely to be critical at lower elevations, must be established in order to avoid dominance by the wind energy development."* *The examples of appropriate and inappropriate types of spatial extent for wind energy developments outline that a small spatial extent with a grid or linear layout is deemed appropriate in a this landscape type, considering the field patterns typically present in a Hilly and Flat Farmland landscape.*

"2(a) Wind energy development of large spatial extent … is inappropriate…"

"2(b)Wind energy development of small spatial extent – this example is appropriate given the scale of this landscape.

"2€Wind energy development with random layo–t - this response is inappropriate given the patchwork field pattern of this landscape.

"2(d) Wind energy development with grid layo–t - this response involving any form of linear layout and regular spacing is appropriate given the patchwork field pattern of this landscape.

"2(e) Small wind energy development with regular linear layo–t - the rhythmic order is more appropriate to this landscape due to the order created by the field pattern.

Spacing - *"The optimum spacing pattern is likely to be regular, responding to the underlying field pattern. The fields comprising the site might provide the structure for spacing of turbines. However, this may not always be the case and a balance will have to be struck between adequate spacing to achieve operability and a correspondence to field pattern."*

Layout - *"The optimum layout is linear and staggered linear on ridges (which are elongated) and hilltops (which are peaked), but a clustered layout would also*

be appropriate on a hilltop. Where a wind energy development is functionally possibly on a flat landscape a grid layout would be aesthetically acceptable."

Height *- "Turbines should relate in terms of scale to landscape elements and will therefore tends not to be tall. However, an exemption to this would be where they are on a high ridge or hilltop of relatively large scale. The more undulating the topography the greater the acceptability of an uneven profile, provided it does not result in significant visual confusion and conflict."*

Cumulative *-"It is important that wind energy development is never perceived to visually dominate. However, given that these landscapes comprise hedgerows and often hills, and that views across the landscape will likely be intermittent and partially obscured, visibility of two or more wind energy development is usually acceptable."*

Most design options appear to be appropriate for 'Hilly and Flat Farmland' and vary depending on the specific site. In respect of the above guidance, the modest spatial extent and grid layout of the proposed Development is in keeping with that recommended for Hilly and Flat Farmland.

11.3.4.2 Clare County Development Plan 2023-2029

The current Clare County Development Plan contains a Landscape Character Assessment which divides the county into 26 different Landscape Character Types (LCTs), which are then used as the basis to determine 21 geographically distinct Landscape Character Areas (LCAs). For most counties there are much fewer generic LCTs than LCAs. The fact that this trend is reversed for County Clare is more an indication of the diverse range of its landscapes than a divergent approach to landscape character assessment.

The proposed Development is contained within two LCTs, with majority of the Site within LCT9 – Farmed Rolling Hills, described as *'Very varied, complex landscape incorporating many elements with a rolling landform that is very uneven. Land cover reflects this complexity with a mosaic of lowland blanket bog, improved and semi-improved pasture and blocks of commercial forest (coniferous)… Condition is also variable, with some areas more intact than others. The presence of bog and forestry also creates the impression of being in a more upland area in places. Views are afforded from more elevated hills across the surrounding areas and to the Shannon estuary'*. A small portion to the northwest of the site is within LCT4 – Coastal Plain and Dunes described as *'Distinctively flat farmland found near to coasts, with sand dune systems with a characteristic hummocky landscape. Land cover is largely pasture and can be rushy in parts. Limited tree cover but present in sheltered pockets… Open and exposed, extensive views are afforded seaward and*

landward within this landscape type'. ***Error! Reference source not found.***, indicates the location of the Site in relation to the County Clare Landscape Character Types.

Correspondingly, majority of the Site is contained within 'LCA19 – Kilrush Farmland,' with a small portion to the northwest within 'LCA21 – Loop Head' and a small section to the south bordering 'LCA18 – Shannon Estuary Farmland.' These LCAs are described as follows:

LCA19 – Kilrush Farmland (also named Kilmihil Farmlands)

The key characteristics of this landscape include:

- *'Undulating to rolling hills, medium-high elevation. Some drumlin type landforms but these do not dominate.*
- *Complex mix of moorland and farmland.*
- *Occasional flatter areas within hills, such as Creegh River Valley*
- *Scattered settlement across the area with Kilmihil, Creegh and*
- *Curraclare the only villages.*
- *Kilmihil town is a designated ACA (Architectural Conservation Area).*

The condition of this area is moderate, with the areas close to the principal corridor routes disturbed and showing evidence of agricultural decline and lack of maintenance. Away from the major route, it is more intact and rural in character. However, even these areas are subject to agricultural degradation, arising from intensification, afforestation, abandonment and the construction of poorly sited farm buildings.'

LCA21 – Loop Head

The key characteristics of this landscape include:

- *'Flat peninsular farmland – very distinctive ladder fields, estuaries, salt marsh and mudflats, sand and boulder coves, shelving coastal rocks, vertical cliffs.*
- *Coast becomes increasingly dramatic towards Loop Head with high cliffs, arches, stacks and rocky inlets. More sheltered bays are typically on the southern side of the peninsula.*
- *The presence of the sea is always apparent and the character of the land reflects the mood of the weather and the storminess of the seas.*
- *The area is remote and feels remote and detached, with peaceful rural unspoilt qualities.*
- *Settlement is more concentrated along the southern peninsula, increasing again towards Kilkee.*

The area is in good condition and is increasingly intact as one travels west. Traditional settlement patterns and the distinctive ladder fields remain largely unaffected by modern development and agricultural change. Both farm buildings and land appear to be well maintained and some larger modern farm buildings are apparent within the landscape. The area is relatively free from tourist related development with a few scattered car parks and picnic areas scattered along the coast, and a concentration of holiday development at Kilkee, the main settlement in the area. Here, caravan parks, amusement arcades etc indicate that this is a long established coastal resort.

Large-scale development would be very evident due to the flat open nature of the area with expansive skies. Traditional small-scale housing development of scattered white painted cottages could be accommodated. The area would be particularly vulnerable to pressures such as windfarms, masts etc. Extensive views are afforded from the sheltered southern coast over to Kerry and along the western seaboard from Loop Head and along the northern coastline. The natural grassland at Loop Head is classified as visually sensitive and vulnerable under the county development plan. The whole of this coastline is also designated as an area of high amenity under the same plan.'

LCA18 – Shannon Estuary Farmland

The key characteristics of this landscape include:

- *'Prominently ridged landscape, with linear hills aligned south-west to north-east.*
- *Secluded areas interspersed with more open views. Views are afforded across the Shannon estuary and across to Limerick from elevated areas and on the estuary shores.*
- *Coastal fringe is flatter and slopes down towards the sea.*
- *Diverse habitat and land cover.*
- *Scattery Island is an important historical and focal feature.*
- *Complex patterns of pasture, woodland and scrub habitats.*
- *Old Vandeleur Estate plantations, gardens and restored woodland recreation area.*

This area is of variable condition. In parts, the traditional landscape pattern dominates. The area is more intact in the east and north, where it is less accessible. Occasional modern residential development along the estuary line can be inappropriate and not reflective of local styles. Around Kilrush and along the coast, tourist and holiday home development has also adversely affected the landscape. Moneypoint power station is a singularly large-scale detractor on the Shannon, accompanied by a number of prominent pylons. The ridges create many small-scale areas unsuitable for large development. The sensitivity remains higher in the more intact areas, with elevated areas also sensitive due to their increased

visibility. The estuary coastline is partly degraded due to infrastructure and the industrial activity within the Shannon estuary. The woodland scrub around Clonderlaw Bay and the broadleaved areas in the grounds of Kilrush house are classified as visually vulnerable and sensitive under the county development plan. The coastline to Clonderlaw Bay is also classified as an area of high amenity under this plan.'

Whilst the County Landscape Character Assessment provides an objective appraisal of the various landscapes of County Clare, it does not apply the more subjective aspect of landscape sensitivity. Instead, landscape policy is driven by determining which of three categories a particular landscape falls into and these are based around the various LCAs. The landscape of County Clare is subdivided into Living Landscape types which area outlined below:

- Settled landscapes - areas where people live and work;
- Working Landscapes – intensively settled and developed areas within Settled Landscapes or areas with a unique natural resource; and
- Heritage Landscapes: areas where natural and cultural heritage are given priority and where development is not precluded but happens more slowly and carefully.

By implication, 'Working Landscapes' are more robust areas of strategic development whilst 'Heritage Landscapes' such as the Burren are highly sensitive. Permissive or protective landscape objectives are applied accordingly. The remainder, and majority of the county, falls into the settled landscapes category by default. The landscape related objectives for this category seek to strike a balance between appropriate development and retaining landscape character and amenity.

The Site and the overwhelming majority of the central Study Area are contained within the 'Settled Landscapes' category (Figure11.4 refers) and the relevant landscape objectives from the Clare County Development Plan are provided below: –***A -*** *To permit development in these areas that will sustain economic activity and enhance social well-being and quality of life – subject to conformity with all other relevant provisions of the Plan and the availability and protection of resources.*

B – *That selection of appropriate sites in the first instances within this landscape, together within the consideration of the details of siting and design, are directed towards minimising visual impact.*

C – *That particular regard should be given to avoiding intrusions on scenic routes and on ridges or shorelines. Developments in these areas will be required to demonstrate:*

1. *That the site has been selected to avoid visually prominent locations*

2. *That site layouts avail of existing topography and vegetation to reduce visibility from scenic routes, walking trails, public amenities and roads;*
3. *That design for buildings and structures reduce visual impact through careful choice of form, finishes and colours and that any site works seek to reduce visual impact of the development*

Within the Clare County Development Plan (2023-2029), the following policies apply to landscape:

CDP14.1 Development Plan Objective: Landscape Character Assessment

It is an objective of Clare County Council: To encourage the utilisation of the Landscape Character Assessment of County Clare and other relevant landscape policy and guidelines and to have regard to them in the management, enhancement and promotion of the landscapes of County Clare.

CDP14.2 Development Plan Objective: Settled Landscapes

It is an objective of the Development Plan: To permit development in areas designated as 'settled landscapes' that sustain and enhance quality of life and residential amenity and promote economic activity subject to:

- *Conformity with all other relevant provisions of the Plan and the availability and protection of resources;*
- *Selection of appropriate sites in the first instance within this landscape, together with consideration of the details of siting and design which are directed towards minimising visual impacts;*
- *Regard being given to avoiding intrusions on scenic routes and on ridges or shorelines.*

Developments in these areas will be required to demonstrate:

- *That the site has been selected to avoid visually prominent locations;*
- *That the site layouts avail of existing topography and vegetation to reduce visibility from scenic routes, walking trails, water bodies, public amenities and roads;*
- *That design for buildings and structures reduce visual impact through careful choice of forms, finishes and colours, and that any site works seek to reduce visual impact.*

11.3.4.3 Clare County Council Wind Energy Strategy 2023 – 2029

A wind energy strategy for County Clare is included within the current Clare County Development Plan in Volume 6. Map E of the current County Development Plan identifies wind energy designations in County Clare.

Wind Energy Policies: Volume 6 of the CCDP 2017-2023 'County Clare Wind Energy Strategy (WES)' contains general and specific objectives for wind energy development. Relevant objectives to landscape and visual are set out below.

***General Objective WES One: Development of Renewable Energy Generation**: It is the objective of the Council to support, in principle and in appropriate scales and locations, the development of wind energy resources in County Clare. It is an objective of the Council to ensure the security of energy supply by accommodating the development of wind energy resources in appropriate areas and at appropriate scales within the County.*

***General Objective WES Three: County Partnership Approach**: Clare County Council will seek to promote wind energy in appropriate sites in the County and will work with agencies such as the Clare County Development Board, Clare Enterprise Board, Limerick Clare Energy Agency, Shannon Development, I.D.A and Enterprise Ireland to encourage investment in research and technology associated with wind farms and other renewable energy technology.*

***General Objective WES Six: Infrastructure Development Proposals:** Proposals for the development of infrastructure for the production, storage and distribution of electricity through the harnessing of wind energy will be considered in appropriate sites and locations, subject to relevant policy, legislation and environmental considerations.*

Section 4 and Annex B of the current wind energy strategy outlines advice on Landscape Capacity for wind energy developments, based on Landscape Character Areas (LCA's). The wind energy strategy states the following relating to wind energy capacity for the relevant LCAs:

LCA19 – Kilrush Farmlands (also named Kilmihil Farmlands)

The majority of this landscape area is designated 'Open for Consideration' for wind development, with part of this LCA within an 'Acceptable in Principle' area. The overall sensitivity to wind farm development is Medium, with the appropriate scale of wind farms designated as Medium/Large, indicating that the landscape has the capacity to absorb wind farm developments comprising of between 6 - 25 turbines. It is outlined that *'the rolling hills and drumlins in this sparsely settled areas offer capacity to accommodate wind farm development'*.

LCA21 – Loop Head (part of Loop Head LCA north of Kilrush close to Moanmore)

This landscape area is designated entirely as 'Acceptable in Principle' for wind development. The overall sensitivity to wind farm development is Medium, with the appropriate scale of wind farms designated as Medium, indicating that the landscape has

the capacity to absorb wind farm developments comprising of between 6 to 10 turbines. It is outlined that *'this particular area proposed as 'Acceptable in Principle' relates to the area around the existing wind energy development where the operating wind farm has become an established landuse and contributes to the landscape character. However, the remainder of the Loop Head LCA is considered to be more sensitive to such development due to the open character, spectacular coastline especially in the north and significant natural heritage designations around Loop Head and Poulnasherry Bay'.*

LCA18 – Shannon Estuary Farmland

This landscape area is designated entirely as 'Open for Consideration' for wind development. The overall sensitivity to wind farm development is Medium, with the appropriate scale of wind farms designated as Small/Medium, indicating that the landscape has the capacity to absorb wind farm developments comprising of between 1 to 10 turbines. It is outlined that *'There is some capacity in the southern part of this LCA for development away from Lough Derg and Killaloe. Small or medium wind farms would be most appropriate. Due to the low-lying nature of the LCA, lower turbine height would be most appropriate'*. Cumulative advice from the 2006 Wind Energy Guidelines for this LCA state; *'a second wind farm may be acceptable only at a very great distance with minimal visual presence'.*

According to the Wind Energy Designation map included within the Wind Energy Strategy, the proposal site is contained entirely within an area identified in the County Clare WES as being 'Open to Consideration' in terms of wind energy development (**Error! Reference source not found.**Figure 11.5 refers). There are 'Acceptable in Principle' areas a short distance to the west and east and favourable 'Strategic' areas to the north. The areas deemed 'Not Normally Permissible' are further west and generally hug the coastline. The relevant 'Open to Consideration' designation is referenced in the following manner:

'Wind energy Applications in these areas will be evaluated on a case-by-case basis subject to viable wind speeds, environmental resources and constraints and cumulative impacts.'

11.3.4.4 Local Authority Renewable Energy Strategy (LARES)

In addition to the Wind Energy Strategy included as Volume 5 of the current Clare County Development Plan, a Local Authority Renewable Energy Strategy has been prepared, and is included as Volume 5 of the current County Development Plan. It is stated that *"this Renewable Energy Strategy provides the necessary framework to maximise the County's renewable energy potential and to assist it in becoming an energy secure, low carbon*

county, to meet renewable energy targets, with the potential to export excess energy". The LARES for County Clare contains limited information about wind energy development but instead references the County Clare Wind Energy Strategy as the primary guidance document for wind development within the county.

11.3.4.5 Limerick County Development Plan 2022-2028

Whilst the Development is wholly contained within County Clare, a section of the south-eastern quarter of the Study Area falls within County Limerick, which comes within 13km southeast of the Site. The nearest landscape character unit from the Limerick Landscape Character Assessment is a narrow protrusion of the LCA 6 Shannon Coastal Zone. As its name suggests it is principally defined and described in terms of the broad estuarine sections of the Shannon below Limerick City.

Given the lack of thematic connection to the landscape units within County Clare that contain and flank the Site, it is not considered that the Landscape Character Assessment, landscape designations and / wind energy related policies from the Limerick County Development Plan are material in this instance. As the Development is potentially visible from substantial portions of northern Limerick, the CDP scenic designations remain relevant and will be addressed in the visual baseline (see Visual Baseline at **Section 11.3.5**).

11.3.4.6 Kerry County Development Plan 2022-2028

The nearest portion of County Kerry to the Site is approximately 9km to the southwest. The Kerry Landscape Character Assessment identifies that the nearest Landscape Character Types are Type B – Pasture with Dry Stone Walls and Hedgebanks and Type C – Pasture with Mature Hedgerows. At a finer scale, the relevant Landscape Character Areas are LCA1 - Beal Hill and Ballybunion and LCA2 - The Shannon Estuary. In terms of visual sensitivity, these LCAs are assigned Medium-High Visual Sensitivity which are the highest and second highest category of sensitivity out of five classes.

Again, the separation distances and wide, intervening Shannon Estuary, lack of contextual landscape connection to the upland site render the Kerry CDP landscape and wind energy related policies and designations as not material to this assessment. However, due to potential for mid and long-range visibility from Kerry, the scenic designations will be relevant (see Visual Baseline at **Section 11.3.5**).

11.3.4.7 Scenic Amenity

Scenic views and routes within 20km of the proposed Development are shown in Error! Reference source not found..

Views relevant to the project, as derived from the Clare, Limerick and Kerry Landscape Character Assessments are outlined in **Table 11.6** below.

County Clare

Section 13.5 of the County Clare CDP (2023-2029) relates to scenic views within County Clare. This section of the CDP contains a Landscape Designations Map (Map 13A) which outlines the Designated Scenic Routes within the County. In relation to scenic routes the County Development Plan states:

CDP13.7 – Development Plan Objective: Scenic Routes

It is an objective of Clare County Council:

a. *To protect sensitive areas from inappropriate development while providing for development and change that will benefit the rural community;*
b. *To ensure that proposed developments take into consideration their effects on views from the public road towards scenic features or areas and are designed and located to minimise their impact;*
c. *To ensure that appropriate standards of location, siting, design, finishing and landscaping are achieved.*

County Limerick

Section 6.4.2 of the County Limerick CDP (2022-2028) relates to views and prospects within County Limerick. In this section of the CDP, 'Map 6.2 – Views and Prospects' indicated the location of the protected views within County Limerick. The County Development Plan states:

Objective EH O31 - Views and Prospects

It is an objective of the Council to:

a. *Preserve, protect and encourage the enjoyment of views and prospects of special amenity value or special interests and to prevent development, which would block or otherwise interfere with views and/or prospects.*
b. *In areas where scenic views and prospects are listed in the Plan, there will be a presumption against development, except that required to facilitate farming and*

appropriate tourism and related activities. The development must be appropriately designed so that it can be integrated into the landscape.

County Kerry

Section 11.6.5 of the County Kerry CDP (2022-2028) addresses the councils objectives concerning scenic views and prospects. Additionally, designated views and routes can be identified by map, included as part of Appendix 7 and Volume 4: Maps. In relation to scenic routes the County Development Plan states that it is an objective of the Council to:

KCDP 11-72

Preserve the views and prospects as defined on Maps contained in Volume 4.

KCDP 11-73

Facilitate the sustainable development of existing and the identification of new Viewing Points along the route of the Wild Atlantic Way in conjunction with Fáilte Ireland, while ensuring the protection of environmental attributes in the area through the implementation of environmental protection objectives, standards and guidelines of this Plan.

KCDP 11-74

Prohibit developments that have a material effect on views designated in this plan from the public road or greenways towards scenic features and/or public areas.

Table 11.6: Schedule of relevant scenic views (within 20km)

View number and description/ location	Direction of visual amenity	Distance of view from site	Proposed Development within Field of View and/or indicating visibility in Zone of Theoretical Visibility (ZTV) Maps
County Clare (C)			
C1 - Coast Road from county boundary (along the Kinvarra Road) to Quilty including the R479 spur to Doolin	West	16.6km	Field of View faces away from the Site. Not in ZTV.
C16 - R487 from Kilfearagh to T-junction before Breaghva	West/Northwest	14km	The field of view in the CDP does not face the proposal. The ZTV shows partial visibility from this route.
C18 - Along coast road from Carrigaholt to Doonaha	South	14km	The field of view in the CDP does not face the proposal, and the ZTV shows intermittent and partial visibility along this route.
C19 - Coast road south east of Cappagh to Carrowdotia South	South	4.5km	The field of view in the CDP does not face the proposal. The ZTV shows intermittent and partial visibility along this route, with majority of the route shielded by landform.

View number and description/ location	Direction of visual amenity	Distance of view from site	Proposed Development within Field of View and/or indicating visibility in Zone of Theoretical Visibility (ZTV) Maps
C20 - R473 from outside Labasheeda to T-junction before Kiladysert	South	13.8km	Field of view faces away from the Site, however likely visibility outside of the field of view, as based on the ZTV. Small portion is in ZTV.
C30 - R487 from junction at Carrounaveehaun along the coast road to Kilkee	West/Northwest	13.4km	The field of view in the CDP does not face the proposal. The ZTV shows intermittent and partial visibility along this route, with a large portion of the route shielded by landform.
C33 - Road running west from Bealaha Bridge as far as its junction with the N67	West/Northwest	10.9km	Field of view faces away from the Site. A very small section of this route is within ZTV.
C34 - R487 from the junction with the R488 south to T-junction at Killeenagh	West/Northwest	18.9km	Field of view faces away from the Site. A very small section of this route is within ZTV.
County Limerick (L) (Note: Views are not labelled in Limerick CDP)			
L1 - Shannon estuary from Foynes to Glin	North/Northwest	13km	Yes – the Site will be within the field of view for the Site and will have partial visibility across the intervening landform.
County Kerry (K) (Note: Views are not labelled in Kerry CDP)			
K1 – Unnamed scenic route along the L6010 to Carrig Island	Northeast	10.4km	This is a limited and directional view which does not face the Site, but there is likely visibility outside of the field of view, as based on the ZTV.
K2 – Unnamed section of scenic route along the R551	North	13.2km	Yes – the Site will be within the field of view for the Site and will have partial visibility across the intervening landform.
K3 – Unnamed scenic route along the L1000 to Beale	North/Northwest	14.8km	This is a limited and directional view which does not face the Site, but there is likely visibility outside of the field of view, as based on the ZTV.
K4 – Unnamed scenic route along an unnamed local road toward Lisselton	East	16.9km	This is a limited and directional view which does not face the Site, but there is likely visibility outside of the main field of view, as based on the ZTV.
K5 - Unnamed scenic route along the L1010 to Ballylongford	West	11.3km	This is a limited and directional view which does not face the Site, but there is likely visibility outside of the main field of view, as based on the ZTV.
K6 – Unnamed scenic route along the N67 from Tarbert Village toward Tarbert Island	East	10km	This is a limited and directional view which does not face the Site, but there is likely visibility outside of the field of view, as based on the ZTV.

11.3.4.8 National Parks & Wildlife Service (NPWS)

Only those NPWS designations within approx. 5km of the Site (i.e. the Central Study Area) are considered in this section, as it is highly unlikely that any proposed development will

have the capacity to generate significant landscape or visual impacts upon an NPWS designation more than approx. 5km from the Site.

There are no NHAs within the Study Area, and the nearest pNHA (and sole one in the Central Study Area) is more than 4km southeast of the Site (i.e. St. Senan's Lough pNHA). Also, the nearest SAC and SPA (and sole ones in the Central Study Area) are located more than 4.8km southwest of the Site (i.e. Shannon Estuary SAC/SPA).

11.3.5 Visual Baseline

Only those parts of the Study Area that potentially afford views of the Development are considered in this part of the assessment. Therefore, the first part of the visual baseline is establishing a 'Zone of Theoretical Visibility' and subsequently, identifying important visual receptors from which to base the visual impact assessment.

11.3.5.1 Zone of Theoretical Visibility (ZTV)

A computer-generated Zone of Theoretical Visibility (ZTV) map was prepared to illustrate where the Development is potentially visible. The ZTV map is based solely on terrain data (bare ground visibility), and ignores features such as trees, hedges, or buildings, which may screen views. Given the complex vegetation patterns within this landscape, the main value of this form of ZTV mapping is to determine those parts of the landscape from which the Development will definitely not be visible, due to terrain screening within the 20km Study Area.

The following key points are illustrated by the 'bare-ground' ZTV map (Figure 11.7 refers):

- The majority of the Study Area will experience theoretical visibility of the Development.
- The visibility of the proposal will vary greatly depending on the intervening landform, which varies across the four quadrants of the Study Area, as previously identified in **Section 11.3.2**.
- Most of the coastal landscape within 10km will experience some degree of theoretical visibility, including receptors within County Kerry on the southern side of the Shannon.
- Visibility is most limited to the east where rugged hill country (containing a high concentration of turbines) results on only sporadic visibility beyond about 5km.
- The settlements of Kilrush, Doonbeg and Coorclare are mostly in ZTV, while only the northern outskirts of Kilkee are within the ZTV pattern indicating potential for visibility.
- Within the Central Study Area, the overwhelming majority of the N68, the N67 and the R483 are in ZTV, including where the Wild Atlantic Way aligns these routes. Co. Clare Scenic route C19 (as per Table 11.6) is partially in ZTV. Please note that C19 is the

only scenic designation within the Central Study Area, while all other scenic designations remain more than 10km from the Site.

The most important point to reiterate in respect of this 'bare-ground' ZTV map is that it is theoretical. Any proposed development, including wind energy developments, has the potential to be screened by intervening or surrounding vegetation (e.g., roadside hedgerows), as well as buildings, walls and embankments in proximity to the viewer, resulting in a much lesser degree of actual visibility. For these reasons, the ZTV represents the very worst-case scenario of what is already an entirely theoretical projection.

11.3.6 Views of Recognised Scenic Value

Views of recognised scenic value are primarily indicated within County Development Plans in the context of scenic views/routes designations, but they might also be indicated on touring maps, guidebooks, roadside rest stops or on post cards that represent the area. The relevant scenic designations contained in the current Clare, Limerick and Kerry County Development Plans have been identified above in Section 11.3.4 'Landscape Policy Context and Designations'.

All of the scenic routes and views that fall inside the ZTV pattern (see Error! Reference source not found.Error! Reference source not found.) were investigated during fieldwork to determine whether actual views of the Development might be afforded. Where visibility may occur, a viewpoint has been selected for use in the visual impact appraisal later in this chapter.

Table 11.7: Rationale for selection of scenic designations within the relevant County Development Plans

Scenic View or Route Reference:	Relevance to visual impact appraisal	Representative VRP No. herein
Clare: 30 - R487 from junction at Carrounaveehaun along the coast road to Kilkee	County Clare designated scenic view and section of the Wild Atlantic Way. Site is not within identified field of vision, however the scenic proximity and ZTV visibility justifies inclusion for assessment.	VRP19
Clare: 18 - Along coast road from Carrigaholt to Doonaha	County Clare designated scenic view and section of the Wild Atlantic Way. Site is not within identified field of vision, however the scenic proximity and ZTV visibility justifies inclusion for assessment.	VRP20
Clare: 20 - R473 from outside Labasheeda to T-junction before Kiladysert	County Limerick designated scenic view. Main field of vision faces away from the Site, however likely visibility outside of the field of view, as based on the ZTV. Small portion is in ZTV.	VRP26
Limerick: Shannon estuary from Foynes to Glin	County Limerick designated scenic view and section of the Wild Atlantic Way. Site is within the field of vision and in ZTV.	VRP23

Scenic View or Route Reference:	Relevance to visual impact appraisal	Representative VRP No. herein
Kerry: Unnamed Scenic Route along the L1000 to Beale	County Kerry designated scenic view and section of the Wild Atlantic Way. Tourist Location. Site is within the field of vision and in ZTV.	VRP21

11.3.6.1 Centres of Population and Houses

The largest and most populated centre of population in the Study Area is Kilrush, a town of almost 3,000 residents, located 3.5km southeast of the Site. The town of Kilkee, with less than 1,000 residents, is the second-most notable centre of population within the Study Area, and is located approximately 12.5km west, along the Atlantic Coast.

There is a selection of smaller settlements and service centres in the wider Study Area, namely the village of Cooraclare (4.5km to the northeast), Doonbeg village (8.5km to the Northwest) and, in the south, the small town/large village of Tarbert (11.1km to the southeast), Ballylongford and Glin. These are relatively small settlements but are a mix of typologies.

Kilkee and Doonbeg are situated along the Atlantic coast and comprise a mixture of holiday homes, mobile homes and permanent dwellings. In Kilkee, the settlement pattern is centred around Kilkee Bay beach. In Doonbeg, the settlement pattern is linear, centred along the N67, which is the main road running through the area. Cooraclare is situated approximately 4.5km northeast of the proposed Site and has a linear settlement pattern of one-off housing along the R483. Cooraclare and Tarbert service a wider, distributed rural population, while Kilkee and Doonbeg appear to service a more transient visiting population that peaks through the summer months. Kilrush services a wider rural population while sustaining substantial area of residential development in the immediate surrounds and has a stronger sense of a consolidated village. In county Kerry, Tarbert is a coastal town which is comprised of small clusters of housing centred radially around the N69 road which passes through the town.

There are clusters of residential development throughout the Study Area, which are focused around transport or landscape features with no public services associated with them, being ribbons of residences along roads, valleys and shorelines. Those which directly relate to the Site are Knockerra (3.3km southeast of the Site), Gower (2.4km northeast of the Site) and Ballinacourty (3.7km northwest of the Site).

11.3.6.2 Transport Routes

The principal transport routes passing through the Study Area are the N67, N68 and N69. Both the N68 and N67 run in a general northeast/southwest direction and are respectively

1km to the south and 3.4km southwest of the proposed Site at their nearest points. The N67 forms part of the Wild Atlantic Way and runs along the coastline in a general north/south direction through the western half of the Study Area as far as Kilkee, where it meets the R487 which continues south. In Kilkee the N67 veers to the southeast, passing through Kilrush and continuing on past Moneypoint Power Station to Killimer Ferry Terminal. At this point it meets the R486 which continues on toward the east, joining the R473 which proceeds to the east.

The R483 passes the Site to the west, running northeast/southwest toward Kilrush, where it meets the N67 and N68, which connect the surrounding community to the nearest centres of population and to those beyond the Study Area. The R483 also connects to the R484 to the north of the Site, which travels east to where it adjoins the N68. The R473 passes approx. 1.9km south of the Site, in an east/southwest direction, where it also converges with the N67 and N68 in Kilrush town.

In the distant southeast of the Study Area, in Counties Limerick and Kerry, the N69 runs in a general east to west direction from Limerick City toward Tarbert town where it veers south. The R524 and R551 connect to the N69 in Glin and Tarbert respectively, connecting these towns to the rural population they serve. The remaining network of roads within the Study Area comprise of local roads, connecting rural housing to the larger, wider road network.

11.3.6.3 Tourism, Recreational and Heritage Features

The most notable amenity feature contained within the Study Area is that of the 'Wild Atlantic Way' touristic driving route, which follows a network of coastal roads along Ireland's west coast from Donegal to Cork. Sections of this route occur throughout the Study Area and generally follow coastal roads. A section of this route follows the N67 national road to the west of the Site from Miltown Malbay towards Kilkee, and on to the Loop Head peninsula. The Wild Atlantic Way joins the L2016 local road back toward Kilrush where it joins the N67 which then runs eastward, following along the Shannon Estuary to Kilrush. In County Kerry, sections of the Wild Atlantic Way also follow the coastal roads to the south of the Study Area, along the N67 and R551 toward Ballybunion.

The Wild Atlantic Way passes less than 3.5km southwest of the Site at Kilrush (its nearest point)Error! Reference source not found.. Along the Wild Atlantic Way within the Study Area are the Kilkee Cliffs. These cliffs are a popular tourist attraction on the Loop Head Peninsula, southwest of Kilkee and approximately 14km west of the proposed Development. However,

it should be noted that there is no theoretical visibility of the Development from or near the cliffs/clifftops.

There are a number of recreational walkways within the Study Area, most notable of which are the Kilrush Forest Recreational walkway and the Tullaher Loop walk starting/ending in Doonbeg, both of which are relatively small local walkways acting as recreational amenity for the towns in which they are situated. The Kilrush Forest walk is a 3.2km walkway acting as a recreational walkway for residents of Kilrush, adjacent to the Vandeleur Walled Garden tourist attraction. As it is a walkway within a thick woodland, there is no potential for even mid-distance views in the direction of the Site. In addition, Kilrush Golf Club is located to the northeast of the town, while the Kilrush Creek Marina (in southwestern fringe of the Central Study Area) is popular for recreational boaters.

The Tullaher Loop walk is a 20km walkway which begins and ends in Doonbeg and utilises local roads, and comes within approx. 6km of the Site, to the northwest. Additionally, the Shannon Way passes through the southern portion of the Study Area and is a 35km country walk between Ballybunion and Tarbert (Co. Kerry). It begins in the seaside resort at Ballybunion and winds its way to the top of Knockanore. From there the walk passes through bogland and farmland passing through Ballylongford and finishes with the John F. Leslie Woodland Walk.

In County Clare, Kilkee and Doonbeg are seaside villages which experience a notable number of visitors during summer months, as is indicated by the multiple caravan/camping parks and mobile home parks in and near both towns. Additionally, Doonbeg is home to the Trump International Golf Links (Doonbeg Golf Club), located approximately 8.5km north of the Site. This golf resort, which is located more than 9km from the Site, hosts a variety of national and international visitors annually.

A number of heritage features also occur within the Study Area, the nearest of those being the remnants of the 16th Century Doonbeg Castle, which occurs along the western banks of the Doonbeg River, approximately 7.7km northwest of the proposed Development. The monastic settlement of Scattery Island is situated within the Shannon estuary some 7km to the southwest of the Site. This can be accessed from Kilrush marina during summer months only, depending on demand. Further south are the remnants of the 15th Century Carrigafoyle Castle, which occurs along the southern banks of the Shannon, just over 10.5km south of the proposed Development. In County Limerick, Glin Castle, built in the

18th Century, is located approximately 15.4km southeast of the Development and is currently operating as a venue for private hire.

The Shannon estuary provides for recreational boating and is also a recognised fishery. It also hosts a number of local coastal walks, which occur on both the northern and southern banks of the river.

11.3.6.4 Identification of Viewshed Reference Points as a Basis for Assessment

The results of the ZTV analysis provide a basis for the selection of Viewshed Reference Points (VRP's), which are the locations used to study the landscape and visual impact of the Development in detail. In accordance with GLVIA3 and industry best practice, a variety of receptor locations are selected that are likely to provide views of the proposed wind farm from different distances, different angles and different contexts).

The visual impact of a proposed Development is assessed using up to 6 categories of receptor type as listed below:

- Key Views (from features of national or international importance);
- Designated Scenic Routes and Views;
- Local Community views;
- Centres of Population;
- Major Routes; and
- Amenity and heritage features.

Where a VRP might have been initially selected for more than one reason it will be assessed according to the primary criterion for which it was chosen. The characteristics of each receptor type vary as does the way in which the view is experienced. These are described below.

Key Views

These VRPs are at features or locations that are significant at the national or even international level, typically in terms of heritage, recreation or tourism. They are locations that attract a significant number of viewers who are likely to be in a reflective or recreational frame of mind, possibly increasing their appreciation of the landscape around them. The location of this receptor type is usually quite specific.

Designated Scenic Routes and Views

Due to their identification in the County Clare Development Plan (2023-2029), this type of VRP location represents a general policy consensus on locations of high scenic value within the Study Area. These are commonly elevated, long distance, panoramic views and may or may not be mapped from precise locations. They are more likely to be experienced by static viewers who seek out or stop to observe such vistas.

Local Community Views

This type of VRP represents those people who live and/or work in the locality of the Development, usually within a 5km radius of the Site. Although the VRPs are generally located on local level roads, they also represent similar views that may be available from adjacent houses. The precise location of this VRP type is not critical; however, clear elevated views are preferred, particularly when closely associated with a cluster of houses and representing their primary views. Coverage of a range of viewing angles using several VRPs is necessary in order to sample the spectrum of views that would be available from surrounding dwellings.

Centres of Population

VRPs are selected at centres of population primarily due to the number of viewers that are likely to experience that view. The relevance of the settlement is based on the significance of its size in terms of the Study Area and/or its proximity to the Site. The VRP may be selected from any location within the public domain that provides a clear view either within the settlement or in close proximity to it.

Major Routes

These include national and regional level roads and rail lines and are relevant VRP locations due to the number of viewers potentially impacted by the Development. The precise location of this category of VRP is not critical and might be chosen anywhere along the route that provides clear views towards the Site, but with a preference towards close and/or elevated views. Major routes typically provide views experienced whilst in motion and these may be fleeting and intermittent depending on screening by intervening vegetation or buildings.

Tourism, Recreational and Heritage Features

These views are often one and the same given that heritage locations can be important tourist and visitor destinations and amenity areas or walking routes are commonly designed to incorporate heritage features. Such locations or routes tend to be sensitive to

development within the landscape as viewers are likely to be in a receptive frame of mind with respect to the landscape around them. The sensitivity of this type of visual receptor is strongly related to the number of visitors they might attract and, in the case of heritage features, whether these are discerning experts or lay tourists. Sensitivity is also heavily influenced by the experience of the viewer at a heritage site as distinct from simply the view of it. This is a complex phenomenon that is likely to be different for every site. Experiential considerations might relate to the sequential approach to a castle from the car park or the view from a hilltop monument reached after a demanding climb. It might also relate to the influence of contemporary features within a key view and whether these detract from a sense of past times. It must also be noted that the sensitivity rating attributed to a heritage feature for the purposes of a landscape and visual assessment is not synonymous with its importance to the Archaeological or Architectural Heritage record.

The Viewshed Reference Points selected in this instance are set out in **Table 11.8** below and shown on the VP selection Map in the photomontage booklet. They have all been selected on the basis of relevant guidance (GLVIA3) and industry best practice.

Table 11.8: Outline description of selected Viewshed Reference Points (See Viewpoint Location Map – Figure 11.9)

VRP No.	Location	Distance to Site (km)	Direction of view
VP1	Residences on northern outskirts of Kilrush	3.13km	NE
VP2	Residences by Corraclare village	4.49km	S/SW
VP3	Local residences to west of Site	1.06km	E
VP4	Local residences at Moyadda along N68	1.15km	NW
VP5	Local residence to east of Site	0.67km	W
VP6	Local road near Knockerra Lower	3.21km	W/NW
VP7	Local residence to southwest of Site	1.15km	N/NE
VP8	Local residents north of Site	0.84km	S/SW
VP9	Wild Atlantic Way along N67 at Moyasta	5.18km	E
VP10	Tullaher Loop Walk along local roads	5.63km	SE
VP11	Wild Atlantic Way along N67 at Killimer	5.98km	N/NW
VP12	Residences on N68	5.2km	W
VP13	Local road near Carabane	9.53km	W/NW
VP14	Dismantled South Clare Rail line near Moanmore	4.26km	SE
VP15	Dismantled South Clare Rail line near Moynasta	5.54km	E
VP16	Wild Atlantic Way near Poulnasherry Bay	8.99km	E
VP17	Doonbeg village	8.26km	S/SE
VP18	Residences along N67 and Wild Atlantic Way	10.93km	S

VRP No.	Location	Distance to Site (km)	Direction of view
VP19	Wild Atlantic Way at Kilkee Bay	13.6km	W
VP20	Designated Co. Clare scenic view and Wild Atlantic Way at Doonaha	13.65km	E/NE
VP21	Co. Kerry designated scenic route and Wild Atlantic Way	15.12km	N/NE
VP22	Wild Atlantic Way and Shannon Way at Ballylongford	12.82km	N
VP23	Wild Atlantic Way & Glin Heritage Trail	14.54km	NW
VP24	N68 in east of Study Area	15.18km	SW
VP25	Regional road near Knockaneden	12.38km	SW
VP26	Designated Co. Clare scenic view near Labasheeda	14.29km	W

11.3.7 Cumulative Baseline

The SNH Guidelines relating to the Cumulative Effects of Wind Farms (2005) and GLVIA - 2013 identify that cumulative impacts on visual amenity consist of combined visibility and sequential effects. The same categories have also been subsequently adopted in the Landscape Institute's 2013 revision of the Landscape and Visual Impact Assessment Guidelines:

> *"Combined visibility occurs where the observer is able to see two or more developments from one viewpoint. Combined visibility may either be in combination (where several windfarms are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various windfarms).*
>
> *Sequential effects occur when the observer has to move to another viewpoint to see different developments. The occurrence of sequential effects may range from frequently sequential (the features appear regularly and with short time lapses between, depending on speed of travel and distance between the viewpoints) to occasionally sequential (long time lapses between appearances, because the observer is moving very slowly and / or there are large distances between the viewpoints.)"*

Based on guidance contained within the SNH Guidelines relating to the Cumulative Effects of Wind Farms (2005) and the DoEHLG Wind Energy Guidelines (2006/2019 revision), cumulative impacts can be experienced in a variety of ways.

In terms of landscape character, additional wind energy developments might contribute to an increasing sense of proliferation. A new wind farm might also contribute to a sense of being surrounded by turbines with little relief from the view of them. The term 'skylining' is used in the SNH Guidelines to describe the effect:

"Where an existing windfarm is already prominent on a skyline the introduction of additional structures along the horizon may result in development that is proportionally dominant. The proportion of developed to non-developed skyline is therefore an important landscape consideration."

In terms of visual amenity, there is a range of ways in which an additional wind farm might generate visual conflict and disharmony in relation to other wind energy developments. Some of the most common include visual tension caused by disparate extent, scale or layout of neighbouring developments. A sense of visual ambivalence might also be caused by adjacent developments traversing different landscape types. Turbines from a proposed wind farm that are seen stacked in perspective against the turbines of nearer or further developments tend to cause visual clutter and confusion. Such effects are exacerbated when, for example, the more distant turbines are larger than the nearer ones and the sense of distance is distorted. **Table 11.9 below** provides criteria for assessing the magnitude of cumulative impacts, which are derived from GLVIA3 and NatureScot guidance (Assessing the cumulative landscape and visual impact of onshore wind energy developments - 2018).

Table 11.9: Outline Magnitude of Cumulative Impact

Magnitude of Impact	Description
Very High	- The proposed wind farm will strongly contribute to wind energy development being the defining element of the surrounding landscape. - It will strongly contribute to a sense of wind farm proliferation and being surrounded by wind energy development. - Strongly adverse visual effects will be generated by the proposed turbines in relation to other turbines.
High	- The proposed wind farm will contribute significantly to wind energy development being a defining element of the surrounding landscape. - It will significantly contribute to a sense of wind farm proliferation and being surrounded by wind energy development. - Significant adverse visual effects will be generated by the proposed turbines in relation to other turbines.
Medium	- The proposed wind farm will contribute to wind energy development being a characteristic element of the surrounding landscape. - It will contribute to a sense of wind farm accumulation and dissemination within the surrounding landscape. - Adverse visual effects might be generated by the proposed turbines in relation to other turbines.
Low	- The proposed wind farm will be one of only a few wind farms in the surrounding area and will be viewed in isolation from most receptors. - It might contribute to wind farm development becoming a familiar feature within the surrounding landscape. - The design characteristics of the proposed wind farm accord with other schemes within the surrounding landscape and adverse visual effects are not likely to occur in relation to these.

Magnitude of Impact	Description
Negligible	- The proposed wind farm will most often be viewed in isolation or occasionally in conjunction with other distant wind energy developments. - Wind energy development will remain an uncommon landscape feature in the surrounding landscape. - No adverse visual effects will be generated by the proposed turbines in relation to other turbines.

As noted in Appendix 1.2, there are 18 operational, consented and proposed wind farms within 20km of the Site. **Figure 11.10** shows the location of proposed, permitted and operational wind farms within a 20km radius of the proposed turbines and provides further information on these wind farms. The nearest operational wind farm is Moanmore Wind Farm which is located approximately 1.31km to the northwest of the Site.

Table 11.10: Cumulative Windfarms within the Study Area (as of January 2023)

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Direction from the Development
Moanmore	Operational	7	c. 1.31km	West
Tullabrack	Operational	6	c. 1.52km	Northwest
Ballylongford	Consented	6	15.5km	South
Beal Hill	Operational	6	c. 16.06km	Southwest
Booltiagh	Operational	18	c. 17.42km	Northeast
Cahermurphy	Operational	4	c. 13.07km	Northeast
Carrownaweelaun	Operational	2	c. 18.08km	West
Crossmore	Consented	7	c. 11.42km	East
Curraghgerrig	Operational	2	c. 15.11km	Southwest
Glenmore	Operational	12	c. 15.18km	Northeast
Kiltumper	Operational	2	c. 12.98km	Northeast
Lahra	Operational	2	c. 16.47km	South
Leanamore	Operational	9	c. 11.57km	Southeast
Moneypoint	Operational	5	c. 5.47km	South
Shronowen	Consented	12	c. 16.86km	South
Tullahennel South	Operational	9	c. 15.58km	South
Tullahennel North	Operational	2	c. 15.72km	South
Moanmore South	Proposed	3	c. 3.27km	West

11.4 ASSESSMENT OF POTENTIAL EFFECTS

11.4.1 Do Nothing Effects

In this instance, the do-nothing effect would be that the receiving landscape stays in the same or similar condition as it currently is.

11.4.2 Landscape Impacts

Landscape impacts are assessed on the basis landscape sensitivity weighed against the magnitude of physical landscape effects within the Site and effects on landscape character within the wider landscape setting. This wider setting is considered in respect of the immediately surrounding landscape (<5km) as well as the broader scale of the Study Area (5-20km).

11.4.2.1 Landscape Character, Value and Sensitivity

Landscape value and sensitivity are considered in relation to a number of factors that accord with the Guidelines for Landscape and Visual Impact Assessment 2013, which are set out below and discussed relative to the proposed project Site and Wider Study Area.

Central Study Area (approx. <5km)

The Central Study Area is a low-lying, highly-utilitarian and anthropocentric domain, that is relatively densely-settled for a rural area of its size in the west of Ireland. It adheres to neither the characteristics or identity associated with east Clare, nor of the coastal, dramatic, windswept character of the more 'iconic' west Clare, further west.

Of the multiple scenic designations across the county, only one enters within the Central Study Area (C19, which comes within 4.5km of the Site, see **Table 11.6**). While the Wild Atlantic Way enters within the Central Study Area, it does so as the only viable means to connect coastal roads to the south and the west; it briefly angles northwards around/north of Poulnasherry Bay, before returning to the southern coastline of Loop Head. It is worth noting that where it does enter the Central Study Area, it does so along the N67, one of two busy national roads in the Central Study Area.

The modest-moderate landscape integrity and condition is reflected in planning policy context associated with the Central Study Area, as previously set out in **Section 11.3.4.1**. Notably, in that regard, the Central Study Area is overwhelmingly deemed to be a 'Settled landscapes – areas where people live and work,' by Clare County Council. Also, of the three aforementioned (in **Section 11.3.4.1**) County Clare Landscape Character Areas that are present in the Central Study Area, two are deemed to be 'Acceptable in Principle' to wind energy developments – including the Site itself – while the third is deemed to be 'Open to consideration.' Furthermore, there are no NPWS designations within 5km of the Site. All of these elements do not indicate a landscape character, value or sensitivity that is particularly rare or sensitive.

On balance of these factors, the Central Study Area is deemed to have a '**Medium-low'** landscape sensitivity.

Wider Study Area (approx. >5km)

The Wider Study Area is considerably more diverse, in terms of landscape sensitivity, integrity and value, compared to those areas within 5km of the Site. It should be noted that wind energy is present as a visible, but sub-dominant, element of the landscape across the Wider Study Area, with 12 operational wind farms at present.

For three of the four quadrants outlined in **Section 11.3.3**, the landscape character is influenced by the coastline within them, be it the Shannon estuary or the Atlantic Ocean. The north-east quadrant is the exception to this, in that it chiefly possesses landscape characteristics very similar to those set out above for the central Study Area. However, it does contain some small loughs, numerous Natural Heritage Areas (NHAs) and undulating terrain exceeding 200m AOD, much of which is covered in commercial conifer plantations.

Characterised by the Shannon Estuary, the southeast and southwest quadrants possess a strong degree of naturalistic and aesthetic quality, although this tends to decrease the more one moves from the coastline. Approximately 12-20km from the Site (i.e. within northern sections of Counties Kerry and Limerick), in these two quadrants the inland landscape character again takes on many similar characteristics of the north-east quadrants. In addition, it possesses some substantial and highly-visible energy infrastructure (i.e. the Tarbert and Moneypoint power stations) and a busy commercial shipping lane. Be that as it may, it is a landscape with multiple scenic designations and recreational facilities, some of which (e.g., the Wild Atlantic Way) are internationally renowned.

The fourth and final quadrant (i.e., the northwest quadrant) is primarily characterised by the scenic west Clare Atlantic seascape, a domain of international regard in its scenic, naturalistic and recreational strength.

On balance of these factors, the Wider Study Area is deemed to have an overall '**High-medium'** landscape sensitivity.

11.4.3 Magnitude of Landscape Effect

The proposed turbines, as well as the ancillary development, such as access and circulation roads, areas for the proposed Electrical Substation and hard standing for the proposed turbines, will impact the physical landscape of the proposed development site, as well as

its character. However, the only expected landscape impact upon the Study Area (i.e., outside the Site) will be the likely impact upon landscape character from the proposed turbines.

11.4.3.1 Construction-stage Effects on the Physical Landscape

It is considered that the Development will have a modest physical impact on the landscape within the Site, because none of the proposed features have an extensive physical 'footprint'.

The topography and land cover of the Site will remain largely unaltered. Aside from the four no. proposed turbines, construction will be limited to an Electrical Substation and Control Building, one 82m-high Met Mast, numerous access tracks, Turbine Hardstands and a Temporary Construction Compound.

Excavations will tie into existing ground levels and will be the minimum required to ensure efficient working. Any temporary excavations or stockpiles of material will be re-graded to marry into existing site levels and reseeded appropriately, in conjunction with advice from the project ecologist. The internal track layout will consist of approx. 560m of upgraded access tracks and approx.1,550m of new access tracks, which will be floating tracks. These floating tracks have been designed to try and avoid environmental constraints, and every effort has been made to minimise the length of necessary tracks by upgrading existing tracks. Furthermore, the internal track layout has been designed to follow the natural contours of the land, wherever possible and, being floating, unlikely to create a 'dent' in the terrain surface of more than few centimetres.

As part of the Development, approximately 17.58ha will need to be felled within the Site, the overwhelming majority of which will be conifer plantations in various different stages of the harvesting cycle. However, the exception to this is the area surrounding the proposed turbine T4, which represents a modest degree of cutaway bog and regenerating scrub/grassland. The commercial conifers that are proposed to be felled to facilitate the Development have been planted specifically in order for them to be felled and harvested upon maturity. Thus, even in a 'Do Nothing' scenario, where the Development is not constructed, this commercial conifer plantation will still be felled and harvested in due course; as is the objective of such land use.

The proposed Electrical Substation and Control Building will have a compound spanning an area of 1,171m^2, but will be set well below the surrounding ridgeline within the Site. The

substation compound will be constructed from engineered stone material, using similar construction techniques as for the Turbine Hardstands. Within the compound there will be two lightning monopole protection masts, which will be approximately 17m in height and associated site works. The control building within the compound will be a single story pitched roof structure with traditional rendered finishes and will measure approximately 17.49mx 7.33m, with a floor area of approximately 128m^2.

All works associated with the connection of the electrical substation to the national electricity grid will be with a Grid Connection Route to Tullabrack 110kV substation, laid within roads and road verges. The physical impact of this will equate to a modest, relatively narrow trench that will then be fully infilled to pre-existing surface levels.

Site activity will be at its greatest during the construction phase due to the operation of machinery on site and movement of heavy vehicles to and from Site. This phase will have a more notable and apparent impact on the character of the Site and cable routes than the operational phase. There will be some long-term/permanent effects on the physical landscape in the form of Turbine Foundations and hardstands, the existing/upgraded access tracks and a substation, but only the on-site substation and mast are likely to remain in perpetuity as part of the national grid network.

As the construction stage of the Development is estimated to take approximately 10 months, construction-stage impacts are considered short-term, by the EPA Guidance terms (i.e., effects lasting from one to seven years).

In summary, the magnitude of construction-stage effects on the physical landscape of the Site are deemed to be High-medium, with a Negative quality of effect and short-term in duration.

As outlined in **Section 11.2**, the significance of landscape impacts is a function of landscape sensitivity weighed against the magnitude of the landscape impact. This is established on the basis of the significance graph (**Table 11.3**) in conjunction with professional judgement. Accordingly, when combined with a Medium-low landscape sensitivity of the receiving environment, of the Central Study Area, the Development is deemed to have a **Moderate** significance of construction-stage effects on the physical landscape. These will have a Negative quality of effect and be short-term in duration.

11.4.3.2 Operational & Decommissioning Stage Effects on Landscape Character

For most commercial wind energy developments, the greatest potential for landscape impacts to occur is as a result of the change in character of the immediate area, due to the introduction of tall structures with moving components. Thus, in some instances, wind turbines that may not have been a characteristic feature of the area become a new defining element of that landscape character.

In this instance, wind turbines are not just a familiar feature of the central and Wider Study Area, but two such wind farms, totalling 13 turbines between them, are located within approximately 2km northwest of the Site, while in the wider Study Area there are 12 operational wind farms at present. Thus, existing wind turbines contribute in a palpable and apparent manner to the landscape character of the Study Area. The existing wind farms ensure that the Development will not be a new or unfamiliar feature of its wider landscape setting. The proposed development, is therefore complimentary to the established land use type in this landscape. Further wind energy development will gradually become more of a characteristic feature of this predominantly rural landscape. In terms of scale and function, the proposed Development will be assimilated within the context of the Central Study Area, which consists of a range of productive rural land uses. Although it represents a higher level of built development than currently exists on the Site, it will not detract significantly from its productive and utilitarian elevated rural character.

A key consideration in this instance relates to the scale and extent of the proposed wind farm relative to the County Clare Wind Energy strategy, which seeks medium to large scale development (6-20 turbines) in this area. It is a relatively unique scenario within the country for a Planning Authority to direct a minimum scale of development within a particular area, less so a maximum scale. Whilst, the proposed development with four turbines is marginally below the lower threshold identified in this area (6 turbines), it is in close proximity to the Moanmore and Tullabrack wind farms which together total 13 turbines. It can, therefore, be considered as part of this general cluster of developments that will total 17 turbines if the proposed development is realised.

Patterns of wind energy development often emerge over time based on a number of factors including planning policy and physical constraints. For example, the Bellacorrick basin in northwest County Mayo has evolved as an extensive and near continuous array of large-scale developments of tall turbines in a vast inland bog context. In the area around Dunmanway in County Cork, small clusters of 4-5 turbines emerged on the surrounding hilltops as a distinct pattern of development that appear planned and not ad hoc. In the case

of the proposed Ballykett Wind Farm, the nearest surrounding developments in the same landscape context are Moanmore (7 turbines) and Tullabrack (6 turbines). Therefore, the proposal for four turbines in Ballykett does not noticeablydeviate from the established pattern of medium / small wind farms in the area and is therefore considered reasonable.

The other key consideration in terms of assimilation with the surrounding context, and particularly existing wind energy development in the vicinity, is that of turbine height. At 150m tip height, the proposed turbines are taller than the existing turbines in the near vicinity (Moanmore 100m and Tullabrack 119m), but this will not generate an undue scale conflict. From experience of having frequently compared tip heights of neighbouring developments over the past 20 years, Macro Works have found that where a difference of less than c. 20% is involved, it is difficult to discern even when schemes are immediately adjacent as the eye tends to equate any variance to relative ground level or viewing distance. In relation to the latter, the increased setback of the proposed turbines from surrounding residences complies with the requirements (i.e. four time the tip height) of the Draft Revised Wind Energy Development Guidelines (DoHLGH, 2019). This equates to a setback of 600m for the proposed 150m tip height turbines, which is 100m more than what is required under the current WEDGs Guidelines (DoHLG, 2006). When viewed from the nearest surrounding residences (and roads), the perceived height of the proposed turbines will be very similar to the existing turbines in the area due to this greater setback distance (see Plate 11.3). The developments are also separated by sufficient distances that the respective turbines are not presented adjacent to each other, where scale conflict from a direct height comparison could be made (see Plate 11.4).

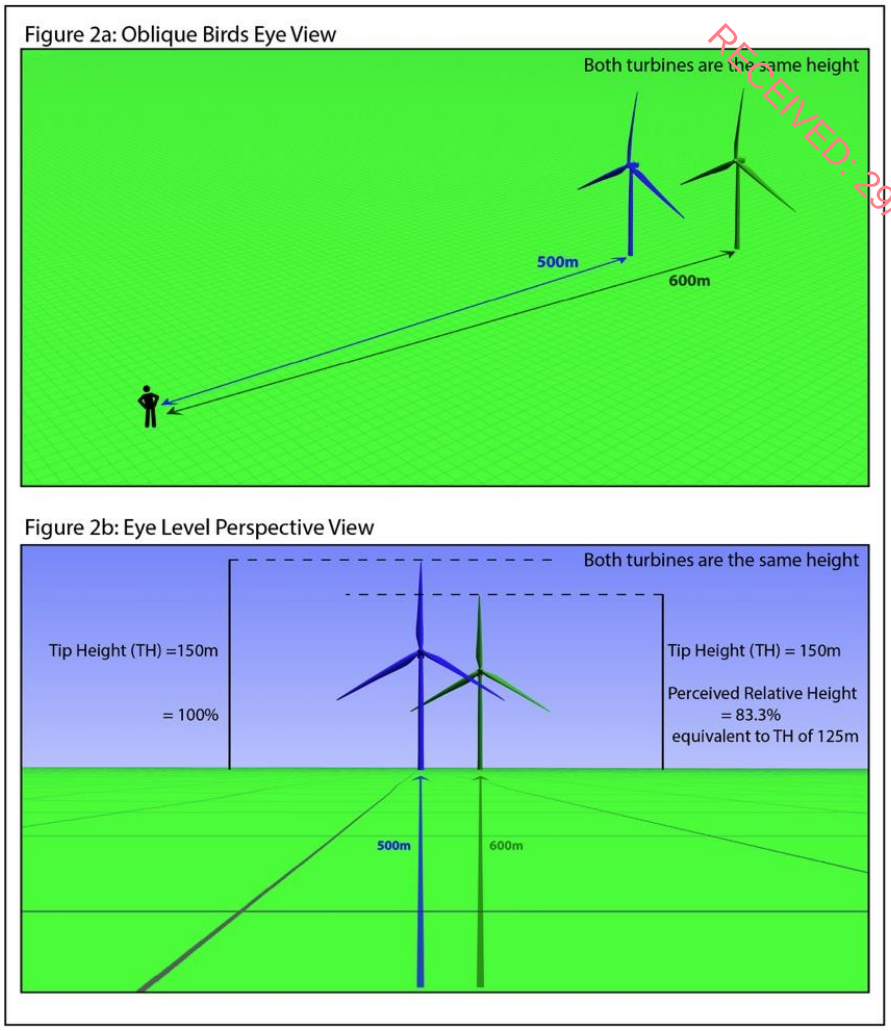


Plate 11.3: Turbine perceived height in relation to distance from increased setback (4 X tip height) required by revised Draft Wind Energy Development Guidelines (DoHLGH, 2019)

Overall, it is not considered that the proposed turbines are over scaled in terms of the receiving landscape setting or existing turbines within the local area. Indeed, 150m tip height turbines are modest by current standards, where most current applications for onshore wind farms involve turbines ranging from 170m – 200m tip heights. It is also a notable current trend that permitted wind farms are subject of amendment applications to increase turbine heights particularly in the context of larger rotor diameters. These trends reflect that this is an ever-evolving industry where it is also very likely that within the short to medium term, that the existing wind farms in the area are subject of repowering applications to replace their current turbines with taller, more productive turbines that may be taller again than the proposed Ballykett Turbines. This scenario is beginning to emerge throughout the country as pioneering wind farm developments reach 20+ years of operation.

Figure 1a

Offset distance from viewpoint: 500m | 500m | 500m

Moanmore Turbine Tip Height: 99m | Ballykett Turbine Tip Height: 150m | Tullabrack Turbine Tip Height: 119m

Figure 1b

Offset distance from viewpoint: 500m | 600m | 500m

Moanmore Turbine Tip Height: 99m | Ballykett Turbine Tip Height: 150m | Tullabrack Turbine Tip Height: 119m

Plate 11.4: Turbine height / setback distance comparison with nearby turbines

It is important to note that in terms of duration, with the exception of the proposed Electrical Substation, Met Mast, and access tracks, the Development represents a long term, but not permanent, impact on the landscape and it is reversible. The expected operational lifespan of the project is 35 years. Within three years of Decommissioning, there would be little evidence that a wind farm ever existed on the Site.

The Decommissioning phase will have similar temporary impacts as the construction phase, with the movement of large turbine components away from the Development. There may be a minor loss of roadside and trackside vegetation that has grown during the operation phase of the Development, but this will be reinstated upon completion of Decommissioning. Areas of hard standing that are of no further use will be reinstated and reseeded to blend with the prevailing land cover in the direct vicinity at that time. As 4 No. turbines are being proposed for this Development, such scale of development can be assimilated into this landscape context without undue conflicts of scale with underlying landform and land use patterns. This is further underlined by the scale of the proposed turbines: at 150m tip height, they will be approx. three-quarters of the height of many onshore turbines currently proposed within Ireland.

On balance of the reasons outlined above, the magnitude of operational & Decommissioning-stage effects on Landscape Character are deemed to be Medium-low within the Central Study Area, reducing at increasing distances beyond this threshold as the wind farm becomes a proportionally smaller feature of a wider landscape context.

As outlined in **Section 11.2.5** above, the significance of landscape impacts is a function of landscape sensitivity weighed against the magnitude of the landscape impact. This is established on the basis of the significance graph (**Table 11.3**) in conjunction with professional judgement.

Accordingly, the significance of operational and Decommissioning stage impacts on landscape character is deemed to be **Moderate-slight** within the Central Study Area, which will have a Negative Quality of effect and be long-term in duration. However, the significance will reduce to Slight and Imperceptible at increasing distances thereafter, as the Development becomes a progressively smaller component of the wider landscape fabric.

11.4.4 Visual Effects

This chapter provides a concise summary of the detailed visual impact assessment in **Appendix 11.1** at each of the 26 selected representative viewpoint locations. This section

should be read in conjunction with both **Appendix 11.1** and the associated photomontage set contained in a separate booklet accompanying the EIAR. A summary table is provided below, which collates the assessment of visual impacts (**Table 11.11** below). A discussion of the results is provided thereafter.

Table 11.11: Summary of Visual Impact Assessment at Representative Viewpoint Locations (refer to Appendix 11.1)

Visual Impact				
VP No.	**Distance to nearest turbine**	**Visual Receptor Sensitivity**	**Magnitude of Visual Impact**	**Significance / Quality / Duration of Impact**
VP1	3.13km (T2)	**Medium low**	Low	**Slight/ Negative/ Long-term**
VP2	4.49km (T4)	**Medium low**	Medium-low	**Moderate-slight / Negative/ Long-term**
VP3	1.06km (T2)	**High-medium**	High	**Moderate/ Negative/ Long-term**
VP4	1.15km (T3)	**Medium-low**	Medium	**Moderate-slight/ Negative/ Long-term**
VP5	0.67km (T4)	**Medium-low**	High	**Moderate/ Negative/ Long-term**
VP6	3.21km (T3)	**Medium-low**	Medium-low	**Moderate-slight/ Negative/ Long-term**
VP7	1.15km (T2)	**Medium-low**	High-medium	**Moderate/ Negative/ Long-term**
VP8	0.84km (T4)	**Medium-low**	High	**Moderate/ Negative/ Long-term**
VP9	5.18km (T2)	**Medium**	Low	**Slight/ Negative/ Long-term**
VP10	5.63km (T1)	**Medium-low**	Low	**Slight/ Negative/ Long-term**
VP11	5.98km (T3)	**Medium**	Low	**Slight/ Negative/ Long-term**
VP12	5.2km (T4)	**High-medium**	Negligible	**Imperceptible/ Neutral/ Long-term**
VP13	9.53km (T3)	**Medium-low**	Negligible	**Imperceptible/ Neutral/ Long-term**
VP14	4.26km (T1)	**Medium-low**	Negligible	**Imperceptible/ Neutral/ Long-term**
VP15	5.54km (T2)	**Medium**	Negligible	**Imperceptible/ Neutral/ Long-term**
VP16	8.99km (T2)	**Medium**	Low-negligible	**Slight-imperceptible/Neutral-negative/ Long-term**
VP17	8.26km (T1)	**Medium**	Negligible	**Imperceptible/ Neutral/ Long-term**
VP18	10.93km (T1)	**Medium**	Negligible	**Imperceptible/ Neutral/ Long-term**
VP19	13.6km (T1)	**Medium**	Negligible	**Imperceptible/ Neutral/ Long-term**
VP20	13.65km (T2)	**Medium**	Negligible	**Imperceptible/ Neutral/ Long-term**
VP21	15.12km (T2)	**High-medium**	Negligible	**Imperceptible/ Neutral/ Long-term**

Visual Impact				
VP No.	**Distance to nearest turbine**	**Visual Receptor Sensitivity**	**Magnitude of Visual Impact**	**Significance / Quality / Duration of Impact**
VP22	12.82km (T3)	**Medium-low**	Low-negligible	**Slight-imperceptible/Neutral-negative/ Long-term**
VP23	14.54km (T3)	**High-medium**	Low-negligible	**Slight-imperceptible/Neutral-negative/ Long-term**
VP24	15.18km (T4)	**Medium-low**	Low-negligible	**Slight-imperceptible/Neutral-negative/ Long-term**
VP25	12.38km (T4)	**Medium-low**	Low-negligible	**Slight-imperceptible/Neutral-negative/ Long-term**
VP26	14.29km (T3)	**Medium-low**	Negligible	**Imperceptible/ Neutral/ Long-term**

11.4.5 Visual Impact summary by receptor type

The visual impacts will be summarised below by receptor type.

11.4.5.1 Visual impacts on Local Community Views

Local Community views are considered to be those experienced by those people who live, work and move around the area within approximately 5km of the Site (i.e., the Central Study Area). These are generally the people that are most likely to have their visual amenity affected by a wind energy proposal due to proximity to the turbines, a greater potential to view turbines in various directions, or having turbines as a familiar feature of their daily views. However, it is worth reiterating that wind turbines in the Central Study Area are already a common/daily feature of local community views. Owing to proximity, local community views understandably tend to have the highest likely visual impact significance of all receptors within the Study Area.

In total, of the 26 viewpoints assessed as part of this LVIA, 11 are within approximately 5km of the Site. Four of these 11 viewpoints are expected to experience the highest likely visual impact from the Development, i.e. 'Moderate' Visual Impact Significance. This is primarily owing to the proximity of these four receptors to the proposed turbines (i.e., all less than 1.2km distance), but also the lack of substantial roadside hedgerows or trees at those sections. A further three viewpoints recorded a Moderate-slight Visual Impact Significance, for similar reasons, while tending to be generally 2-5km from the Site, with the remaining four viewpoints in the Central Study Area likely to experience either Slight or Imperceptible visual impact significance.

Due to proximity, the local community receptor group has the most potential to experience a sense of overbearing from surrounding wind turbines. However, being mindful of this, the Developer has applied an increased setback distance to reflect the recommended setback

distance of four times the tip height (excluding derelict and financially involved houses) from the revised Draft Wind Energy Development Guidelines (DOHLGH, 2019). Therefore, the proposed turbines will not appear overbearing, as reflected in the visual impact assessment results. The greater setback distance applied, also ensures that they will appear to "blend in" with other existing wind turbines in the vicinity (see Plate 11.3).

For the reasons outlined above, it is considered that the proposed wind farm Development will not generate significant visual effects in respect of local community receptors.

11.4.5.2 Visual impacts on designated views

As previously set out in **Section 11.3.5.2**, above, all of the scenic routes and views that fall inside the ZTV pattern were investigated during fieldwork to determine whether actual views of the Development might be afforded. Where visibility may occur, a viewpoint has been selected for use in the visual impact appraisal. This resulted in five such viewpoints from those designated views. Of these five, four were deemed to have an 'Imperceptible' likely visual impact significance. The fifth and final viewpoint is deemed to a 'Slight-imperceptible' likely visual impact significance.

Thus, it is not considered that the proposed wind farm Development will generate significant visual impacts in respect of designated views.

11.4.5.3 Visual impacts on centres of population

Of the two settlements within the Central Study Area (i.e. Kilrush and Cooraclare), sections of each both fall within the ZTV and resulted in selected viewpoints. Although being the further away from the Site of the two settlements, Cooraclare (i.e. VP2) recorded the higher of the two likely visual impact significance: 'Moderate-slight.' Kilrush (VP1), meanwhile, recorded a likely visual impact significance of 'Slight.'

Although there are multiple settlements within the wider Study Area, some did not fall within the ZTV pattern. Those that did fall within the ZTV and were selected for viewpoints include the County Clare settlements of Kilkee (VP19) and Doonbeg (VP17), both of which were deemed to have a likely visual impact significance of 'Imperceptible.' The north County Kerry settlement of Ballylongford, however, recorded a likely visual impact significance of 'Slight-imperceptible:' the highest such likely visual impact associated with this receptor type.

Thus, it is not considered that the proposed wind farm Development will generate significant visual impacts in respect of centres of population.

11.4.5.4 Visual impacts on major routes

As previously set out in **Section 11.3.5.4**, there are multiple major routes within the Study Area. In total, of the 26 viewpoints assessed as part of this LVIA, 10 are from major routes, covering both regional and national roads.

Of these, the highest likely visual impact experienced is 'Moderate' (VP3) along the R483, followed by 'Moderate-slight' along the N68. This is primarily owing to the proximity of these two receptors to the proposed turbines (i.e., all less than 1.2km distance), but also the lack of substantial roadside hedgerows or trees at those sections. Of the remaining eight viewpoints along major routes that were also assessed were the N67 (four viewpoints), a further two viewpoints from the N68, one from the N69, as well as one from the R473. In all of these viewpoints, the likely visual impacts experienced ranges from 'Imperceptible (in four viewpoints) to 'slight-imperceptible' (in two viewpoints) to 'Slight' (in two cases).

Thus, it is not considered that the proposed wind farm Development will generate significant visual impacts in respect of major routes.

11.4.5.5 Visual impacts on Tourism, Recreational & Heritage Features

As previously set out in **Section 11.3.5.5**, there are numerous tourism, recreational & heritage features within the Study Area. In total, of the 26 viewpoints assessed as part of this LVIA, 9 adhere to this receptor type.

Notably, 7 of these 9 viewpoints are from the Wild Atlantic Way, the highest likely visual impact along which is deemed to be 'Slight', where both viewpoints being less than 6km from the nearest Development. Notably, four viewpoints from along the Wild Atlantic Way are likely to experience an 'Imperceptible' visual impact significance, with a further two viewpoints deemed to have a 'Slight-imperceptible' likely visual impact significance. Further receptors such as the Tullaher Loop Walk, the Shannon Way and the Glin Heritage Trail recorded a likely visual impact significance of no higher than 'Slight.' Notably, two viewpoints (i.e. VP14 & 15) were captured from the dismantled South Clare Rail Line, which is proposed to be potentially developed, at some point in the future, as a public greenway. In spite of both viewpoints being within 6km of the nearest proposed turbine, the likely visual impact significance is deemed to be 'Imperceptible.'

Thus, it is not considered that the Development will generate significant visual impacts in respect of tourism, recreational & heritage features.

11.4.5.6 Visual impacts Conclusion

Based on the visual impact assessment outlined in **Sections 11.4.4.1 - 11.4.4.6** above, it is not considered that the Development will generate significant visual impacts at receptors in the Central Study Area or Wider Study Area.

11.4.6 Cumulative Impacts

There are 18 existing, permitted and in-planning wind farms contained within the Study Area. These are arranged in three distinct clusters within relatively discrete landscape settings and there are also three somewhat isolated developments. The cumulative developments are outlined in **Table 11.10** above, which also indicates where they lie in relation to the Development.

A cumulative Zone of Theoretical Visibility (ZTV) map is also provided as **Figure 11.7** and indicates parts of the Study Area with visibility of the Development in isolation as well as existing, permitted and in-planning turbines only. Combined visibility between the Development and other developments is also indicated and this is the most relevant category to the cumulative impact assessment.

The cumulative ZTV map indicates that the majority of the central and southwestern portions of the Study Area will have combined theoretical visibility of the proposed Development in conjunction with other wind energy developments. This partly due to the low-lying landform in these parts of the Study Area that incline gently towards the broad Shannon Estuary. It is also due to the presence of three nearby wind energy developments in the peatland / marginal farmland context of the central study area and the substantial cluster of six developments on the southern side of the River Shannon. Despite the presence of five wind energy developments within the eastern hill country of the Study Area, combined visibility with the Development is sporadic and accounts for only about 50% of the eastern Study Area. Based on the sporadic 'sand ripple' nature of the cumulative ZTV pattern in this part of the Study Area, any combined visibility is likely to relate to only partial visibility (partial blade sets) of either the proposed and/or cumulative developments.

The north-eastern cluster of developments comprises Booltiagh, Cahermurphy, Glenmore and Kiltumper. Slightly isolated, but still part of the eastern hill country developments is Crossmore. These developments are all well beyond 10km away from the Development

with the larger Booltiagh and Glenmore developments both beyond 17km away. These developments are contained within a different landscape context to the Development and this serves to reinforce the low level of visual and perceptual connection between them and the Development. Likewise, the southern wind farm developments, comprising Beale, Beal Hill, Tullahennel North, Tullahennel South, Shronowen and Leanamore are also contextually and perceptually divided by the broad Shannon estuary, as well as 13-18km of physical separation. These distant wind farms will not generate significant cumulative impacts in conjunction with the proposed Development. The same is true of the distant and isolated Carrownaweelaun pair of turbines located along the Loop Head peninsula (18km away). Whilst located closer to the proposed Development and on the same side of the Shannon, the Moneypoint turbines are approximately 7km from the proposed turbines and separated by a low ridge.

The greatest potential for cumulative impacts to occur is in relation to the existing Tullabrack and Moanmore turbines and the in-planning Moanmore South turbines. The existing turbines can frequently be seen in the photomontage set, but never in a visually confusing manner that suggests the proposed turbines are a slightly isolated extension to one of them. It can also be considered that the assessment provided in **Section 11.4** above is a cumulative one with respect to the surrounding existing developments because their presence and visual interaction with the proposed turbines is accounted for. From VP3, VP7 and VP8, which lie in close proximity to the west and north of the proposed Development, the existing and in-planning developments are all seen in the opposite direction or a widely disparate viewing direction, albeit in relatively close proximity also (see Plate 11.4).

From VP9 and VP10 to the northwest where the proposed turbines are aligned more closely, but beyond the existing Moanmore and Tullabrack turbines, there is a greater potential for visual confusion and clutter from turbine stacking. At VP9 the proposed turbines present at a similar scale and just to the right to the Moanmore turbines even though they are further away. They may be perceived as part of the same development form here albeit without undue confusion or clutter. At VP10, the proposed Development fills a gap between the two existing wind farms and visually links them as one consolidated, but extensive development. However, it does this without generating clutter or undue scale/distance confusion.

From viewpoints VP4, VP5 and VP6 to the east and south-eastern side of the Site, the proposed turbines are also closely aligned with the existing and in-planning turbines beyond. However, due to the larger scale of the nearer turbines the distance between the

existing and proposed developments is perceptually accentuated. This renders the overlapping of turbines in perspective as less of an issue.

The fact that the proposed turbines are often closely associated in views with the nearby Tullabrack and Moanmore turbines, serves to reinforce that the Clare County Development Plan policy to encourage medium to large scale wind energy developments (6 - 20 turbines) is not being contravened by the proposed four turbine development in terms of the overall effect. That being, a consolidated and legible wind energy development pattern that responds to the underlying landscape context.

11.4.6.1 Cumulative Impact Conclusion

Based on the reasons outlined above, it is considered that the proposed wind farm will contribute to cumulative impacts in a very minor way at the scale of the Study Area where turbines are already a familiar feature and the Development represents marginal intensification. Within the central Study Area, there is a greater potential for cumulative impacts with the two existing and the single in-planning wind farm developments. However, there is a reasonable degree of cohesion between these modest scale developments where they either appear as a single larger entity or a series of discrete smaller developments, but seldom with clutter or scale confusion or a strong sense of being surrounded by turbines. Overall, the magnitude of cumulative impact is deemed to be consistent with a Medium-low effect based on the criteria contained in **Table 11.5**.

11.5 MITIGATION MEASURES

In addition to the landscape and visual mitigation measures that were integrated into the iterative design process for this Development, other specific landscape and visual mitigation measures are not considered necessary. Thus, the impacts assessed in **Section 11.4** apply to residual impacts too.

11.5.1 Decommissioning Phase

The Decommissioning phase will see a similar nature of effects to the construction stage due to the movement of heavy machinery within the Site and to and from the Site removing turbine components. However, such effects will be temporary in duration and decreasing in scale as turbines are removed from view and the landscape is substantially reinstated to former uses. As with construction stage impacts, Decommissioning stage effects are not considered to be significant.

11.6 SUMMARY OF SIGNIFICANT EFFECTS

It is not considered that there will be any significant effects arising from the proposed Ballykett Wind Farm.

11.7 STATEMENT OF SIGNIFICANCE

Based on the landscape, visual and cumulative assessment contained herein, it is considered that there will not be any significant effects arising from the proposed Ballykett Wind farm.

11.8 REFERENCES

1. Environmental Protection Agency (EPA) publication 'Guidelines on the Information to be contained in Environmental Impact Statements (2018) and the accompanying Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (2018).
2. Department of Environment Heritage and Local Government (DoEHLG) Wind Energy Planning Guidelines (2006/2019 revision) and Preferred Draft Approach to revising the 2006 Guidance published 2017.
3. Landscape Institute and the Institute of Environmental Management and Assessment publication entitled Guidelines for Landscape and Visual Impact Assessment (2013).
4. Scottish Natural Heritage (SNH) Guidance Note: 'Assessing the cumulative impact of onshore wind energy developments' (2012).
5. Scottish Natural Heritage (SNH) Siting and Designing Wind Farms in the Landscape Version 3 (2017).

12 AIR QUALITY AND CLIMATE

12.1 INTRODUCTION

This chapter assesses the effects of the Project (**Figure 1.2**) on air and on climate in Section 12.2 and 12.3 respectively. The Project refers to all elements of the application for the construction of Ballykett Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.4.** This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **Appendix 12.1 Scottish Government – Carbon Calculator Input and Output Data**

12.1.1 Statement of Authority

This chapter has been prepared by Jennings O'Donovan & Partners Limited. It was prepared jointly by David Kiely and Sarah Moore, with the assistance of Darren Timlin.

David Kiely has a Bachelor of Engineering Degree in Civil Engineering and a Master's of Science degree in Environmental Protection, in addition to 40 years' experience in the civil engineering/ environmental sector. David has led/managed EISs/EIARs and overseen the development of over 50 wind farms in Ireland. This includes whole life cycle from feasibility, planning and environmental assessment through to construction, including the preparation of alternative consideration chapters for other wind farms.

Sarah Moore is an Environmental Scientist in JOD with over 17 years of environmental consultancy experience. She has obtained a MSc in Environmental Engineering from Queens University, Belfast, and a BSc in Environmental Science from University of Limerick. Since joining JOD, Sarah has been involved as a Project Environmental Scientist on a range of renewable energy, wastewater, structures and commercial projects. She has experience in the preparation of Appropriate Assessments, Ecological Impact Assessments, Environmental Impact Assessments and Geographic Information Systems.

Darren Timlin is a graduate Environmental Scientist with a Bachelor (Hons.) degree in Environmental Science from the Atlantic Technological University (Sligo). His key capabilities include report writing, GIS and assisting senior consultants.

12.1.2 Assessment Structure

In line with the revised EIA Directive and current EPA guidelines listed in **Chapter 1**, **Section 1.7** the structure of this Air and Climate chapter is as follows:

- Assessment Methodology and Significance Criteria
- Description of baseline conditions at the Site
- Identification and assessment of effects to air and climate associated with the Project, during the construction, operational and decommissioning phases of the Project
- Mitigation measures to avoid or reduce the effects identified
- Identification and assessment of residual effects of the Project considering mitigation measures
- Identification and assessment of cumulative effects if and where applicable

The desktop study as outlined in Section 12.2 and Section 12.3, together with the other assessments detailed in this chapter, and related assessments within this EIAR, provide the planning authority with sufficient details regards Air Quality and Climate assessment for the Project.

12.2 AIR QUALITY

12.2.1 Assessment Methodology

This assessment of air quality involved the following:

- A desk study of the air quality baseline in the area of the Project and nationally;
- Evaluation of potential effects;
- Evaluation of the significance of effects;
- Identification of measures to avoid and mitigate potential effects.

12.2.2 Relevant Legislation and Guidance

The Ambient Air Quality and Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC) incorporates revised provisions for sulphur dioxide (SO_2), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), benzene (C_6H_6) and carbon monoxide (CO). This replaced the Air Quality Framework Directive (96/62/EC) and first three Daughter Directives (1999/30/EC, 2000/69/EC, 2002/3/EC). The Fourth Daughter Directive (2004/107/EC) (as amended) will be incorporated into the CAFE Directive at a later date and stands alone as a separate EU Directive.

The Fourth Daughter Directive (2004/107/EC) relates to arsenic (As), cadmium (Cd), nickel (Ni), and mercury (Hg)_and polycyclic aromatic hydrocarbons (PAH) in ambient air and has been transposed into Irish legislation by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009) (as amended).

The CAFE Directive is currently transposed into Irish legislation by the Ambient Air Quality Standards Regulations 2022 (S.I. No. 739/2022)

The Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), (as amended by Directive EU 2015/1480) encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for $PM_{2.5}$ (fine particulate matter) including the limit value and exposure concentration reduction target
- The possibility to discount natural sources of pollution when assessing compliance against limit values
- The possibility for time extensions of three years (for particulate matter PM_{10}) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

The limit values of the CAFE Directive are set out in **Table 12.1**. Limit values are presented in micrograms per cubic metre ($\mu g/m^3$) and parts per billion (ppb). The notation PM_{10} is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. $PM_{2.5}$ represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

Table 12.1: Limit values of CAFE Directive 2008/50/EC (Source: EPA 11/11/2023)

Pollutant	Limit Value Objective	Averaging Period	Limit Value ($\mu g/m^3$)	Limit Value (ppb)	Basis of Application of Limit Value
Sulphur Dioxide (SO_2)	Protection of human health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year
Sulphur Dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year
Sulphur Dioxide (SO_2)	Protection of vegetation	Calendar Year	20	7.5	Annual mean
Sulphur Dioxide (SO_2)	Protection of vegetation	1 Oct to 31 Mar	20	7.5	Winter mean
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year
Nitrogen dioxide (NO_2)	Protection of human health	Calendar Year	40	21	Annual mean
Nitric oxide (NO) + Nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar Year	30	16	Annual mean
PM_{10}	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year
PM_{10}	Protection of human health	Calendar Year	40	-	Annual mean
$PM_{2.5}$ - Stage 1	Protection of human health	Calendar Year	25	-	Annual mean
$PM_{2.5}$ - Stage 2	Protection of human health	Calendar year	20	-	Annual mean

Pollutant	Limit Value Objective	Averaging Period	Limit Value ($\mu g/m^3$)	Limit Value (ppb)	Basis of Application of Limit Value
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8620	Not to be exceeded
Benzene (C_6H_6)	Protection of human health	Calendar year	5	1.5	Annual mean

Table 12.2 presents the limit and target values for ozone as per the Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC).

Table 12.2: Target values for Ozone Defined in Directive 2008/50/EC

Objective	Parameter	Target Value from 2010	Target Value from 2020 onwards
Protection of human health	Maximum daily 8- hour mean	120 µg /m^3 not to be exceeded more than 25 days per calendar year averaged over 3 years	120 µg /m^3
Protection of vegetation	*AOT_{40} calculated from 1 hour values from May to July	18,000 µg /m^3 h^{-1} averaged over 5 years	6,000 µg /m^3 h^{-1}
Information Threshold	1-hour average	180 µg /m^3	180 µg /m^3
Alert Threshold	1-hour average	240 µg /m^3	240 µg /m^3

*AOT_{40} is a measure of the overall exposure of plants to ozone. It is the sum of the excess hourly concentrations greater than 80 $\mu g/m^3$ and is expressed as $\mu g/m^3$ hours.

12.2.3 Air Quality & Health

The Irish Environmental Protection Agency (EPA, 2020)[1], the European Environmental Protection Agency (EEA, 2020)[2] and World Health Organisation (WHO, 2014) reports estimate that poor air quality accounted for premature deaths of approximately 600,000 people in Europe in 2012, with 1,300 Irish deaths predominantly due to fine particulate matter ($PM_{2.5}$) in 2020 and 30 Irish deaths attributable to Ozone (O_3) in 2016[3,4]. Fine particulate matter, ozone, along with others including carbon dioxide (CO_2), nitrogen oxides (NO_x) and sulphur oxides (SO_x) are produced during the burning of fossil fuels for energy generation, transport or home heating. There are no such emissions associated with the operation of wind turbines. Therefore, the construction of wind turbines such as in the proposed Development will result in lower environmental levels of such parameters, and consequential beneficial effects on human health.

12.2.4 Air Quality Zones

The EPA has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The Project lies within Zone D, which represents rural areas located away from large population centres.

12.2.5 Existing Air Quality Conditions

Generally, Ireland is recognised as having some of the best air quality in Europe. However, from time to time, and under certain weather conditions, it is possible to experience some air pollution in the larger towns and cities. The most recent published report on air quality in Ireland is the '*Air Quality in Ireland 2021*' report published by the EPA in 2022[5]. This report provides an overview of the ambient air quality in Ireland in 2021. The measured concentrations are compared with both EU legislative standards and WHO air quality guidelines[6] for a range of air pollutants. The closest monitoring site (National Network) to

[1] Ireland's Environment – An Integrated Assessment 2020, EPA, 2020, accessed 11th November 2023
[2] EEA (European Environment Agency), 2020b. Air Quality in Europe 2020. EEA Report No. 09/2020. EEA, Copenhagen, accessed 11th November 2023
[3] https://www.euro.who.int/en/health-topics/environment-and-health/air-quality/news/news/2014/03/almost-600-000-deaths-due-to-air-pollution-in-europe-new-who-global-report, accessed 11th November 2023
[4] Irelands Environment 2016 – An Assessment', EPA, 2016, accessed 11th November 2023
[5] https://www.epa.ie/publications/monitoring--assessment/air/EPA-Air_Quality_in-Ireland-Report_2021_-interactive-pdf.pdf [Accessed 11/11/2023]
[6] https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health [Accessed 11/11/2023]

the Project within the same air quality zone is Askeaton, Co. Limerick. Askeaton monitoring site is located approximately 32km southeast of the Site. Results from the monitoring campaign during 2021 show:

- No levels above the EU limit value (in **Table 12.1**) were recorded at any of the ambient air quality network monitoring sites in Ireland in 2021.
- WHO guideline values were exceeded at a number of monitoring sites for fine particulate matter ($PM_{2.5}$) and (PM_{10}), ozone (O_3), NO_2. WHO guideline values for Sulphur dioxide (SO_2) were exceeded at one monitoring station. PAHs exceeded the European Environment Agency reference level at 3 monitoring sites.
- Askeaton exceeded WHO 24-hour mean guideline (15µg/m^3 24-hour mean) for ($PM_{2.5}$) on 8 occasions in 2021 and exceeded the annual mean (5µg/m^3) guideline with a mean of (5.7µg/m^3) for 2021. Askeaton did not exceed any WHO guidelines for any other parameter in 2021.
- The annual mean PM_{10} and $PM_{2.5}$ levels for Askeaton were (8.7 µg/m^3) and (5.7 µg/m^3) respectively. These values are below the limit values set out by Directive 2008/50/EC as per **Table 12.1**.

12.2.6 Do Nothing Impact

If the Project was not to proceed, the opportunity to reduce emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2) to the atmosphere would be lost due to the continued dependence on electricity derived from coal, oil and gas-fired power stations, rather than renewable energy sources such as the Project. This would result in an indirect, negative effect on air quality.

12.2.7 Potential Impacts of the Project

12.2.7.1 Construction Phase

12.2.7.1.1 Dust Emissions

The main potential source of effects on air quality during construction is dust. There is potential for the generation of dust from excavations and from construction including construction of Site access tracks, Turbine Hardstands and the trenches for the cable ducting for the Grid Connection Route (GCR).

The potential nuisance issues arising from this are dependent on the terrain, weather conditions, (i.e., dry and windy conditions), and the proximity of receptors. Dust from cement can cause ecological damage if allowed to migrate to water courses, though it is proposed that ready-mix concrete will be used with no on-site batching taking place. Therefore, this

will not be a potential source of emissions. Potentially dust generating activities are as follows:

- Earth moving and excavation plant and equipment for handling and storage of soils and subsoils.
- Transport and unloading of stone materials for Site access track construction.
- Rock that is suitable will be extracted from an on-site borrow pit, Turbine Foundation areas and the Electrical Substation and this will be used in the construction of Site access tracks and Turbine Hardstands.
- Vehicle movements over dry surfaces such as Site access tracks and public roads.

The potential effect from dust becoming friable and a nuisance to workers and local road users, if unmitigated, is considered, a slight, negative, short-term, direct effect during the construction phase.

Friable dust cannot remain airborne for a very long time. The distance it can travel depends on the particle sizes, disturbance activities and weather conditions. Larger dust particles tend to travel shorter distances than smaller particles. Particle sizes greater than 30µm will generally deposit within approximately 100m of its source, while particles between 10-30µm travel up to approximately 250-500m and particle sizes of less than 10µm can travel up to approximately 1km [7].

Generally, (depending on the conditions outlined), dust nuisance is most likely to occur at sensitive receptors within approximately 100m of the source of the dust. It is considered that the principal sites of friable dust generation will be the Turbine Foundations and Hardstands, borrow pit and also along new site access tracks. All turbines are situated greater than 600m away from inhabited dwelling houses. Therefore, these principal source sites of dust generation are greater than 100m distant from these sensitive receptors. In addition, vegetation such as trees and hedgerows in the vicinity will help to mitigate any airborne dust migrating off the Site. Any effects of dust on vegetation will be confined to the construction and possibly the Decommissioning phases and be short-term, slight, negative effect.

If unmitigated, there would also be dust deposition arising from mud on public roads, resulting from traffic leaving the construction Site. Impacts from dust deposition at sensitive receptors would give rise to nuisance issues for residents of those properties. The effect would be short-term, temporary and slight negative impact on sensitive receptors.

[7]Department of the Environment, Transport and the Regions (DETR) (2000a) Controlling and mitigating the environmental effects of minerals extraction in England. Mineral Planning Guidance Note 11, consultation paper. DETR, London. Cited in Technical Guidance Document (Monitoring) M17 – Environment Agency March 2004

12.2.7.1.2 Exhaust Emissions

Emissions from plant and machinery, including trucks, during the construction of the Project are a potential effect. The engines of these machines produce emissions such as carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_x), and particulate matter (PM_{10} and $PM_{2.5}$).

Particulate matter ("PM") less than ten micrometres in size (PM_{10}) can penetrate deep into the respiratory system increasing the risk of respiratory and cardiovascular disorders. PM_{10} arises from direct emissions of primary particulate such as black smoke and formation of secondary particulate matter in the atmosphere by reactions of gases such as sulphur dioxide (SO_2) and ammonia (NH_3). The main sources of primary PM_{10} are incomplete burning of fossil fuels such as coal, oil and peat and emissions from road traffic, in particular diesel engines. Other sources of particulates include re-suspended dust from roads. Natural particulate matter includes sea-salt and organic materials such as pollens.

Nitrogen oxides (NO_x), include the two pollutants, nitric oxide (NO) and nitrogen dioxide (NO_2). Anthropogenic (human) activities such as power-generation plants and motor vehicles are the principal sources of nitrogen oxides through high temperature combustion. Nitrogen oxides are an important air pollutant by themselves but can also react in the atmosphere to contribute to the formation of tropospheric ozone (ozone in the air we breathe) and acid rain. Short-term exposure to nitrogen dioxide is associated with reduced lung function and airway responsiveness, and increased reactivity to natural allergens. Long-term exposure is associated with increased risk of respiratory infection in children.

The construction phase is likely to result in an increase in exhaust emissions from construction vehicles and transport vehicles associated with the site works. The impact on air quality from an increase in exhaust emissions will be a short-term, slight negative effect.

12.2.7.2 Operational Phase

12.2.7.2.1 Dust Emissions

There will be a small number of light vehicles accessing the Site during the operational phase. This could lead to some localised dust being generated, though this will be small and sporadic as only approximately one to two site visits per week will occur at the Project. In the unlikely event that a turbine or elements of a turbine need to be replaced during the lifetime of the wind farm, there would be significantly less traffic than during the initial construction phase. There would only be one turbine delivered, compared to 4 No. turbines and the Site access tracks and other Site infrastructure will already have been established. Therefore, the operational phase will have an imperceptible negative effect.

12.2.7.3 Decommissioning Phase

Effects during the Decommissioning phase of the Project are anticipated to be less than those arising during the construction phase. The Decommissioning phase will be as follows:

- Removal of 4 No. wind turbines;
- Removal of the permanent meteorological mast;
- Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm Electrical Substation. Ducting is to remain *in-situ.*

All other elements of the Project will remain in-situ. The Site access tracks and associated drainage systems will also serve existing ongoing forestry and agricultural activity in the area. All other hard surfaced areas will be allowed to revegetate naturally.

The Decommissioning phase would be expected to last approximately 3-6 months, and any air quality effects would be predicted to be imperceptible.

12.2.8 Mitigation Measures and Residual Effects

12.2.8.1 Construction Phase Mitigation

The main potential effect during the construction phase of the proposed Development will be from dust nuisance at sensitive receptors close to the Site. Good practice construction procedures will be followed by the appointed contractor to prevent dirt and dust being transported onto the local road network and all mitigation measures outlined in the CEMP (**Appendix 2.1**) will be implemented on site. Good practice site control measures will comprise the following:

- Site access tracks will be upgraded and built in the initial construction phases. These tracks will be finished with graded aggregate which compacts, preventing dust.
- Approach roads and construction areas will be cleaned on a regular basis to prevent build-up of mud and prevent it from migrating around the Site and onto the public road network.
- Wheel wash facilities will be provided near the Site entrance to prevent mud/dirt being transferred from the site to the public road network. The Wheel wash will be located outside the 50m watercourse buffer zone see **Appendix 2.1 CEMP Sections 5.4** and **5.5**.
- Public roads along the construction haul routes will be inspected and cleaned daily. In the unlikely event that dirt/mud is identified on public roads, the roads will be cleaned. The wheel wash facility will be investigated and the problem fixed to prevent this from happening again.
- During periods of dry and windy weather, there is potential for dust to become friable and cause nuisance to nearby residences and users of the local road network. This requires wetting material and ensuring water is supplied at the correct levels for the

duration of the work activity. The weather will be monitored so that the need for damping down activities can be predicted. Water bowsers will be available to spray work areas (Turbine Hardstand areas and Grid Connection route) and construction haul route roads to suppress dust migration from the Site. See **Appendix 2.1 CEMP Sections 5.4** and **5.5**.

- Vehicles delivering materials to the Site will be covered appropriately when transporting materials that could result in dust, e.g., crushed rock or sand.
- Exhaust emissions from vehicles operating within the Site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the Contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.
- All machinery when not in use will be turned off and stored in a secure, bunded location (e.g. construction compound).
- Ready-mix concrete will be delivered to the Site; no batching of concrete will be permitted on Site. Only washing out of chutes will take place on Site and this will be undertaken at a designated concrete washout facility at the contractor's Temporary Construction Compound see **Appendix 2.1 CEMP Section 5.4, 5.5** and **5.6**. The concrete washout facility is a lined containment system designed to prevent run-off into soil, surface water or groundwater.
- Speed restrictions of 15km/h on Site access tracks will be implemented to reduce the likelihood of dust becoming airborne. Consideration will be given to how Site speed limits are policed by the Contractor and referred to in the toolbox talks.
- Good practice will be applied and care will be taken with stockpiled materials to minimise their exposure to wind; stockpiles will be covered with geotextiles layering and damping down will be carried out when weather conditions require it.
- Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable.
- An independent, qualified Geotechnical Engineer will be contracted for the detailed design stage of the project and geotechnical services and will be retained throughout the construction phase, including monitoring and supervision of construction activities on a regular basis. The methodology statement will be signed off by a suitably qualified Geotechnical Engineer.
- A complaints procedure will be implemented on Site where complaints will be reported, logged and appropriate action taken.

12.2.8.2 Operational Phase Mitigation

As the operation of the proposed wind farm will have positive effects on air quality, mitigation measures are considered unnecessary. Where turbine components are being replaced the same mitigation measures as per the construction phase will apply.

12.2.8.3 Decommissioning Phase Mitigation

Mitigation measures during the decommissioning phase will be similar to those employed during the construction phase as outlined above.

12.2.9 Cumulative Effects

In terms of cumulative impacts, negative cumulative effects in relation to air quality would only occur if a large development was located in the vicinity of the Site and in the process of construction at the same time as the Project.

Table 2.1 of **Chapter 2: Project Description** (Section 2.3.2) sets out the existing and proposed wind farms within 20 km of the Site.

Apart from two wind farms i.e., Shronowen and Moanmore South, all other wind farms listed in **Table 2.1** are operational. Shronowen Wind Farm, located in Co. Kerry was granted permission by An Bord Pleanála on 27/09/2022 Case Reference PA08-309156. From a review of the EIAR attached to that application it is evident that the construction of Shronowen Wind Farm will not impose any cumulative air quality impacts if constructed simultaneously to the proposed Ballykett Wind Farm.

The proposed Moanmore South Wind Farm (3-turbine site) is some 3.27km west of Ballykett Wind Farm. There is potential for cumulative impact during deliveries of concrete or stone or during turbine deliveries. During the placing of concrete for a foundation, the number of HGV loads (75 per day) will be similar for both wind farms.

The Clare County Council Planning portal was accessed to check planning permissions granted within a 10 km radius of the wind farm and other major development or proposed developments (larger than a one-off house) are summarised in **Table 2.2** of Section 2.3.3 of **Chapter 2 Project Description**.

Much of the non-wind energy planning permissions relate to (see **Table 2.2** of **Chapter 2: Project Description**):

- Livestock slatted units;
- Solar Farm;

- Ballroom;
- Wastewater Project;
- 400kV Electrical Line Upgrade Works;
- Graveyard Extension;
- Pitch and Putt Course;
- Conversion of building to apartments; and
- External Refrigeration Unit.

In terms of their scale, it is considered that the construction and use of the agricultural buildings would only have a negligible to minor localised impact on air quality should their construction and operational use be concurrent with the Project as none are located close to the proposed Ballykett wind farm Development (all are 6.9 – 7.2km distant).

In a worst-case scenario cumulative air effects may arise if the construction, operational and maintenance period and decommissioning of any of the projects listed in **Appendix 1.2** occur simultaneously with the construction of the Project, Grid Connection Route (GCR) and Turbine Delivery Route (TDR) works. The existing and consented wind energy developments within 20 kilometres of the Site as listed in **Chapter 2 Project Description - Table 2.1** have been considered for cumulative air quality effects. Only those wind energy developments that would be under construction at the same time as the Project are relevant in the context of cumulative effects. The consented (not yet built) and the proposed wind energy developments within 20 kilometres of the Site include:

- Crossmore (Consented) – 11km east;
- Shronowen (Consented) – 16km south; and
- Moanmore South (Proposed) – 3km west.

Given the distances from the Site, they are not in the direct vicinity of the Project. Even if construction of these wind energy developments takes place at the same time as construction for the proposed Ballykett Wind Farm Development, given the distances from the Site, there would not be any cumulative air quality effects.

During the operational phase emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2) or dust emissions from the Project and other developments listed in **Chapter 2 Project Description - Table 2.2**, will result from the operation and maintenance vehicles on the Site. However, these emissions will be minimal. Therefore, there will be a long-term imperceptible negative cumulative impact on air quality and climate.

Cumulative impacts during the Decommissioning phase will be similar to the construction phase although slightly less as a result of the reduced works required during the decommissioning phase as some infrastructure will be left in-situ e.g., Turbine Foundations and the Site access tracks.

The nature of the Project and other energy developments within 20 kilometres are such that, once operational, they will have a cumulative long-term, significant, positive effect on air quality.

12.2.10 Residual Impacts of the Project

The use of plant and machinery during the construction phase is not likely to have a significant effect on air quality in the area, both in terms of dust generation and exhaust emissions. Overall, with mitigation in place this effect is assessed as slight/imperceptible, negative, direct and temporary/short-term in nature.

During the operational phase of the Project exhaust emissions will arise from occasional machinery use and Light-Good Vehicles (LGV) that will be required for occasional on-Site maintenance works. The effects will be long-term imperceptible and negative.

However, the wind energy created by the Project will displace the production of electricity from coal, oil or gas-fired power stations resulting in emission savings of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2). This will lead to a long-term significant positive effect on air quality. Section 12.3 of this EIAR chapter details the calculated carbon dioxide and combustion savings in greater detail.

The Decommissioning phase , and consequential effects will be similar to the construction stage, albeit of less effect as the works required will be less as described in **Chapter 2: Project Description**. For example, the Turbine Foundations will remain in-situ, covered with earth and reseeded as appropriate. The Electrical Substation building will also be left in-situ. This means there will be no additional excavation works required for the Decommissioning of these infrastructure components. Therefore, no additional truck movements are required for the demolition and removal of this infrastructure. The mitigation measures outlined for the construction phase of the Project will be implemented during the Decommissioning phase thereby minimising any potential effects.

12.2.11 Summary of Significant Effects

This assessment has identified no potentially significant effects, given the mitigation measures embedded in the design which will be implemented in the Project.

12.2.12 Statement of Significance

The Project has been assessed as having no significant direct or indirect effects on air quality during the construction, operation or decommissioning phases of the Project.

12.3 CLIMATE AND GREENHOUSE GASES

Greenhouse gases, if released in excessive amounts, can lead to increases in global temperatures known as '*global warming'* or the '*greenhouse effect'* which can influence the climate.

There are a wide range of gases known as greenhouse gases. The most critical greenhouse gases are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). There are also other greenhouse gases known as F-Gases, man-made gases used in refrigeration and air conditioning appliances. Greenhouse gases produced by human activities are changing the composition of the earth's atmosphere. Human activities that produce greenhouse gases include:

- Carbon dioxide emissions through burning fossil fuels such as coal, oil and gas and peat
- Methane and nitrous oxide emissions from agriculture
- Emissions through land use changes such as deforestation, reforestation, urbanization, desertification

Current projections indicate that continued emissions of greenhouse gases, including the burning of fossil fuel to produce electricity, will cause further warming and changes to our climate. Climate is predicted to have indirect and direct impacts on Ireland including:

- Rising sea-levels threatening habitable land and particularly coastal infrastructure;
- Extreme weather, including more intense storms and rainfall affecting our land, coastline and seas;
- Further pressure on our water resources and food production systems with associated impacts on fluvial and coastal ecosystems;
- Increased chance and scale of river and coastal flooding;
- Greater political and security instability;
- Displacement of population and climate refugees;
- Heightened risk of the arrival of new pests and diseases;
- Poorer water quality; and

- Changes in the distribution and time of lifecycle events of plant and animal species on land and in the oceans[8].

Climate change means a significant change in the measures of climate, such as temperature, rainfall, or wind, lasting for an extended period – decades or longer. Earth's climate has changed naturally many times during the planet's existence. However, currently human activities are significantly contributing to climate change through greenhouse gas emissions. The global average temperatures have now increased by more than 1°C since pre-industrial times.

At the Paris climate conference (COP21) in 2015, 195 countries adopted the first-ever universal, legally binding global climate deal. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to below 2°C above pre-industrial levels and to limit the increase to 1.5°C. Under the agreement, Governments also agreed on the need for global emissions to peak as soon as possible, recognising that this will take longer for developing countries and to undertake rapid reductions thereafter in accordance with the best available science.

The Glasgow Climate Pact (COP26) of 2021 aims to limit the rise in global temperature to 1.5°C and finalise the outstanding elements of the Paris Agreement. The Glasgow Climate Pact is manifested across three United Nations climate treaties, including the United Nations Framework Convention on Climate Change (the COP), the Kyoto Protocol (the CMP), and the Paris Agreement (the CMA).

The Climate Action Plan 2023 as set out by the Department of the Environment, Climate and Communications provides a detailed plan for Ireland. It plans for taking decisive action to achieve a 75% reduction in overall greenhouse gas emissions by 2030 and setting us on a path to reach net-zero emissions by no later than 2050, as committed to in the Programme for Government and set out in the Climate Act 2021. This Plan makes Ireland one of the most ambitious countries in the world on climate.

The provision of the Project will have a long-term positive impact by providing a sustainable energy source. Should the Project not proceed, fossil fuel power stations will be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other emissions. It will also hinder Ireland in its commitment to meet

[8] The Department of the Environment, Climate and Communications – 'Climate Action Plan 2023 – Changing Ireland for the Better'. Available at: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions as agreed at the Paris climate conference (COP21) in 2015 and Glasgow Climate Pact (COP26) in November 2021.

12.3.1 Relevant Legislation and Guidance

Greenhouse gases are the subject of international agreements, such as the United Nations Framework Convention on Climate Change, Kyoto Protocol and the Paris Agreement. The Glasgow Climate Pact is manifested across these three United Nations climate treaties. These agreements along with International and National Policy and Legislation are discussed in **Chapter 4: Planning and Legislative Context**.

12.3.2 Assessment Methodology

This assessment of climate involved the following:

- A desk study of the climate baseline in the area of the Project and nationally;
- Evaluation of potential effects;
- Evaluation of the significance of effects; and
- Identification of measures to avoid and mitigate potential effects.

12.3.3 Existing Climate

The Köppen climate classification divides regions of the globe based on seasonal precipitation and temperature patterns. The five main groups are tropical, dry, temperate, continental, and polar. The Irish climate is defined as a temperate oceanic climate on the Köppen climate classification system[9]. Ireland's climate is mild, moist and changeable with abundant rainfall and a lack of temperature extremes. The country generally receives cool summers and mild winters and it is considerably warmer than other areas on the same latitude. Ireland's land mass is warmed by the North Atlantic Current all year and as a result does not experience a great annual range of air temperatures.

Nationally, the mean air temperature is generally between 9 and 11 degrees. Annual rainfall totals on the west coast generally average between 1,000mm and 1,400mm with the wettest months being December and January and April being the driest month. The prevailing wind direction is between south and west. Average wind speed ranges from 3m/s in south Leinster to 8m/s in the extreme north of the country.

For the purpose of this assessment of changes to the climate, meteorological data from the nearest meteorological station to the Project, Shannon Airport monitoring station, over a

[9] https://www.britannica.com/science/Koppen-climate-classification/World-distribution-of-major-climatic-types, [Accessed 11/11/2023]

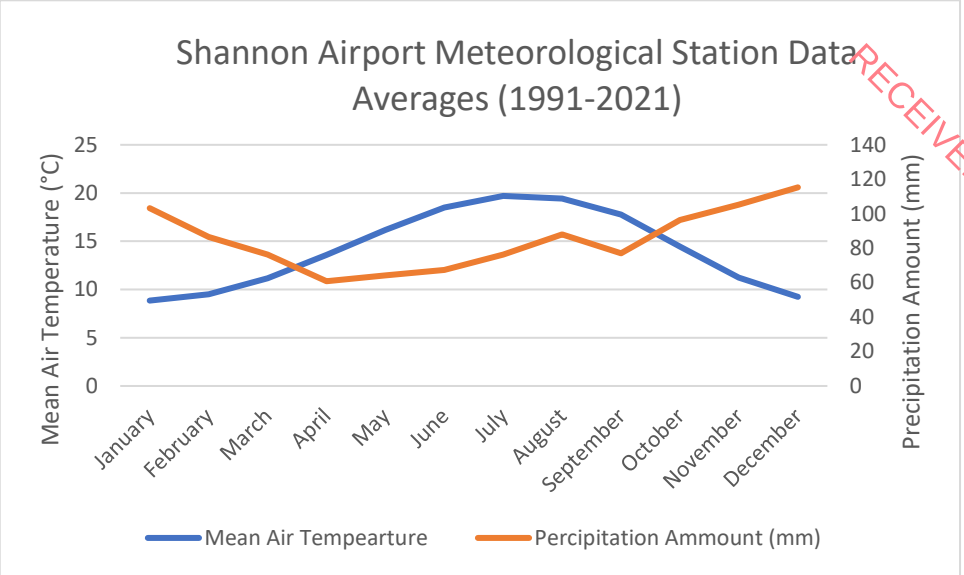
period of 1991-2021 is shown in **Table 12.3**. **Figure 12.1** shows the mean air temperature and precipitation amount (mm) recorded at Shannon Airport from 1991 to 2021. Shannon Airport is located 34km east of the Project and is the closest Met Éireann meteorological station to the Project.

The mean annual air temperature as shown in **Table 12.3** is between 1981 and 2021 was 10.775°C. Mean monthly temperatures ranged from 6.1°C in January to 16.2°C in July. Mean annual rainfall over this period was 1013.9mm, with a maximum monthly mean rainfall of 115mm in December and a minimum monthly mean rainfall of 61mm in April[10].

[10] https://data.gov.ie/dataset/shannon-airport-monthly-data?package_type=dataset [Accessed 11/11/23].

Table 12.3: Shannon Airport Meteorological Station Data Averages (1991- 2021)

Month	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Maximum Temperature (°C)	Mean Minimum Temperature (°C)	Mean Precipitation Amount (mm)	Grass Minimum Temperature (°C)	Mean Wind Speed (knot)	Highest Gust (knot)	Sunshine Duration (hours)
January	6.1	14.8	-11.2	8.9	3.5	103.2	-7.8	9.9	75.0	52.7
February	6.5	15.5	-5.0	9.5	3.5	86.5	-7.0	10.1	86.0	68.8
March	7.7	19.6	-5.8	11.2	4.2	76.3	-6.9	9.6	63.0	109.2
April	9.6	23.5	-2.9	13.6	5.6	60.8	-4.4	9.2	66.0	164.1
May	12.1	27.8	-0.6	16.2	8.1	64.1	-1.6	9.0	52.0	183.5
June	14.6	32.0	3.7	18.5	10.7	67.3	2.0	8.5	51.0	163.9
July	16.2	30.2	6.7	19.7	12.7	76.2	4.6	8.3	52.0	136.1
August	15.9	29.8	4.4	19.4	12.4	87.9	3.7	8.2	61.0	142.4
September	14.2	27.9	1.7	17.8	10.6	77.0	1.0	8.4	58.0	117.2
October	11.3	22.3	-2.0	14.4	8.1	96.4	-2.2	8.8	66.0	93.6
November	8.4	17.7	-6.6	11.2	5.6	105.2	-4.9	9.1	69.0	62.2
December	6.6	15.4	-11.4	9.2	4.0	115.3	-6.1	9.7	83.0	46.4



Graph 12.1: Shannon Airport Meteorological Station Data for the last 30 years

The next section examines the Carbon losses and savings from the Project and its impact on the Climate.

12.3.4 Calculating Carbon Losses and Savings

12.3.4.1 Carbon Calculator

To assess the effect of the Project on the climate, the carbon emitted or saved as a result of the Project was determined using a carbon calculator. The Scottish Government have produced an online carbon calculator which aims to assess, in a comprehensive and consistent way, the carbon emission offset effects of wind farm developments. This is done by comparing the carbon costs of wind farm developments with the carbon savings attributable to the wind farm. The carbon calculation takes into account the carbon released from a number of sources during the construction, operational and decommissioning stages. These include the effects of drainage works on peat soils, forestry felling, losses associated with harvesting and transport of felled trees, changes in land use and wind turbine manufacture, transportation and construction. Also included in the assessment tool is the assessment of peat disturbance.

Assessments are also carried out to estimate the carbon saving over the lifetime of the wind farm, compared to electricity produced using fossil fuel. The assessment of carbon savings relates to the capacity of the wind farm over the number of years for which it is operational, site improvement works, (i.e., peatland improvement, habitat creation, etc.), forestry felling, and site restoration works, (i.e., removal of infrastructure and restoration of previous site conditions), when the wind farm will be decommissioned.

The completed worksheet, including the assumptions used in the model, is provided in **Appendix 12.1** of this EIAR. The model calculates the total carbon emissions associated with the Project including manufacturing of the turbine technology, transport, construction of the Project and tree felling. The model, which is assessed for both the lower range (4MW) and the higher range (5MW), accounts for improvement works (see **Appendix 5.5 Habitat Enhancement Plan**) and the years taken for the site to return to its original characteristics but does not factor in the potential re-use of turbine components. All metal components can be recycled, while there is limited potential at present for the recycling/reuse of the fibreglass blades.

The model also calculates the carbon savings associated with the Project against three comparators:

i. Coal fired Electricity Generation

ii. Grid mix of Electricity Generation

iii. Fossil fuel mix of Electricity Generation (oil, gas and coal)[11].

This is to compare this renewable source of electricity generation to traditional methods of electricity generation to assess the carbon savings and losses.

12.3.4.2 Carbon Losses

The potential carbon losses were assessed for the Project.

The main CO_2 losses due to the Project are summarised in **Table 12.4**. A copy of the input and output data is provided in the completed worksheet in **Appendix 12.1**.

Table 12.4: Carbon Losses

Origin of Losses	Total CO_2 Losses (tonnes CO_2 equivalent)	
	Lower Range Output (4MW Turbine)	Higher Range Output (5MW Turbine)
Loss due to Turbine Life (i.e., Turbine manufacture, construction and Decommissioning)	14,199	17,936
Losses due to Backup	10,596	13,245

[11] Ireland's energy imports comprise oil (56%), gas (31%) and coal (10%). http://ireland2050.ie/present/oil-and-gas/?q=where-does-ireland-get-its-electricity#:~:text=Ireland%20has%20only%20small%20proven,%25)%20and%20coal%20(10%25, Accessed 11/11/23

Origin of Losses	Total CO_2 Losses (tonnes CO_2 equivalent)	
	Lower Range Output (4MW Turbine)	Higher Range Output (5MW Turbine)
Losses due to reduced carbon fixing potential	681	681
Losses from soil organic matter	8,030	8,030
Losses due to DOC and POC leaching	4	4
Felling of Forestry	8,131	8,131
Total Expected Losses	41,642	48,028

The worksheet model calculated that the Project is expected to give rise to up to 41,642 tonnes of CO_2 equivalent losses at the lower range (4MW) and 48,028 tonnes of CO_2 equivalent losses at the higher range (5MW) over its 35-year life. Of this total figure, the proposed wind turbines (i.e. manufacture, construction, decommissioning) directly account for 14,199 tonnes, or 34% at the lower range and 17,936 tonnes or 37% at the higher range, of the expected total CO_2 losses. Losses due to backup[12] account for 10,596 tonnes or 25% at the lower range and 13,245 tonnes, or 28% of the expected total CO_2 losses.

Losses from soil organic matter, reduced carbon fixing potential, DOC and POC leaching and the felling of forestry accounting for the remaining 41% or 16,846 tonnes at the lower range and 35 % or 16,846 tonnes at the higher range. The estimated 16,846 tonnes of CO_2 (higher and lower range) arising from ground activities associated with the Project is calculated based on the entire Project footprint being "*Acid Bog*", as this is one of only two choices, the other being fen. The main difference between a fen and a bog is that fens have greater water exchange and are less acidic, so their soil and water are richer in nutrients. Fens are often found near bogs and over time most fens become bogs. Although the peat area is degraded and shallow at the Site, "*Acid Bog*" is a much more suitable term to describe it.

The habitat that will be impacted by the Project footprint comprises predominantly agricultural land and commercial forestry rather than the (cutaway) acid bog assumed by the model that gives rise to the 16,846tonnes (lower and higher range) and therefore the actual CO_2 losses are expected to be lower than this value.

[12] CO_2 loss due to back up is calculated from the extra electricity production baseload capacity required for backup of the windfarm to meet net generation demands when the wind farm is non-generating.

The figures discussed above are based on the assumption that the hydrology of the Site and habitats within the site are not restored on decommissioning after its expected 35-year useful life. However, at the end of the 35-year lifespan of the Project, the turbines may be replaced with newer models subject to a consent for the same being obtained. This would mean the carbon losses associated with not restoring the habitats hydrology at the Site would be offset by the carbon-neutral energy that the new turbines would generate.

Based on the calculations as presented above, the worst case scenario is that 41,642 tonnes of CO_2 at the lower range (4MW) and 48,028 tonnes of CO_2 at the higher range (5MW) are expected to be lost to the atmosphere due to the construction, operation and decommissioning of the Project.

12.3.4.3 Carbon Savings

The carbon calculator is pre-loaded with information specific to the CO_2 emissions from the United Kingdom's electricity generation plant, which is used to calculate emissions savings from proposed wind farm projects in the UK and similar data was not available in the model for the Irish electricity generation plant. Therefore, these CO_2 emissions savings from the Project were calculated separately from the worksheet.

A simple formula is used to calculate carbon dioxide emissions reductions resulting from the generation of electricity from wind power rather than from carbon-based fuels such as peat, coal, gas and oil. The formula is:

$$CO_2 \text{ (in tonnes)} = \frac{(A \times B \times C \times D)}{1000}$$

where:

A = The maximum capacity of the wind energy development in MW

B = The capacity or load factor, which takes into account the availability of wind turbines and array losses etc.

C = The number of hours in a year

D = Carbon load in grams per kWh (kilowatt hour) of electricity generated and distributed via the national grid.

For the purposes of this calculation, the rated capacity of the Project is assumed to be approximately 16MW at the lower range and 20MW at the higher range. A load factor of 0.283 (or 28.3%) has been used for the Project.

There has been a strong reduction in the CO_2 intensity of electricity generation, especially after 2016, with intensity falling below 300g CO_2/kWh for the first time in 2020. It is now less than a third of its 1990 value[13]. The number of hours in a year is 8,760. The most recent data for the carbon load of electricity generated in Ireland is for 2021 and was published in October 2022 in an information paper published by the Commission for Regulation of Utilities (CRU) entitled "*Fuel Mix Disclosure and CO2 Emissions, 2021*". The emission factor for electricity in Ireland in 2021 was 258g CO_2/kWh.

The calculation for carbon savings at the lower range and higher range are therefore as follows:

$$CO_2 \text{ (in tonnes)} = \frac{(16 \times 0.283 \times 8{,}760 \times 258)}{1000}$$

= 10,234 tonnes per annum at the lower range

$$CO_2 \text{ (in tonnes)} = \frac{(20 \times 0.283 \times 8{,}760 \times 258)}{1000}$$

= 12,792 tonnes per annum at the higher range

Based on this calculation, approximately 10,234 (lower range) or 12,792 (higher range) tonnes of CO_2 will be displaced per annum from the largely carbon-based traditional energy mix by the Project.

In total, it is estimated that 358,177 tonnes (lower range) or 447,721 tonnes (higher range) of CO_2 will be displaced over the proposed 35-year lifetime of the wind farm.

12.3.5 Do Nothing Impact

If the Project was not to proceed, greenhouse gas emissions, e.g., carbon dioxide (CO_2), carbon monoxide (CO) and nitrogen oxides (NO_x) associated with construction and decommissioning works would not arise. However, the greenhouse gas savings that would be gained from the operation of the Project would also be lost leading to a long-term, moderate, negative impact.

[13] Fuel Mix Disclosure and CO2 Emissions, 2021 - Commission for Regulation of Utilities (CRU), 2022
Online: https://www.cru.ie/wp-content/uploads/2022/10/Fuel-Mix-Disclosure-and-CO2-Emissions-2021.pdf [Accessed 11/11/23]

12.3.6 Potential Impacts of the Project

12.3.6.1 Construction Phase

Greenhouse gas emissions, e.g., carbon dioxide (CO_2), carbon monoxide (CO) and nitrogen oxides (NO_x) are associated with vehicles and plant utilised for construction activities. This potential impact will be slight, given the insignificant quantity of greenhouse gases that will be emitted, and will be restricted to the duration of the construction phase. Therefore, this is a short-term, slight, negative impact. Mitigation measures to reduce this impact are outlined in **Section 12.2.8**.

12.3.6.2 Operation Phase

The Project is a renewable energy project which will be in direct contrast to traditional energy and the associated emission of greenhouse gases from electricity-generating stations dependent on fossil fuels, thereby having a positive impact on the climate. The Project will displace carbon dioxide from fossil fuel-based electricity generation, over the proposed 35-year lifespan of the Project. The Project will assist in reducing carbon dioxide (CO_2) emissions (10,234 tonnes per annum at the lower range or 12,792 tonnes per annum at the higher range) that would otherwise arise if the same energy that the Project will generate were otherwise to be generated by conventional fossil fuel plants. This is a long-term, moderate, positive effect on the climate.

12.3.6.3 Decommissioning Phase

Any impacts that occur during the decommissioning phase are similar to that which occur during the construction phase. The mitigation measures prescribed for the construction phase of the Project will be implemented during the decommissioning phase thereby minimising any potential impacts.

12.3.7 Climate - Mitigation Measures

It is considered that the Project will have an overall positive impact in terms of carbon reduction and climate.

This Project will have a local/regional and national impact on carbon reduction. The Project will assist Ireland in meeting a 75% reduction in overall greenhouse gas emissions by 2030 and support increasing the onshore wind capacity to 9GW, as per the Climate Action Plan 2023. It will also contribute to Clare County Councils objective that 40% of the County's electricity needs can be met from wind farms as set out in the Clare County Development plan 2017-2023 - Clare Wind Energy Strategy. It will help to meet the objective to "*C2-Minimise emissions of greenhouse gases and contribute to a reduction and avoidance of*

human induced global climate change" with a target to "*Establish incentives/increase no. of permission or renewable energy projects*." as set out in the Clare County Council Strategic Environmental Report (2019).

12.3.7.1 Construction Phase

All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.

12.3.7.2 Operation Phase

The operation phase of the Project will have a positive impact on the climate due to the displacement of fossil fuels and therefore no mitigation is necessary for this phase.

12.3.7.3 Decommissioning Phase

Mitigation measures during the decommissioning phase will be similar to those employed during the construction phase as outlined above.

12.3.8 Cumulative Effects

Potential cumulative effects on the climate between the Project and other developments in the vicinity were also considered as part of this assessment. The other developments considered as part of the cumulative effects assessment are described in **Appendix 1.2**. and in **Chapter 2**, **Table 2.2 in Section 2.3.3**.

During the construction phase of the Project and other consented developments within 20 kilometres that are yet to be constructed, there will be minor exhaust emissions from construction plant and machinery and dust emissions from construction activities. In a worst-case scenario if any of these developments were constructed at the same time as the Project in Ballykett, there would be short-term slight negative cumulative impact on climate due to exhaust and dust emissions.

The nature of the Project is such that, once operational, it will have a long-term, moderate, positive impact on the air climate. It is considered that the cumulative impact will be positive in terms of carbon reduction and the climate.

During the operational phase emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2) or dust emissions from the Project and other projects listed in **Table 2.1 and Table 2.2 of Chapter 2 Project Description**, will result from the operation and maintenance vehicles onsite. However, these emissions will be minimal. Therefore, there will be a long-term imperceptible negative cumulative impact on the climate.

Cumulative impacts during the Decommissioning phase will be similar to the construction phase although slightly less as a result of the reduced works required because some infrastructure will be left in-situ e.g., turbine foundations and the site roads.

The nature of the Project, once operational, they will have a cumulative long-term, significant, positive effect on the climate.

12.3.9 Residual Impacts of the Project

12.3.9.1 Construction Phase

There will be a short-term imperceptible negative impact to air and climate as a result of greenhouse gas emissions.

12.3.9.2 Operational Phase

There will be a long-term, moderate, positive impact to air and climate as a result of reduced greenhouse gas emissions.

12.3.9.3 Decommissioning Phase

Any impacts and consequential effects that occur during the Decommissioning phase are similar to that which occur during the construction phase, albeit of less impact. For example, turbine foundations and site roads will be left in-situ. No forest felling will take place during the Decommissioning phase.

12.3.10 Summary of Significant Effects

This assessment has identified no potential significant effects, given the mitigation measures embedded in the design and recommended for the Project

12.3.11 Statement of Significance

The Project has been assessed as having the potential to result in a short-term imperceptible, negative impact on climate during construction. There will be long-term moderate, positive impact to air and climate as a result of reduced greenhouse gas emission during the operational phase.

Potential cumulative impact of the Project on climate was assessed as having a long-term, significant, positive impact on the Climate.

13 SHADOW FLICKER AND ELECTROMAGNETIC INTERFERENCE

13.1 INTRODUCTION

This chapter assesses the effects of the Project (**Figure 1.2**) in terms of shadow flicker and electromagnetic interference. The Project refers to all elements of the application for the construction of Ballykett Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.4.** This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **Appendix 13.1 Shadow Flicker Analysis**

13.1.1 Statement of Authority

This chapter has been prepared by Ms. Aileen Byrne of Jennings O'Donovan & Partners Limited. Aileen Byrne is an Environmental Scientist, who holds a Bachelor (Hons) Degree in Geography and Information Technology from the National University of Ireland, Galway, and a Higher Diploma in Environmental Science from the University of Limerick. She forms part of the Environmental team responsible for preparing the EIAR Chapters. Aileen has experience writing EIARs, Feasibility Studies and Shadow Flicker analysis.

The chapter has been reviewed by Mr. David Kiely of Jennings O'Donovan & Partners Ltd. Mr. Kiely has 40 years' experience in the civil engineering and environmental sector. He has obtained a Bachelor's Degree in Civil Engineering and a Masters in Environmental Protection, has overseen the construction of over 60 wind farms and has carried out numerous soils and geology assessments for EIA's. He has been responsible in the overall preparation of in excess of 20 EIA Reports (EIAR's).

13.1.2 Assessment Structure

In line with the revised EIA Directive and current EPA guidelines listed in **Chapter 1**, **Section 1.6** the structure of this shadow flicker and electromagnetic interference chapter is as follows:

- Assessment methodology and significance criteria

- Description of baseline conditions at the Site
- Identification and assessment of effects of shadow flicker and electromagnetic interference associated with the Development, during the construction, operational and Decommissioning phases of the Development
- Mitigation measures to avoid or reduce the effects identified
- Identification and assessment of residual impact of the Development considering mitigation measures
- Identification and assessment of cumulative effects if and where applicable

The desktop study as outlined in Section 13.2 is considered appropriate to allow Clare County Council to carry out an adequate assessment of the Development.

13.2 SHADOW FLICKER

This section comprehensively assesses the potential shadow flicker effects of the Project. No shadow flicker will occur during the construction or Decommissioning phases.

13.2.1 Assessment Methodology

This assessment of shadow flicker involved the following:

- Evaluation of potential effects
- Evaluation of the significance of effects
- Identification of measures to avoid and mitigate potential effects

The Study Area is defined as 10 times the widest potential rotor diameter within the range (10 x 136m = 1,360m). This was increased to 1,500m for completeness. A shadow flicker computer model (WindPRO 3.6) was used to calculate the occurrence of shadow flicker at relevant receptors to the Development. The output from the calculations is analysed to identify and assess potential shadow flicker effects. Wind turbines, like other tall structures, can cast long shadows when the sun is low in the sky.

The 2019 Draft Revised Wind Energy Guidelines confirms that:
"Shadow Flicker occurs when the sun is low in the sky and the rotating blades of a wind turbine casts a moving shadow which if it passes over a window in a nearby house or other property results in a rapid change or flicker in the incoming sunlight. The time period in which a neighbouring property may be affected by shadow flicker is completely predictable."

In order to ensure the full extent of the moving shadow which would be created by the turning turbines is considered in the assessment the following scenario was modelled:

- Four 4-2MW wind turbines,
- Overall ground to blade tip height of 150m,
- A rotor diameter of 136m, and
- A hub height of 82m.

This scenario was included in the assessment along with the cumulative effects of nearby wind farms (within 2km) in order to fully assess the effects of the Project.

Where negative effects are predicted, this section identifies appropriate mitigation strategies. The assessment considers the potential effects during the operational phase of the project.

A shadow flicker computer model was used to calculate the occurrence of shadow flicker at relevant receptors to the Development. The output from the calculations is analysed to identify and assess potential shadow flicker effects. This is further detailed in **Appendix 13.1**.

Shadow flicker lasts only for a short period and happens only in certain specific combined circumstances. The circumstances required for shadow flicker to occur are:

- the sun is shining
- the turbine is directly between the sun and the affected property, and
- there is enough wind energy to ensure that the turbine blades are moving.

If any one of these conditions is absent, shadow flicker cannot occur.

The 2019 Draft Revised Wind Energy Development Guidelines (WEDG)[1] also added the circumstance where:

- *"There is sufficient direct sunlight to cause shadows (cloud, mist, fog or air pollution could limit solar energy levels)" and note that*
- *"Generally only properties within 130 degrees either side of north, relative to the turbines, can be affected at these latitudes in the UK and Ireland – turbines do not cast long shadows on their southern side".*

Shadow flicker may have the potential to cause disturbance and annoyance to residents if it affects occupied rooms of a house. Persons with photosensitive epilepsy can be sensitive

[1],Department of Housing, Planning and Local Government, 2019. *Draft Revised Wind Energy Development Guidelines*, Dublin. Government of Ireland. [Available Online: https://assets.gov.ie/46097/6e68ea81b8084ac5b7f9343d04f0b0ef.pdf]

to flickering light between 3 and 60 Hertz (Hz). This is supported by research in recent years asserting that flicker from turbines must interrupt or reflect sunlight at frequencies greater than 3 Hz to pose a potential risk of inducing photosensitive seizures. The frequencies of flicker caused by modern wind turbines are less than 1 Hz and are well below the frequencies known to trigger effects in these individuals. Therefore, any potential shadow flicker effect from the Project is considered an effect on residential amenity, rather than having the potential to affect the health of residents.

Careful site selection, design and planning, and good use of relevant software to control the turbine operation can help reduce the possibility of shadow flicker. Modern wind turbines have the facility to measure sunlight levels and to reduce or stop turbine rotation if the conditions exist that would lead to any shadow flicker at neighbouring properties.

The distance and direction between the turbine and property is of significance because:

- The duration of the shadow will be shorter the greater the distance (i.e., it will pass by quicker)
- The shadow flicker cast by rotating wind turbine blades will be reduced, the further a dwelling is from an operating turbine.

The path of the sun varies over the seasons resulting in a changing potential for a shadow to be cast throughout the year. Similarly, the sun's position in the sky over the course of a day is changing such that the shadow cast by a turbine is constantly changing. Shadow flicker is more likely to occur on sunny winter days when the sun is lower in the sky and shadows cast a greater distance from the turbine. Shadow flicker is more likely to occur to the west or north-west of the Site with some occurrences also predicted to the east. This can be seen in **Appendix 13.1**.

13.2.2 Relevant Guidance

The relevant Irish guidance for shadow flicker is derived from the '*Wind Energy Development Guidelines*' (Department of the Environment, Heritage and Local Government (DoEHLG), 2006) the '*Best Practice Guidelines for the Irish Wind Energy Industry*' (Irish Wind Energy Association, 2012), and the Draft Revised Wind Energy Development Guidelines (Department of Housing, Local Government and Heritage, 2019).

The Department of Environment, Community and Local Government in its Wind Energy Development Guidelines (2006) (the 2006 Guidelines) considers that:

"*At distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. Where shadow flicker could be a problem, developers should provide calculations to quantify the effect and where appropriate take measures to prevent or ameliorate the potential effect, such as by turning off a particular turbine at certain times".*

The 2006 Guidelines also state that:
"It is recommended that shadow flicker at neighbouring offices and dwellings within 500m should not exceed 30 hours per year or 30 minutes per day".

A minimum separation distance from all occupied dwellings not connected to the project of 600m (four times the rotor diameter) has been used with the Project design. There are 89 no. occupied dwellings within 1.5km of any proposed wind turbine location.

The 2006 Guidelines state that shadow flicker lasts only for a short period of time and occurs only during certain specific combined circumstances, as follows:

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

Although the DoEHLG thresholds apply to dwellings located within 500 metres of a proposed turbine location, for the purposes of this assessment, the guideline thresholds of 30 hours per year or 30 minutes per day have been applied to all properties located within ten rotor diameters (i.e., 1,360 metres (136m)) of the proposed turbines within the Site (as per IWEA guidelines, 2012[2]). The 2006 Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

The adopted 2006 DoEHLG guidelines are currently under review. The Department of Housing, Local Government and Heritage released the 'Draft Revised Wind Energy Development Guidelines' in December 2019. The Draft Revised Wind Energy Development Guidelines (2019) provides for zero shadow flicker:
"Computational models can be used to accurately predict the strength and duration of potential shadow flicker during daylight hours for every day of the year. A Shadow Flicker Study detailing the outcome of computational modelling for the potential for shadow flicker

[2] Irish Wind Energy Association, 2012. *Best Practice Guidelines for the Irish Wind Energy Industry*, Cork: Wind Skillnet. [Available online: https://windenergyireland.com/images/files/9660bdfb5a4f1d276f41ae9ab54e991bb600b7.pdf]

from the development should accompany all planning applications for wind energy development.

If a suitable shadow flicker prediction model indicates that there is potential for shadow flicker to occur at any particular dwelling or other potentially affected property, then a review of site design involving the possible relocation of one or more turbines to explore the possibility of eliminating the occurrence of potential flicker is required. Following such a review, if shadow flicker is not eliminated for any dwelling or other potentially affected property then clearly specified measures which provide for automated turbine shut down to eliminate shadow flicker should be required as a condition of a grant of permission."

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

The assessment herein is based on compliance with the current DoEHLG Guidelines limit (30 hours per year or 30 minutes per day). However, it should also be noted the Development can be brought in line with the requirements of the 2019 draft guidelines, should they be adopted while this application is in the planning system, through the implementation of the mitigation measures outlined herein.

Taking the above into consideration, JOD examined maps and aerial photographs to identify receptors (dwellings) within the ten rotor diameters guidance (1,360m; all turbines with a rotor diameter of a maximum of 136m) extended to 1.5km for completeness. The house survey was ground truth-ed to confirm there are a total of 89 houses within 1,500m of any turbine. Other wind farms within 2km of the Development were also included in the assessment to determine the cumulative effects.

13.2.3 Shadow Flicker Modelling

An industry standard wind farm assessment software package, WindPRO from EMD International Version 3.6 was used to prepare a model of the Development. The programme facilitates the analysis of a wind farm for possible shadow flicker occurrence at nearby houses. It allows for the production of maps, and shadow flicker prediction. The data output from the programme has been analysed and the receptors potentially vulnerable to shadow flicker were identified. The significance of shadow flicker effects was assessed.

Generic windows of 2m width, 2m height and 0.5m from bottom line above ground are applied in the model to each side of the house. The model assumes the receptor will not face any particular direction, but instead will face all directions. These windows represent an approximation of the existing windows on the houses facing north, south, east and west and provide an estimate of potential shadow flicker to a window on each side of the house. The software determines the times of day/year when the sun will be in line with the rotational components of the turbine and the house/receptor, thereby having the potential to cause shadow flicker. The software outputs details of potential shadow flicker, in this case by mean and maximum duration of the shadow flicker events, days per year and times of occurrence and maximum hours per year and maximum minutes per day of shadow flicker.

The following data inputs were required and used to produce an estimate of the effect of shadow flicker from the wind farm:

- Digital elevation model of the Development and areas around all properties within the model (10m resolution – OS X, Y, and Z data points)
- Turbine locations
- Turbine dimensions (rotor diameter and hub height)
- Receptor locations (i.e., property locations)
- Bottom line height above ground 'window' (0.5m above ground level)
- Wind speed and direction for the Site to determine the period that the wind turbines will be in operation from the different wind directions during the year

The software creates a mathematical model of the Development and its surroundings and uses this information to calculate specific theoretical times and durations of flicker effects for the identified properties. The following 'worst-case' assumptions were initially incorporated into the shadow flicker modelling:

- there are no clouds and sunlight is always bright and direct
- the turbines are always rotating whereas this might not be the case due to maintenance works, break downs, wind speeds below the turbine threshold or curtailment
- there is no intervening structures or vegetation (other than topography) that may restrict the visibility of a turbine, preventing or reducing the effect
- a limit to human perception of shadow flicker is not considered by the model

The model operates by simulating the path of the sun during the year. The results of the model provide a calculation of theoretical specific times and durations of flicker effects for the identified properties. As previously stated, given the assumptions incorporated into the model, the calculations overestimate the duration of effects. The worst-case assumption is

considered to be sufficient for the purposes of this assessment as it 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 of the receptors and the turbines (except where this is prevented due to topography). In reality, this will not occur; the turbines will not always be orientated as described, clouds will obscure the sun and line of sight may also be obscured (for example, from leaves on trees). The flicker effects will be substantially less than this and will not meet the results of the worst-case assumption.

The model also outputs a more realistic scenario, or "expected values". In this scenario, the only change in assumptions is that the statistically likely monthly sunshine frequency and wind direction frequency data is assessed. This assessment only changes the annual hours per year metric and is not applied to the daily data. 'This is because it could be sunny, with the wind coming from the relevant direction, on any individual day. The data used in the model was the:

- Long-term sunshine probability data from the Met Éireann synoptic station in Valentia
- Long-term wind rose data from the SEAI Wind Mapping System (ITM co-ordinates 502000E, 658000N).

13.2.4 Baseline Description

Taking the above into consideration, JOD examined maps to identify receptors (dwellings) in the local area within a Study Area, a distance ten times the maximum proposed rotor diameter of the proposed turbines (10 x 136m = 1360m), extended to 1500m for completeness. This dimension will give the most significant outcome as smaller rotor diameters will cast less shadow. The properties were identified using a combination of Ordnance Survey of Ireland (OSI) Maps, AutoCAD drawings and from internet mapping resources including *Eircode Finder, Google Street View*, *Google Earth*, *Bing Maps,* a planning permission search using the Clare County Council web resource and from a visit to the Study Area. There are 89 occupied properties within the shadow flicker Study Area radius. The majority of houses are located to the south and south-west of the Development. The coordinates of each dwelling and its distance to the closest proposed turbine are listed in **Table 13.1** and are shown in **Figure 1.3**.

Table 13.1: Properties within the shadow flicker study area

Current House ID	East_ITM	North_ITM	Closest Turbine	Closest Distance to Turbine (m)
H1*	502459.8	658250.2	4	560.44
H2**	502399.6	657727.9	3	531.57

Current House ID	East_ITM	North_ITM	Closest Turbine	Closest Distance to Turbine (m)
H3	502538.4	658258.2	4	635.78
H4	501974.2	658979.7	4	607.65
H5	501368.1	657536	2	578.72
H6	501003.7	658951.1	1	691.74
H7	500979.7	658864.5	1	658.17
H8	502597.2	658351.5	4	684.18
H9	502520	657768.6	3	626.24
H10	502068.3	659061.4	4	703.5
H11	500910.9	657733.8	2	696.4
H12	502536.3	657734.9	3	653.26
H13	502234	659009	4	710.33
H14	502524.4	657817.5	3	616.31
H15	500916.9	658973.7	1	773.15
H16	501998.5	659116	4	745.77
H17	500971.9	658979.3	1	734.28
H18	501008.7	659015.8	1	732.2
H19	502646.9	658743.4	4	820.73
H20	502355.2	659039.3	4	797.69
H21	502329.9	659059.9	4	801.5
H22	502266.5	659125.3	4	829.1
H23	502626.1	658820.7	4	840.46
H24	502214.9	659189.4	4	868.32
H25	500598.9	658322.9	2	932.62
H26	500828.7	659102.3	1	923
H27	500568.8	658254.1	2	948.2
H28	502557.8	657360.2	3	879.03
H29	501807	659352.5	1	899.36
H30	502796.4	658774.2	4	968.93
H31	500539	658209.5	2	971.51
H32	500526.7	658181.8	2	981.04
H33	500513	658145.6	2	992.25
H34	501249.2	659412.2	1	955.35
H35	502268.5	659318.3	4	1007.82
H36	500682.8	657529.2	2	999.38
H37	500487.7	658211.2	2	1022.7
H38	502922.9	658648.1	4	1045.74
H39	500700.1	657459.6	2	1027.03
H40	500436.6	658129.7	2	1068.05
H41	500761.5	657365	2	1043.81
H42	502437.2	659304.3	4	1066.65
H43	502205.1	656909.1	3	1100.01

Current House ID	East_ITM	North_ITM	Closest Turbine	Closest Distance to Turbine (m)
H44	502997.2	658596.6	4	1106.16
H45	500855.4	657246	2	1071.27
H46	500477.4	657678.3	2	1109.37
H47	500461	657716.6	2	1110.87
H48	500450.5	657743.4	2	1111.9
H49	500504.7	657595.7	2	1118.85
H50	502403.7	656964.4	3	1115.64
H51	501340.1	659545.2	1	1063.64
H52	502042.4	656845.4	3	1134.07
H53	501906.3	656820.2	3	1153.67
H54	501855.4	656798.8	3	1177.11
H55	501357.8	659583.9	1	1098.94
H56	500378.6	657833.7	2	1156.25
H57	501827.7	656770.5	3	1207.35
H58	500368.1	657797.6	2	1175.25
H59	501531.8	659631.2	1	1133.18
H60	501709.7	656737.3	3	1255.57
H61	502517.5	656978.2	3	1156.78
H62	501744.3	656750.8	3	1236.63
H63	501153.6	656962.9	2	1188.45
H64	501079.7	656967.3	2	1208.24
H65	500216.6	658015	2	1290.29
H66	500341.2	657710.3	2	1226.09
H67	501676.9	656727.8	3	1271.01
H68	500907.6	657071.8	2	1187.44
H69	502813.6	657237	3	1151.71
H70	502557.4	656912.9	3	1233.31
H71	501767.8	656721	3	1262.96
H72	503143.7	658543.6	4	1241.76
H73	500307.3	657573.5	2	1306.99
H74	502769.8	657040.3	3	1256.72
H75	501469.9	656657.6	3	1393.61
H76	500489.4	659366.1	1	1352.43
H77	500968.7	659682.1	1	1308.85
H78	500203.8	657813.7	2	1331.15
H79	500152.9	658099.4	2	1351.23
H80	501004.9	656859.9	2	1335.41
H81	502779.8	659409.4	4	1349.23
H82	501198.7	656727.5	2	1404.59
H83	502860	659401	4	1395.86
H84	500533.7	659464.7	1	1385.62

Current House ID	East_ITM	North_ITM	Closest Turbine	Closest Distance to Turbine (m)
H85	500251.1	657458.6	2	1406.99
H86	501272.3	656641.2	2	1475.61
H87	500511.9	659542	1	1455.73
H88	500185.5	657430.2	2	1478.33
H90	503116.8	657153.1	3	1444.32

* H1 An abandoned house which still has a roof intact so has been included in the assessment.

** H2 is an old cottage that has been converted to a workshop and is not considered a sensitive receptor

Note: H89 is not included as it is beyond the extent of the study area

No shadow flicker is experienced at 20 No. out of 89 No. dwellings, (**Table 13.2**) due to the orientation of these dwellings with respect to the proposed turbines in all scenarios assessed and these are therefore ruled out for further assessment. A total of 69 No. dwellings experience shadow flicker (**Table 13.3**).

Table 13.2: Dwellings with no shadow flicker experienced

Dwellings with no shadow flicker experienced		
H43	H50	H52
H53	H54	H57
H60	H61	H62
H63	H64	H67
H68	H70	H71
H74	H75	H80
H82	H86	-

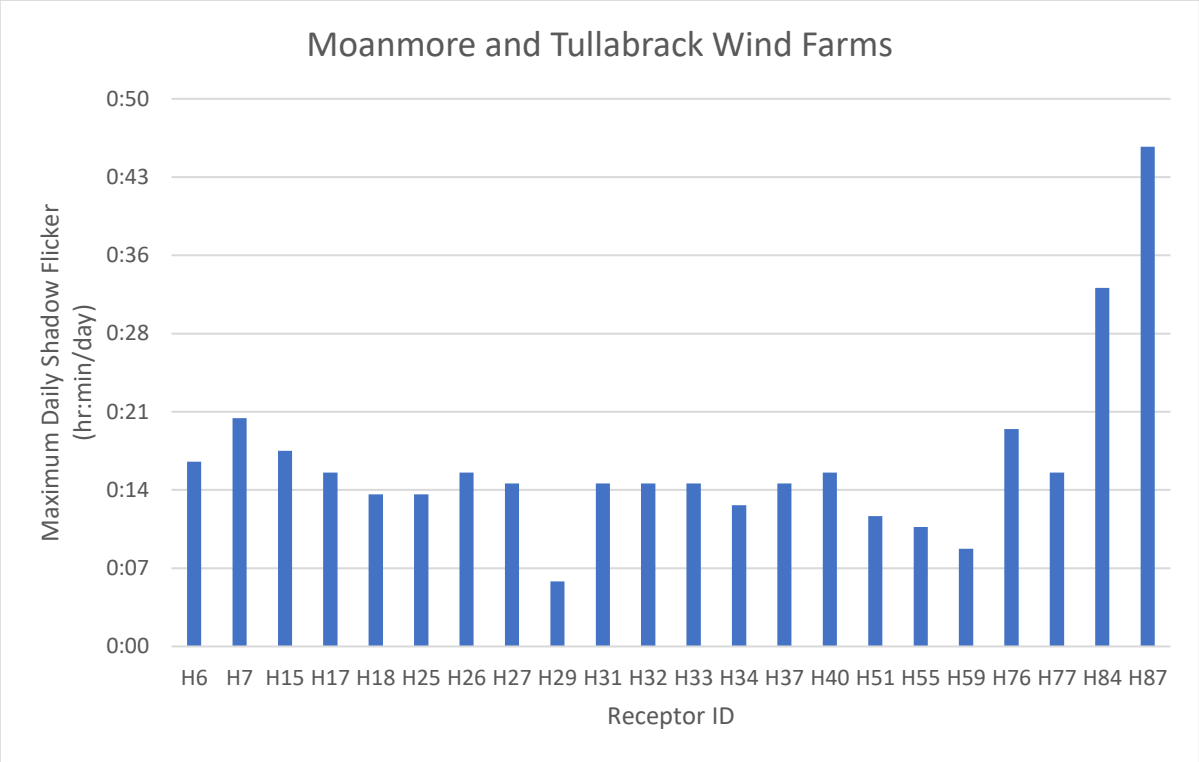
13.2.5 Assessment of Potential Effects

This assessment considers the potential shadow flicker effect of the Development on the remaining surrounding properties in terms of:

- Predicting and assessing the extent of shadow flicker experienced by all properties within the shadow flicker Study Area
- Specifying mitigation measures, where deemed necessary

Other developments within 2km were then considered in the assessment of the Development for cumulative effects. Moanmore Wind Farm is located 1,800m from the nearest turbine and Tullabrack Wind Farm is located 2,093m from the nearest turbine proposed as part of this Development.

Graph 13.1 shows the baseline expected annual shadow flicker to be experienced by receptors from the nearby Moanmore and Tullabrack wind farms. Full details of this can be seen in **Appendix 13.1**. The calculation of the potential total hours of shadow flicker per year, the number of days per year that shadow flicker is possible, the maximum hours of shadow flicker per day for each receptor from the Development and the Moanmore and Tullabrack wind farms is shown in **Table 13.3** and discussed under cumulative effects in **Section 4.6**. Full assessment outputs are in **Appendix 13.1** of the EIAR.



Graph 13.1: Summary of Potential Shadow Flicker Listing for Receptors from Moanmore and Tullabrack Wind Farms

Moanmore and Tullabrack Wind Farms are located within 2km of the nearest turbines of the Development. Shadow flicker analysis has shown that this Development already has some effects on 22 No. receptors as can be seen in **Graph 13.1**. The analysis has shown that 6 No. receptors are impacted by Moanmore and Tullabrack Wind Farms only, as can be seen in **Table 13.3**.

Table 13.3: Summary of Potential Cumulative Shadow Flicker Listing for All Properties

Receptor ID	Ballykett Turbines only			Ballykett Turbines and Cumulative Wind Farms*		
	Worst Case Shadow [h/year]	Max. Shadow [h/day]	Expected Shadow [h/year]	Worst Case Shadow [h/year]	Max. Shadow [h/day]	Expected Shadow [h/year]
H1	116:27	00:59	21:51	116:27	00:59	21:51
H2	89:34	01:04	18:33	89:34	01:04	18:33
H3	85:38	00:54	16:06	85:38	00:54	16:06
H4	68:05	00:52	06:47	68:05	00:52	06:47
H5	04:54	00:12	00:54	04:54	00:12	00:54
H6*	**67:55**	**01:05**	**08:08**	**73:22**	**01:05**	**09:07**
H7*	**81:59**	**01:04**	**09:58**	**88:08**	**01:04**	**11:14**
H8	70:39	00:56	12:38	70:39	00:56	12:38
H9	61:23	00:52	13:21	61:23	00:52	13:21
H10	49:38	00:44	04:53	49:38	00:44	04:53
H11	51:00	00:44	10:00	51:00	00:44	10:00
H12	59:17	00:50	12:48	59:17	00:50	12:48
H13	58:10	01:02	05:45	58:10	01:02	05:45
H14	61:40	00:52	13:18	61:40	00:52	13:18
H15*	**56:03**	**00:56**	**06:40**	**62:34**	**00:56**	**07:51**
H16	42:02	00:44	03:48	42:02	00:44	03:48
H17*	**58:44**	**00:59**	**06:59**	**64:21**	**00:59**	**07:59**
H18*	**62:04**	**00:58**	**07:00**	**69:24**	**00:58**	**08:20**
H19	55:40	00:39	06:45	55:40	00:39	06:45
H20	61:14	01:03	05:55	61:14	01:03	05:55
H21	51:30	00:59	04:58	51:30	00:59	04:58
H22	22:46	00:34	02:28	22:46	00:34	02:28
H23	47:21	00:39	05:35	47:21	00:39	05:35
H24	31:56	00:35	03:07	31:56	00:35	03:07
H25*	**37:31**	**00:33**	**07:30**	**51:40**	**00:44**	**10:23**
H26*	**39:45**	**00:44**	**04:34**	**47:44**	**00:44**	**05:57**

Receptor ID	Ballykett Turbines only			Ballykett Turbines and Cumulative Wind Farms*		
	Worst Case Shadow [h/year]	Max. Shadow [h/day]	Expected Shadow [h/year]	Worst Case Shadow [h/year]	Max. Shadow [h/day]	Expected Shadow [h/year]
H27*	**37:29**	**00:33**	**07:38**	**48:48**	**00:43**	**09:57**
H28	12:40	00:19	02:26	12:40	00:19	02:26
H29*	***00:00***	***00:00***	***00:00***	**00:30**	**00:06**	**00:06**
H30	34:40	00:31	04:24	34:40	00:31	04:24
H31*	**35:37**	**00:32**	**07:17**	**40:53**	**00:39**	**08:27**
H32*	**35:16**	**00:31**	**07:16**	**40:19**	**00:38**	**08:24**
H33*	**35:29**	**00:31**	**07:23**	**40:55**	**00:36**	**08:34**
H34*	***00:00***	***00:00***	***00:00***	**07:25**	**00:13**	**01:30**
H35	23:30	00:30	02:08	23:30	00:30	02:08
H36	16:54	00:19	03:19	16:54	00:19	03:19
H37*	**30:06**	**00:30**	**06:08**	**35:25**	**00:30**	**07:19**
H38	25:44	00:27	03:47	25:44	00:27	03:47
H39	06:37	00:19	01:25	06:37	00:19	01:25
H40*	**29:08**	**00:28**	**06:06**	**36:45**	**00:28**	**07:43**
H41	10:09	00:20	02:04	10:09	00:20	02:04
H42	12:58	00:24	01:21	12:58	00:24	01:21
H43	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H44	21:28	00:25	03:20	21:28	00:25	03:20
H45	08:36	00:15	01:34	08:36	00:15	01:34
H46	20:44	00:31	04:27	20:44	00:31	04:27
H47	23:17	00:32	04:58	23:17	00:32	04:58
H48	26:51	00:32	05:40	26:51	00:32	05:40
H49	24:23	00:30	04:59	24:23	00:30	04:59
H50	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H51*	***00:00***	***00:00***	***00:00***	**03:58**	**00:12**	**00:52**
H52	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H53	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*

Receptor ID	Ballykett Turbines only			Ballykett Turbines and Cumulative Wind Farms*		
	Worst Case Shadow [h/year]	Max. Shadow [h/day]	Expected Shadow [h/year]	Worst Case Shadow [h/year]	Max. Shadow [h/day]	Expected Shadow [h/year]
H54	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H55*	***00:00***	***00:00***	***00:00***	**03:57**	**00:11**	**00:52**
H56	36:54	00:27	07:32	36:54	00:27	07:32
H57	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H58	35:13	00:28	07:10	35:13	00:28	07:10
H59*	***00:00***	***00:00***	***00:00***	**02:46**	**00:09**	**00:36**
H60	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H61	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H62	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H63	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H64	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H65	18:55	00:23	04:04	18:55	00:23	04:04
H66	24:34	00:26	05:03	24:34	00:26	05:03
H67	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H68	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H69	06:23	00:12	01:14	06:23	00:12	01:14
H70	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H71	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H72	14:51	00:20	02:27	14:51	00:20	02:27
H73	13:37	00:24	02:54	13:37	00:24	02:54
H74	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H75	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H76*	**18:56**	**00:25**	**02:03**	**37:40**	**00:30**	**04:55**
H77*	***00:00***	***00:00***	***00:00***	**18:45**	**00:16**	**03:41**
H78	18:50	00:21	04:01	18:50	00:21	04:01
H79	15:22	00:20	03:12	15:22	00:20	03:12
H80	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*

Receptor ID	Ballykett Turbines only			Ballykett Turbines and Cumulative Wind Farms*		
	Worst Case Shadow [h/year]	Max. Shadow [h/day]	Expected Shadow [h/year]	Worst Case Shadow [h/year]	Max. Shadow [h/day]	Expected Shadow [h/year]
H81	12:50	00:23	01:10	12:50	00:23	01:10
H82	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H83	15:29	00:21	01:26	15:29	00:21	01:26
H84*	**15:55**	**00:22**	**01:42**	**52:36**	**00:33**	**07:59**
H85	11:42	00:21	02:26	11:42	00:21	02:26
H86	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*	*00:00*
H87*	**13:52**	**00:20**	**01:26**	**72:24**	**00:46**	**12:05**
H88	09:51	00:19	02:03	09:51	00:19	02:03
H90	10:04	00:14	01:57	10:04	00:14	01:57

*Impacted by Moanmore Wind Farm and Tullabrack Wind Farm

It can be demonstrated from **Table 13.3**, there will be 69 receptors out of 89 that will experience some degree of shadow flicker and 20 receptors that will experience no shadow flicker. H1 is expected to experience 21 hours 51 minutes of shadow flicker in a year, which is the worst affected occupied receptor.

However, 6 No. of the shadow flicker receptors are impacted by the operational Moanmore and Tullabrack wind farms only and these receptors will not experience shadow flicker from the Development. The worst affected receptor in this scenario is H77 which is expected to experience 3 hours and 41 minutes of shadow flicker in a year.

Table 13.4 Dwellings that will experience shadow flicker but not from the Development

Dwellings affected by Tullabrack/Moanmore Wind Farms only	
H29	H34
H51	H55
H59	H77

The calculated worst-case shadow flicker occurrences in the **Table 13.3** assumes the sun is always shining, that there is no cloud cover, the turbines are rotating and the dwelling is always occupied. As previously stated, this calculation is based on topography alone and excludes vegetation, buildings and other man-made structures. As can be seen in the shadow flicker assessment attached as **Appendix 13.1** all of the proposed turbines give rise to some degree of cumulative shadow flicker, if unmitigated.

13.2.6 Assessment of Expected Shadow Flicker Impact

In order to calculate more realistic and '*real world*' occurrences of shadow flicker for the receptors that are identified as potentially vulnerable to shadow flicker (**Table 13.3**), it is necessary to identify the likely meteorological conditions which are expected to be experienced at the Site. To estimate the likely duration of sunshine occurrence at the Site, historical meteorological data from Met Éireann is automatically uploaded by the software. Data from Valentia meteorological observatory was used as this Met Éireann observatory is the closest to the Site and also measures multiple environmental parameters. This gives a good representation of data for the Development. This data was utilised to consider the probability of sunshine occurrence, and thus allow the determination of '*projected*' values for shadow flicker occurrence.

The worst-case predicted hours for shadow flicker are reduced by the average time the weather is cloudy annually. As discussed above, to estimate the impact of sunshine occurrence, historical meteorological data is utilised to consider the likelihood of sunshine (the sunshine probability) at different times of the year. This allows the determination of '*expected*' values for shadow flicker occurrence. This is achieved by applying a reductive factor to the worst-case total hours per year of shadow flicker. 'Long term average sunshine hours' refers to data collected by Met Éireann.

Table 13.3 shows the potential and the expected shadow flicker values per year which are likely to be experienced by each receptor. '*Potential sunshine hours'* refers to the intervening time period between modelled sunrise and sunset. Although the projected duration of shadow flicker is reduced substantially for each dwelling, they are not eliminated entirely for all of the 89 receptors within the shadow flicker Study Area of the Development. The expected shadow flicker results showed that 35 receptors would have a maximum shadow flicker over 30 minutes per day. This exceeds the 2006 Wind Energy Development Guidelines. The Draft Revised Wind Energy Development Guidelines, December 2019, recommend that shadow flicker should not affect any dwelling, therefore the relevant turbine (or turbines) must be shut down on a temporary basis until the potential for shadow flicker ceases. The mitigation measures to avoid this exceedance is outlined in section 13.2.8.

13.2.7 Cumulative Effects

Cumulative shadow flicker effects could arise if dwellings are at risk from potential shadow flicker effects as a result of more than one wind farm. While separate wind farms are not likely to cause effects simultaneously, they could increase the cumulative total hours where a receptor is affected. In this instance, there are two operational wind farms (Moanmore and Tullabrack wind farms) within a 2km range of the turbines that may cause cumulative effects.

The assessment showed 6 houses will be affected by the operational Moanmore and Tullabrack wind farms and not the Development (**Table 13.3**). There are 16 No. receptors (**Table 13.5**) that will be affected by cumulative shadow flicker effects. The installation of a blade shadow control system on all wind turbines will eliminate shadow flicker effects from the Development, therefore, removing cumulative shadow flicker effects.

Table 13.5: Dwellings with cumulative shadow flicker experienced

Dwellings with cumulative shadow flicker experienced		
H6	H7	H15
H17	H18	H25
H26	H27	H31
H32	H33	H37
H40	H76	H84
H87	-	-

13.2.8 Mitigation Measures & Residual Effects

Due to the potential for shadow flicker to effect receptors within the shadow flicker Study Area, it is proposed that a shadow control system will be installed on each of the wind turbines. The control system will calculate, in real-time:

- Whether shadow flicker has the potential to effect nearby properties, based on pre-programmed co-ordinates for the properties and turbines
- Wind speed (can affect how fast the turbine will turn and how quickly the flicker will occur)
- Wind direction
- The intensity of the sunlight

When the control system detects that the sunlight is strong enough to cast a shadow, and the shadow falls on a property or properties, then the turbine will automatically shut down; and will restart when the potential for shadow flicker ceases at the effected properties. Such systems are common in many wind farm developments and the technology has been well established. A case study in Scotland found that the use of turbine shut-down control modules for turbines which were causing shadow flicker at nearby offices was successful.

It is intended that the measures outlined above, subject to safe shut down time of approximately 60 seconds, will eliminate the potential for shadow flicker to affect any of the properties within the Study Area, this will be the case regardless of which turbine is selected within the turbine range. In the event that complaints of shadow flicker are received by the Developer / site operator or by Clare County Council, an investigation will take place and the complaints frequency, duration and time of complaints will be considered and specialist modelling software will be used to confirm the occurrence(s). Should the complaint persist, a shadow flicker survey involving the collection of light data will also be carried out at the property in which the complaint was made. Further refinement of the blade shadow control

system will be conducted to eliminate the shadow flicker occurrence. This will result in the shutting off turbines at specific times of day.

13.3 ELECTROMAGNETIC INTERFERENCE

Electromagnetic fields ("EMF") are invisible lines of force that surround electrical equipment, power cords, wires that carry electricity and outdoor power lines. Electric and magnetic fields can occur together or separately and are a function of voltage and current. When an electrical appliance is plugged into the wall, an electric field is present (there is voltage but no current); when that appliance is turned on, electric and magnetic fields are present (there is both voltage and current). Both electric and magnetic fields decrease with distance. Electric fields are also dissipated by objects such as building materials. On a daily basis, people are exposed to extremely low frequency ("ELF") EMF as a result of using electricity.

National and international health and scientific agencies have reviewed more than 35 years of research including thousands of studies. None of these agencies has concluded that exposure to ELF-EMF from power lines or other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health. The International Commission on Non-Ionising Radiation Protection (ICNIRP) Guidelines give a limit of 100µT for sources of AC magnetic fields. This compares to 0.13µT that arises from a 110kV underground cable when directly above it; 1.29µT that arises from a 220kV underground cable when directly above it and 11.4µT that arises from a 400kV AC underground cable that is one metre deep and measured directly above it. This is detailed in information booklet published by ESB in 2017 called "EMF & You" which provides information about Electric & Magnetic Fields and the electricity network in Ireland[3].

In 2014, a study was undertaken in Canada[4], measuring electromagnetic fields around wind farms and the impact on human health. The study found that:
"there is nothing unique to wind farms with respect to EMF exposure; in fact, magnetic field levels in the vicinity of wind turbines were lower than those produced by many common household electrical devices and were well below any existing regulatory guidelines with respect to human health".

[3] EMF & You, ESB, 2017 - https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0, accessed 04/01/2024
[4] Lindsay C McCallum, *et al*. (2014) *Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern?*

From the limit of 100μT for sources of AC magnetic fields given by the ICNIRP, a comparison of between 0.02μT and 0.41μT arises when turbines operate under "high wind" scenarios.

13.3.1 Assessment of Potential Impacts

Electromagnetic fields from wind farm infrastructure, including the Grid Connection and Electrical Substation, are very localised and are considered to be an imperceptible, long-term effects.

13.3.2 Mitigation Measures and Residual Effects

As the potential effects are localised and considered to be imperceptible in the long term, it is not necessary to implement mitigation measures. Residual effects are not expected.

13.4 SUMMARY OF SIGNIFICANT EFFECTS

This assessment has identified the potential for shadow flicker to effect 69 No. out of 89 No. receptors within the shadow flicker Study Area. Of these, 6 No. receptors will be solely affected by the consented Moanmore and Tullabrack wind farms. It is proposed that a shadow control system be installed to eliminate the potential for shadow flicker from the Project.

The assessment has not identified any likely significant effects from the Project on Electromagnetic Interference

13.5 STATEMENT OF SIGNIFICANCE

This chapter has assessed the significance of potential effects of the Project on shadow flicker and electromagnetic interference.

This assessment has identified that by installing a blade shadow control system on the proposed turbines, there will be no significant effects. Given that only effects of significant impact or greater are considered "significant" in terms of the EIA Directive the potential effects of the Project as a result of shadow flicker, when mitigated, are considered to be not significant.

The Project has been assessed as having the potential to result in effects of **imperceptible, long-term impact** overall with regards to electromagnetic interference. Cumulative effects are predicted as unlikely.

14 CULTURAL HERITAGE

14.1 INTRODUCTION

This chapter assesses the effects of the Project on the cultural heritage resource. The Development refers to all elements of the application for the construction of Ballykett Wind Farm (**Chapter 2: Project Description**). Where adverse effects are predicted, the chapter identifies appropriate mitigation strategies. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

The term 'Cultural Heritage' encompasses heritage assets relevant to both the tangible resource (including archaeology and architectural heritage); and non-tangible resources (including historical associations, folklore, tradition, language and placenames). The recorded and potential cultural heritage resource within lands encompassing the proposed wind farm Site and the surrounding landscape was reviewed in order to compile a comprehensive cultural heritage baseline for the assessment. The proposed Grid Connection route and work areas to facilitate the delivery of turbines (Turbine Delivery Route) to the Site were also assessed.

Common acronyms used throughout this EIAR can be found in **Appendix 1.3.** This chapter of the EIAR is supported by figures provided in **Volume III** and by the following appendix documents provided in **Volume IV** of this EIAR:

- **Appendix 14.1 Plates**

14.1.1 Statement of Authority

The chapter was prepared by Tony Cummins of John Cronin and Associates. Mr Cummins holds B.A. and M.A. degrees in archaeology (University College Cork (UCC) 1992/1994) and has twenty-eight years industry experience. He was approved as licence eligible archaeologist by the National Monuments Service in 1998 and has extensive experience in the preparation of archaeological, architectural and cultural heritage assessments for renewable energy projects.

14.1.2 Assessment Structure

The desktop study and the field surveys described in **Section 14.3** together with the other assessments will allow the planning authority to carry out an assessment of the

Development from a cultural heritage perspective. In line with the revised EIA Directive as amended and the EPA (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports* the chapter provides considerations of effects based on the following:

- Assessment of cultural heritage value and sensitivity
- Assessment of the magnitude of cultural heritage effects within the Study Area
- Assessment of the significance of cultural heritage effects
- Assessment of cumulative cultural heritage effects

14.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

14.2.1 Definition of Study Area

There are no professional guidelines which define the extent of study areas required to assess the effects of wind farm developments on the cultural heritage resource. The extent of the study areas used for this assessment are, therefore, informed by the years of experience and professional judgement of the specialist and are considered suitable for the assessment of potential effects. The Study Area reviewed for the assessment comprised the area within the Site and the surrounding lands extending for 2km in all directions beyond its boundary as well as a 100m wide area centred on the Grid Connection route and work areas required to facilitate the delivery of turbines to the Site (shown in **Volume III; Figures 14.1** and **14.5**). The extent of the 2km Study Area around the Site is suitable as it facilitated the compilation of a baseline context for the known cultural heritage resource within the Site and its surrounds which informed the assessment of potential direct and indirect effects of potential medium-high magnitude on the locations and settings of known cultural heritage assets within this area. The extent of the 100m Study Area centred on the Grid Connection route and Turbine Delivery Route work areas is suitable as it facilitated the compilation of a baseline context of known and potential cultural heritage constraints within the vicinity of their localised footprints and also allowed an appraisal of the potential presence of any sub-surface elements which may be susceptible to direct or indirect effects.

In addition, the wider landscape extending for 10km in all directions from the Site was reviewed to determine the presence of any nationally significant cultural heritage assets with heightened visual sensitivities, such as National Monuments in State Care and World Heritage sites (including tentative sites). This also included a review of other cultural heritage assets within the 10km area that possess visual attributes that extend beyond their immediate settings, such as archaeological monuments with ritual visual alignments across the wider landscape (e.g., stone circles, stone rows and megalithic tombs). The extent of this 10km area is based on professional judgement and is suitable to appraise if the wider

landscape contains individual or groupings of such visually sensitive monuments that may be susceptible to potential high-to-medium magnitudes of indirect effects on their wider settings or alignments.

The assessment of the significance of visual effects on publicly accessible cultural heritage receptors within 20km of the Site is presented in the Landscape and Visual Amenity Assessment chapter which was reviewed as part of this assessment (see **Chapter 11**).

14.2.2 Assessment Methodology

The methodology used for this assessment is based on Environmental Protection Agency (EPA 2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)*[1] and the European Commission (2017) *Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report*[2]. The chapter has been compiled to comply with the requirements of Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment as amended by Directive 2014/52/EU, and the Planning and Development Acts, 2000 to 2022 and Planning and Development Regulations, 2001 – 2022.

14.2.3 Relevant Legislation and Guidance

The tangible elements of the cultural heritage resource can be divided into the archaeological resource comprising sites and monuments dating from the prehistoric period to the post-medieval period and the architectural heritage resource, encompassing standing structures and sites of cultural importance often dating to the post-medieval and modern periods. In addition, assets such as local placenames, language, folklore and traditions are considered part of the intangible cultural heritage resource. The management and protection of the cultural heritage resource in Ireland is achieved through a framework of international conventions and national laws and policies. This framework was established in accordance with the provisions of the 'European Convention on the Protection of the Archaeological Heritage (Revised) (ETS No. 143)' (the Valletta Convention) and the 'Convention for the Protection of the Architectural Heritage of Europe (ETS No. 121)' (Grenada Convention). Both of these conventions were ratified by the Republic of Ireland in 1997. While there is no current national legislation providing legal protection for the Irish intangible heritage resource it is noted that the UNESCO Convention for the Safeguarding

[1] https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf
[2] https://op.europa.eu/en/publication-detail/-/publication/2b399830-cb4b-11e7-a5d5-01aa75ed71a1

of the Intangible Cultural Heritage, 2003, which seeks to safeguard and promote awareness of this element of cultural heritage, was ratified by Ireland in 2015.

The legislation and guidelines that are relevant to this assessment comprise the following:

- Historic and Archaeological Heritage and Miscellaneous Provisions Act 2023
- National Monuments Acts 1930 to 2014
- Heritage Council Acts 1995 and 2018
- National Cultural Institutions Act, 1997 (as amended)
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999
- Planning and Development Acts 2000 to 2022)
- Department of Arts, Heritage and Gaeltacht (2011) *Architectural Heritage Protection Guidelines for Planning Authorities*[3]
- Department of Arts, Heritage, Gaeltacht and the Islands (1999) *Framework and Principles for the Protection of the Archaeological Heritage*[4]
- International Council on Monuments and Sites (2011) *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*[5]

14.2.3.1 Archaeological Heritage

The National Monuments Service is currently based in the Department of Housing, Local Government and Heritage (DHLGH) and is responsible for the preservation, protection and promotion of Ireland's archaeological heritage.

The Historic and Archaeological Heritage and Miscellaneous Provisions Act 2023 was signed into law on October 13th, 2023[6]. The Department of Housing, Local Government and Heritage circulated a guidance document in relation to this Act in November 2023 which provides an overview of its current status, and this is summarised hereafter. While the Act is now law most of its provisions will not enter into force until the Minister has made one or more "Commencement Orders". This means that section 7 of the Act (which provides for the repeal of the National Monuments Acts 1930 to 2014 and related legislation) has not entered into force. Accordingly, the National Monuments Acts 1930 to 2014 and other legislation which section 7 of the Act will, when it comes into force, repeal, remain fully in

[3] https://www.gov.ie/en/publication/0937a-architectural-heritage-protection-guidelines-for-planning-authorities/
[4] https://www.archaeology.ie/sites/default/files/media/publications/framework-and-principles-for-protection-of-archaeological-heritage.pdf
[5] https://openarchive.icomos.org/id/eprint/266/1/Guidance_on_heritage_impact_assessments.pdf
[6] https://www.irishstatutebook.ie/eli/2023/act/26/

force as they stood on 13th October and will continue to do so for the time being. The Act contains transitional provisions which will, if necessary, enable certain aspects of the existing National Monuments Acts 1930 to 2014 to continue in operation notwithstanding their repeal post-commencement of the Act while successor provisions are being brought fully into operation. This includes provisions enabling the Record of Monuments and Places to continue to have effect pending the establishment of the new Register of Monuments (see section 48 of the Act).

The National Monuments Acts 1930 to 2014 (and amendments), the Heritage Council Acts 1995 and 2018 and relevant provisions of the National Cultural Institutions Act, 1997 (as amended) therefore currently remain the primary means of ensuring the satisfactory protection of archaeological remains. There are a number of mechanisms under the National Monuments Acts 1930 to 2014 that are applied to secure the protection of archaeological monuments. These include the designation of National Monument status, the Register of Historic Monuments, the Record of Monuments and Places and the Sites and Monuments Record as well as the placing of Preservation Orders and Temporary Preservation Orders on endangered sites. A National Monument is described as 'a monument or the remains of a monument, the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (Section 2, National Monument Acts 1930 to 2014). There are no National Monuments in state care located within or adjacent to the Site, the Grid Connection route or Turbine Delivery Route work areas. The location of the one example within 10km of the Site is detailed in **Section 14.3.7** of this chapter.

The Record of Monuments and Places was established under Section 12(1) of the National Monuments (Amendment) Act, 1994 and was based on the earlier Sites and Monuments Record and Register of Historic Monuments. These records comprise lists and maps of all known archaeological monuments and places for each county in the state. The National Monuments Service maintains an online Historic Environment Viewer which comprises an interactive map/search facility that provide access to current records stored on its national database of sites and monuments. The Viewer includes designated areas around recorded monuments known as 'zones of notification' which do not comprise buffer zones but are intended to indicate areas of archaeological potential within their environs[7]. All archaeological sites listed in the Record of Monuments and Places receive statutory

[7] https://www.archaeology.ie/sites/default/files/media/publications/archaeology-planning-process-pl13.pdf

protection under the National Monuments (Amendment) Act, 1994 (as amended) and no works can be undertaken at their locations without providing two months advance notice to the National Monuments Service. The known archaeological sites located within the environs of the Project are detailed in **Section 14.3**. The potential for the presence of hitherto unrecorded, sub-surface archaeological features within proposed construction areas is also considered.

14.2.3.2 Architectural Heritage

Protection of architectural or built heritage is provided for through a range of legal instruments that include the Heritage Council Acts 1995 and 2018, the Architectural Heritage (National Inventory) and National Monuments (Miscellaneous Provisions) Act, 1999, and the Planning and Development Acts 2000 to 2022. Section 2(1) of the Heritage Act 1995, describes architectural heritage as follows:

All structures, buildings, traditional and designed, and groups of buildings including streetscapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents, and, without prejudice to the generality of the foregoing, includes railways and related buildings and structures and any place comprising the remains or traces of any such railway, building or structure.

The Planning and Development Acts 2000 to 2022 requires Planning Authorities to maintain a 'Record of Protected Structures' of buildings and other structures that are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. All structures listed for protection in current Development plans, are designated Protected Structures and planning permission is required for any works to such structures that would affect their character. A protected structure also includes the lands and other structures within its curtilage. While the notion of curtilage is not defined by legislation, the *Architectural Heritage Protection Guidelines for Planning Authorities* (Department of Arts, Heritage and the Gaeltacht, 2011), describes it as the parcel of land immediately associated with a structure and which is (or was) in use for the purposes of the structure. The current Record of Protected Structures for County Clare is published in the *County Clare Development Plan 2023--2029*. The Planning and Development Acts 2000 to 2022 also provides for the inclusion of objectives for preserving the character of places, areas, groups of structures or townscapes of special interest to be designated as Architectural Conservation Areas.

The National Inventory of Architectural Heritage and the Historic Gardens and Designed Landscapes Survey comprise non-statutory records of a representative sample of post 1700 architectural heritage structures and associated lands within the State. While inclusion in the inventory does not provide statutory protection to listed structures or lands, it does provide an indication of their architectural heritage value and is intended to advise local authorities on the compilation of their Records of Protected Structures.

There are no Protected Structures or buildings and historic gardens listed in the National Inventory of Architectural Heritage located within the Site or within adjoining lands. There are two Protected Structures located within 2km of the Site (Brew's House in Ballykett townland, and Gower Hall in the townland of Gower south) and these are detailed in **Section 14.3.6** of this chapter.

14.2.4 Clare County Development Plan 2023-2029

The County Clare Development Plan 2023-2029 includes the following relevant objectives in relation to the protection of the archaeological resource within the county:

CDP16.8: Sites, Features and Objects of Archaeological Interest

It is an objective of Clare County Council:

a) To safeguard sites, features and objects of archaeological interest generally;

b) To secure the preservation (i.e. preservation in situ or in exceptional cases preservation by record) of all archaeological monuments included in the Record of Monuments and Places as established under Section 12 of the National Monuments (Amendment) Act, 1994, and of sites, features and objects of archaeological and historical interest generally

c) In securing such preservation, the Council will have regard to the advice and recommendations of the Department of the Culture, Heritage and the Gaeltacht;

d) To have regard to the government publication 'Framework and Principles for the Protection of the Archaeological Heritage 1999' in relation to protecting sites, features and objects of archaeological interest;

e) To advocate for greater financial assistance for the maintenance and improvement of features of archaeological interests in County Clare.

CDP16.9 Development Plan Objective: Newly Discovered Archaeological Sites

It is an objective of Clare County Council:

To protect and preserve archaeological sites discovered since the publication of the Record of Monuments and Places.

CDP16.10 Development Plan Objective: Zones of Archaeological Potential

It is an objective of Clare County Council:

To protect the Zones of Archaeological Potential located within both urban and rural areas as identified in the Record of Monuments and Places.

CDP16.11 Development Plan Objective: Archaeology and Infrastructure Schemes

It is an objective of Clare County Council:

To ensure that decisions relating to development (including infrastructure associated with broadband, telecommunications, renewable energy, major road/ rail infrastructure, flood relief schemes and other services) which may have implications for Recorded Archaeological. Monuments/Sites, Zones of Archaeological Potential or undiscovered archaeology, are informed by an appropriate level of archaeological investigation undertaken by qualified persons and the case of flood relief schemes have regard to archaeological Guidelines for Flood Relief Schemes (DHLGH and OPW2022)

CDP16.13 Development Plan Objective: Underwater Archaeology

It is an objective of Clare County Council:

To protect and preserve the archaeological value of underwater archaeological sites in rivers, lakes, intertidal and sub-tidal environments.

The current Record of Protected Structures for County Clare is published in the County Clare Development Plan 2023-2029 which also presents the Council's objectives in relation to the protection of the architectural heritage resource within the county. These include the following relevant objectives:

CDP16.1 Development Plan Objective: Architectural Heritage

It is an objective of Clare County Council:

a) To ensure the protection of the architectural heritage of County Clare through the identification of Protected Structures, the designation of Architectural Conservation Areas, the safeguarding of historic gardens, and the recognition of structures and elements that contribute positively to the vernacular and industrial heritage of the County;

b) To ensure that the archaeological or architectural heritage of the County is not damaged either through direct destruction or by unsympathetic developments nearby.

CDP16.2 Development Plan Objective: Protected Structures

It is an objective of Clare County Council:

a) To protect, as set out in the Record of Protected Structures, all structures and their settings, which are of special architectural, historical, archaeological, artistic, cultural, scientific, social, or technical interest;

b) To review the Record of Protected Structures periodically and add structures of special interest as appropriate, including significant elements of industrial, maritime or vernacular heritage and any twentieth century structures of merit.

CDP16.3 Development Plan Objective: Industrial Heritage

It is an objective of Clare County Council:

To protect and preserve buildings and features of industrial heritage such as mills, bridges, lighthouses, harbours, amongst others. Proposals for refurbishment works to, or redevelopment/ conversion of, these sites will be subject to a full architectural and archaeological assessment together with an ecological assessment with respect to the presence of protected species.

CDP16.4 Development Plan Objective: Vernacular Heritage

It is an objective of Clare County Council:

To seek the retention, appreciation and appropriate revitalisation of the vernacular heritage of County Clare, in both towns and rural areas, by discouraging the replacement of good quality vernacular buildings with modern structures and by protecting vernacular buildings where they contribute to the character of an area or town and/or where they are rare examples of a structure type.

CDP16.5 Development Plan Objective: Architectural Conservation Areas

It is an objective of Clare County Council:

To ensure that new developments within or adjacent to an ACA respect the context of the area and contribute positively to the ACA in terms of design, scale, setting and material finishes.

The *County Clare Development Plan 2023-2029* also contains objectives in relation to the cultural heritage of the county and these relate to the Art, Heritage, Cultural and Creative Sectors (Plan ref. CDP16.14), Museums, Heritage and Cultural Centres (Plan ref. CDP16.15), Genealogy (Plan ref. CDP16.16), Linguistic Heritage (Plan ref. CDP16.17) and Folklore and Oral Cultural Heritage (Plan ref. CDP16.18).

14.2.5 Desktop Study

The assessment presents the results of a desktop study of relevant published sources and datasets undertaken in order to identify all recorded and potential archaeological, architectural and other cultural heritage sites/features/areas within the Study Area for the Site, Grid Connection route and Turbine Delivery Route work areas. The principal sources reviewed for the assessment of the recorded archaeological resource were the Sites and Monuments Record and the Record of Monuments and Places. The relevant Records of Protected Structures and the National Inventory of Architectural Heritage were consulted for assessing the locations of designated elements of the architectural heritage resource.

Other sources consulted as part of the desktop study included the following:

National Monuments Service's Historical Environment Viewer[8]: There is currently no published archaeological inventory for County Clare but the Historical Environment Viewer does present summary descriptions of certain recorded archaeological sites within the county and these entries are included within **Section 14.3.2**.

Heritage Council of Ireland Map Viewer[9]*:* This online mapping resource collates various cultural heritage datasets provided by, among others, the National Monuments Service, the National Museum of Ireland, local authorities, the Royal Academy of Ireland and the Office of Public Works. This resource includes datasets on surveys of County Clare Bridges and features of Industrial Heritage which were commissioned by Clare County Council and includes examples listed as Protected Structures as well as additional structures of architectural, industrial, social or technical merit. The locations of structures listed in these surveys were reviewed as part of the assessment.

Topographical Files of the National Museum of Ireland: These files comprise paper and digital records of known information on Irish artefacts, including their discovery locations. The file archive is stored in the museum premises in Kildare Street, Dublin and was inspected as part of the assessment.

Database of Irish Excavation Reports: This online database contains summary accounts of archaeological site investigations carried out in Ireland (North and South) from 1970 to present[10].

Literary Sources: Various published sources were consulted in order to assess the archaeological, historical, architectural heritage and folklore record of the Study Area.

Cartographic Sources: A review of available historic cartographic sources was undertaken, and these included the 17th-century Down Survey and various map editions published by the Ordnance Survey from the mid-19th century onward. These sources can indicate the presence of past settlement patterns, including features of archaeological and architectural heritage significance that no longer have any surface expression. Relevant extracts from the reviewed cartographic sources are provided in **Volume III**.

[8] www.archaeology.ie accessed in November 2023
[9] www.heritagemaps.ie accessed in November 2023
[10] www.excavations.ie accessed in November 2023

Aerial and Satellite imagery: A review of available imagery of the Study Area was undertaken in order to review the extent of modern interventions and to ascertain if any traces of unrecorded archaeological sites were visible within proposed development areas.

Irish National Folklore Collection: A review was undertaken of transcribed material from the National Folklore Collection archive which has been digitised and published online at www.duchas.ie.

UNESCO World Heritage Sites and Tentative List: There are currently two designated World Heritage sites in Ireland (Brú na Bóinne, Co. Meath and Sceilg Mhichíl, Co. Kerry). A number of other significant examples have been included in a Tentative List (2022) to be nominated by Ireland for inclusion and these comprise the Passage Tomb Landscape of County Sligo, the Transatlantic Cable Ensemble, County Kerry and the Royal Sites of Ireland (Dún Ailinne County Kildare; Hill of Uisneach, County Westmeath; Rock of Cashel, County Tipperary; Rathcroghan, County Roscommon and Tara, County Meath)[11]. None of these sites are located in Co. Clare or are within the environs of its boundary.

14.2.6 Field Survey

Proposed construction locations within the Site were subjected to field walking surveys and inspections of the Grid Connection route and work areas along the Turbine Delivery Route where ground works are required were also undertaken. These surveys were carried out in May 2022 and January 2023. There are no relevant guidelines in relation to cultural heritage field surveys for wind farm developments. In the professional judgement of the specialist, the duration, frequency and method of the field surveys carried out as part of this assessment were suitable to the existing environment at the location of the Project. The surveyed lands were assessed in terms of historic landscape, existing land use, vegetation cover and the potential for the presence and survival of unrecorded archaeological and undesignated architectural heritage sites or features. The results of the field surveys are described within the chapter while annotated extracts from the photographic record are provided in **Appendix 14.1**. The cultural heritage constraints within the sections of the Study Area outside the boundary of the Project are located within private properties which were not accessible during field surveys. These constraints were assessed based on a combination of reviews of their classifications and conditions of preservation as described in available published inventory descriptions as well as reviews of their locations on consulted historic mapping and modern aerial/satellite imagery.

[11] Ministers announce new World Heritage Tentative List for Ireland | Tentative List | World Heritage | World Heritage Ireland

14.2.7 Consultation

A response to a scoping request for the Development was issued by the Development Applications Unit on 27th October 2022 and contained no content in relation to the cultural heritage resource.

14.2.8 Assessment of Effects Methodology

14.2.8.1 Level of Effect

The following provides a summary of the criteria used to assess effects in order to outline the methodology specifically applied to the cultural heritage resource which complies with relevant EPA and ICOMOS guidelines (see **Section 14.2**).

Duration of Effect

The duration of effects is assessed based on the following criteria:

- Momentary (seconds to minutes)
- Brief < 1 day
- Temporary <1 year
- Short-term 1-7 years
- Medium Term 7-15 years
- Long Term 15-60 years
- Permanent > 60 years
- Reversible: Effects that can be undone through remediation or restoration

Quality of Effect

The quality of an effect on the cultural heritage resource can be positive, neutral or adverse:

- Positive Effect – a change which improves the quality of the cultural heritage environment, (e.g., increasing amenity value of a site in terms of managed access, signage, presentation or high-quality conservation/restoration and re-use of an otherwise vulnerable derelict structure)
- Neutral Effect – no change or effects that are imperceptible, within the normal bounds of variation for the cultural heritage environment
- Adverse Effect – a change which reduces the quality of the cultural heritage resource, (e.g., visual intrusion on the setting of an asset, physical intrusion on features/setting of a site)

Type of Effect

The type of effect on the cultural heritage resource can be direct, indirect or no predicted effect.

- Direct Effect – where a cultural heritage site is physically located within the footprint of the EIA Development, which will result in its complete or partial removal.
- Indirect Effect – where a cultural heritage site or its setting in the landscape is located within the environs of the EIA Development.
- Cumulative Effect -The addition of many minor or insignificant effects, including effects of other projects, to create larger, more significant effects.
- 'Do-nothing Effects' - The cultural heritage environment as it would be in the future should the Project not be carried out.
- 'Worst-case' Effects - The effects arising from a Project in the case where mitigation measures substantially fail.
- Indeterminable Effects - When the full consequences of a change in the environment cannot be described.
- Irreversible Effects - When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
- Residual Effects - The degree of environmental change that will occur after the proposed mitigation measures have taken effect.

Magnitude of Effect

This is based on the degree of change, incorporating any mitigation measures, on a cultural heritage asset and can be adverse or positive. The magnitude is ranked without regard to the value of the asset according to the following scale: High; Medium; Low and Negligible and has been informed by criteria published in the International Council on Monuments and Sites *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS 2011) (**Table 14.1**).

Value assessment criteria

The evaluation of the values of cultural heritage asset used for the purposes of assessment is not intended as definitive, but rather an indicator which contributes to a wider judgment based on the individual circumstances of each asset. The value of all known or potential assets that may be affected by development are ranked according to the following scale: Very High; High; Medium; Low and Negligible. The factors for assessing the value of cultural heritage assets provided in **Table 14.2** have regard to the ICOMOS *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS 2011, 14-17). This guidance is intended as indicative and is used in combination with a consideration of the condition/preservation; documentary/historical significance, group value, rarity, visibility in the landscape, fragility/vulnerability and amenity value of the cultural heritage assets on a case-by-case basis. The values assigned to identified assets within the Study Areas were

determined following the completion of the desktop research combined with subsequent site inspections and are presented in **Section 14.4** of this chapter.

Significance of Effects

The significance of effect can be described as Profound, Very Significant, Significant, Moderate, Slight, Not Significant or Imperceptible (**Table 14.3**) and is assigned based on the combined evaluation of effect magnitude and asset significance (**Table 14.4**).

Table 14.1: Magnitude of Effect Assessment Indicators for Cultural Heritage Assets

Indicative factors for assessing the Magnitude of Effect on the Cultural Heritage Asset *(after ICOMOS Guidelines 2011)*	
High	Most or all key archaeological or architectural materials affected such that the resource is totally altered Comprehensive changes to setting Changes to most or all key historic landscape elements, parcels or components; extreme visual effects; fundamental changes to use or access; resulting in total change to historic landscape character Major changes to area that affect Intangible Cultural Heritage activities or associations or visual links and cultural appreciation
Medium	Changes to many key archaeological or historic building materials/elements such that the resource is clearly/significantly modified Considerable changes to setting that affect the character of the archaeological asset. Changes to the setting of a historic building, such that it is significantly modified Change to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, considerable changes to use or access, resulting in moderate changes to historic landscape character. Considerable changes to area that affect the Intangible Cultural Heritage activities or associations or visual links and cultural appreciation.
Low	Changes to key archaeological materials/historic building elements, such that the resource is slightly altered/slightly different Slight changes to setting of an archaeological monument Change to setting of a historic building, such that it is noticeably changed Change to few key historic landscape elements, parcels or components; slight visual changes to few key aspects of historic landscape; slight changes to use or access; resulting in limited change to historic landscape character Changes to area that affect the Intangible Cultural Heritage activities or associations or visual links and cultural appreciation
Negligible	Very minor changes to key archaeological materials or setting Slight changes to historic building elements or setting that hardly affect it Very minor changes to key historic landscape elements, parcels or components; virtually unchanged visual effects; very slight changes to use or access; resulting in very small change to historic landscape character Very minor changes to area that affect the Intangible Cultural Heritage activities or associations or visual links and cultural appreciation

Table 14.2: Value Indicators for Cultural Heritage Assets

Indicative factors for assessing Value of Cultural Heritage Assets *(after ICOMOS Guidelines 2011)*	
Very High	World Heritage Sites (including Tentative List properties) Sites, buildings or landscapes of acknowledged international importance Intangible associations with individuals or innovations of global significance

Indicative factors for assessing Value of Cultural Heritage Assets *(after ICOMOS Guidelines 2011)*	
High	Nationally designated sites, buildings and landscapes of significant quality, rarity, preservation and importance Undesignated assets of the quality and importance to be designated Assets that can contribute significantly to acknowledged national research objectives Archaeological Landscapes with significant group value Intangible associations with individuals or innovations of national significance
Medium	Designated or undesignated assets that can contribute significantly to regional research objectives, including buildings that can be shown to have exceptional qualities in their fabric or historical associations Conservation Areas and historic townscapes containing buildings that contribute significantly to its historic character Intangible associations with individuals or innovations of regional significance
Low	Assets compromised by poor preservation and/or poor survival of contextual associations Assets of limited value, but with potential to contribute to local research objectives Historic Townscape or built-up areas of limited historic integrity in their buildings and settings Intangible associations with individuals or innovations of local significance
Negligible	Assets with very little or no surviving archaeological interest Landscapes with little or no significant historical interest Buildings or urban areas of no architectural or historical note; buildings of an intrusive character
Unknown Potential	Assets whose importance has not been ascertained Buildings with some hidden (i.e., inaccessible) potential for historic significance

Table 14.3: Significance of Effects (per EPA EIAR Guidelines 2022)

Significance	Description
Imperceptible	An effect capable of measurement but without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Slight	An effect which causes noticeable changes in the character of the environment but without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics

Table 14.4: Significance of Effects (per EPA EIAR Guidelines 2022)

Magnitude of Effect	**High**	Not Significant/ Slight	Moderate/ Significant	Significant/ Very Significant	Very Significant/ Profound
	Medium	Not Significant	Slight	Moderate/ Significant	Significant/ Very significant
	Low	Not Significant/ Imperceptible	Slight/ Not Significant	Slight	Moderate
	Negligible	Imperceptible	Not Significant/ Imperceptible	Not Significant/ Slight	Slight
		Negligible	**Low**	**Medium**	**High**
		Value/Sensitivity of the Asset			

14.3 BASELINE DESCRIPTION

14.3.1 Introduction

The following sections present summary details of the main periods within the Irish archaeological record with references to known archaeological sites and designated architectural heritage structures, as listed in the Record of Protected Structures and the National Inventory of Architectural Heritage, located within the Study Area around the Site, Grid Connection route and Turbine Delivery Route work areas. Datasets have been interrogated and retrieved from current state and local authority sources and are considered accurate at the time of writing in November 2023. The available inventory entries, as published on the Historic Environment Viewer and by the National Inventory of Architectural Heritage, for recorded archaeological sites and designated architectural heritage structures within the Study Area are presented within the following sections.

14.3.2 The Site: Archaeological and Historical Background

Until the recent identification of Palaeolithic human butchery marks on a bear bone recovered from a cave site in County Clare, the earliest recorded evidence for human activity in Ireland dated to the Mesolithic period (7000–4000 BC) when groups of hunter-gatherers lived on the heavily wooded island. The archaeological record indicates that these mobile groups tended to favour coastal, lake and river shores locations which provided a transport resource and also provided elements of their varied diet. They did not construct any settlements or monuments that have left any above ground traces although their presence in an area can often be identified by scatters of worked flints in ploughed fields or sub-surface traces of their settlements revealed during earth-moving undertaken as part of development works. The Neolithic period (4000-2400 BC) began with the arrival of agriculture and its establishment as the principal form of economic subsistence, which resulted in more permanent settlement patterns. As a consequence of the more settled nature of agrarian life, new site-types, such as substantial rectangular timber houses, field systems and various types of megalithic tombs, begin to appear in the archaeological record. There are no known archaeological sites dating to the Mesolithic or Neolithic periods located within the 2km Study Area around the Site.

Metalworking arrived in Ireland with the advent of the Bronze Age period (c. 2400–500 BC). This new technology introduced a new artefactual assemblage into the Irish archaeological record and this period was also associated with the construction of new monument types such as standing stones, stone rows, stone circles and fulachta fiadh. The development of new burial practices meant that the construction of funerary monuments such as cairns,

barrows, boulder burials and tumuli or cists was a common practice during this period. The arrival of iron-working technology in Ireland saw the advent of the Iron Age (600 BC – 400 AD). Relatively little has been known about settlement patterns during this period until recent decades when the corpus of evidence has been greatly increased by the discovery of Iron Age sites during archaeological investigations undertaken as part of various development projects. Based on the information currently available, a *fulacht fia* (CL057-071----) in Moyadda is the only recorded site within the Study Area that is of probable late prehistoric date as excavations of these site types typically produce Bronze Age dates. The Study Area also contains two sites designated as earthworks. This designation is applied to sites with no diagnostic features that allow classification within a definite monument category and the potential exists that some earthworks may form the remains of prehistoric sites.

A review of the lands extending for 10km in all directions from the Site was carried out to ascertain if they contain any prehistoric archaeological monuments with potential ritual visual alignments across the wider landscape. The reviewed monument types included all classes of megalithic monuments, stone circles, stone rows and standing stone pairs. Only one monument with a potential alignment attribute was identified and this is a standing stone pair (CL048-060----) in Kilmihil townland, which is located c.9.7km to the northeast of the Site. A review of online aerial images of its location indicate that there is no likely intervisibility between the turbine locations and this monument due to the presence of farm buildings immediately to the southwest of its location.

The early medieval period began with the introduction of Christianity to Ireland and continued until the arrival of the Anglo-Normans in the late 12th century (c. 400–1169 AD). While this period saw the emergence of the first phases of urbanisation around the larger monasteries and the Hiberno-Norse ports, the dominant settlement pattern continued to be rural-based and founded on an agricultural economy centred on enclosed farmsteads known as ringforts and their stone-built equivalents known as cashels. The early medieval church sites were often morphologically similar to ringforts but are often differentiated by the presence of features such as church buildings, graves, stone crosses and shrines. There are eighteen ringforts, one of which has an associated underground structure known as a souterrain, located within the Study Area which also contains an early medieval site type known as a crannog. These comprise lake settlements built on lake islands that may in part or entirely built up by depositing timber, earth and stone onto the lakebed. The presence of these sites demonstrate the presence of widespread farming communities within the general area during this period. There are also six enclosures located within the

Study Area and while sites assigned this classification can theoretically date from any period from prehistory onwards, many may form the remains of unclassified ringforts, but this cannot be conclusively proved without recourse to archaeological excavation. The following description of one of enclosures (CL057-073----) is included in the National Monuments Service's Historic Environment Viewer:

On a slight N-facing slope in pasture. A circular area (diam. c. 45m) visible as a cropmark on Google Earth imagery (20 March 2020) and reported to the National Monuments Service by Jean-Charles Caillère. It is also faintly visible on Digital Globe (2011-2013).

The Study Area also contains a burial ground in Breaghva townland (CL057-039001-) known as Kilkeevan, which is now occupied by graves with headstones dating to recent centuries, but the location is associated with the former site of an early church site dedicated to St. Caomhan. No surface traces of this church site remain at the location.

The arrival of the Anglo-Normans in the late 12th century broadly marks the advent of the Irish high medieval period which continued to c.1400 and was followed by the late medieval period which extended to c.1550. These periods saw the continuing expansion of Irish urbanisation as many of the port cities developed into international trading centres and numerous villages and towns began to develop throughout the country, often within the environs of Anglo-Norman manorial centres which were defended by masonry castles. By the 15th century, the native Irish chieftains and lords began to construct tower-house castles within their own landholdings as centres of territorial control. There is one recorded late or high medieval monuments located within the Study Area, and this comprises the former site of a tower house in Ballykett (CL057-041----) which local information records that following its demolition the stones were removed to be used as building material[12].

The centuries following 1550 comprise the post-medieval period which continued into the middle of the 19th century and the period thereafter is often described as early modern. The early phase of the post-medieval period was a turbulent time in Ireland and saw a period of wars between the 1560s and 1603 with further conflict during the mid-17th century Cromwellian Wars which resulted in extensive dispossession of forfeited Gaelic lands. An agricultural boom in the late 18th and early 19th centuries saw a rise in prices for both Irish tillage and dairy produce which resulted in landlords investing in extensive land

[12] https://webservices.archaeology.ie/arcgis/rest/services/NM/NationalMonuments/MapServer/0/5872/attachments/12344

improvement works within their holdings to increase productivity. This included widespread land drainage works and enclosure of open lands into field systems that survive to the present-day. The post-medieval period saw the development of high and low status stone houses throughout the Irish countryside and rural settlement clusters at this time typically consisted of single-storey thatched cottages with associated farm buildings while two-storey farmhouses became more common during the 19th century. The settlement pattern throughout much of the rural landscape was greatly affected by the Famine period and its aftermath in the middle of the 19th century which saw the depopulation of many areas.

The Civil Survey and Down Survey were compiled in the mid-17th century in order to establish records on lands to be forfeited to members of the Cromwellian army as payment for service. The Site extends into three townlands, Ballykett, Gowerhass and Tullabrack East, which formed part of the extensive Clare landholdings of Sir Daniel O'Bryan in the 17th century (**Table 14.5**). The Down Survey maps typically only depict larger settlements as well as other significant built features within the landscape such as castles, churches, roads and bridges, none of which are shown within the general area containing the Site.

Table 14.5: Down Survey record of 17th century landowners of townlands within the Site

Townland	Down Survey Name	1641 Owner	1670 Owner	Survey Notes
Ballykett	Ballykitt	Sir Daniel O'Bryan (Catholic)	Sir Daniel O'Brien (Catholic)	Unprofitable land: 604 plantation acres Profitable land: 114 plantation acres Forfeited: 114 plantation acres
Tullabrack East	Tullobrack	Sir Daniel O'Bryan (Catholic)	Sir Daniel O'Brien (Catholic)	None
Gowerhass	Gowerhass	Sir Daniel O'Bryan (Catholic)	Sir Daniel O'Brien (Catholic)	Unprofitable land: 286 plantation acres Profitable land: 165 plantation acres Forfeited: 165 plantation acres

Samuel Lewis's *The Topographical Dictionary of Ireland* (1837)[13] presents high-level descriptions of Irish parishes during the early decades of the 19th century which often provide information on contemporary land use patterns, historical events and the presence of archaeological sites and features of architectural heritage interest such as large country houses. The Site is located within the civil parish of Kilrush and Lewis's description of this area does not contain references to any of the townlands within or adjacent to the Redline

[13] https://www.libraryireland.com/topog/

Boundary. A review of the Ordnance Survey Field Name Books[14] compiled during the same period revealed that they contain no references to any potential unrecorded archaeological sites within the townlands extending into the Site. Further details on the character of the Site and its environs during the 19th century are presented in the review of historical Ordnance Survey (OS) maps (**Section 14.4.10**).

The Study Area around the Site contains one recorded archaeological site of potential post-medieval date and this comprises a quarry site (CL057-060----) located in Moyadda More townland. The following description of the quarry is included in the National Monuments Service's Historic Environment Viewer:

Listed as 'Potential site – aerial photo' in the SMR (1992) and the RMP (1996). A potential archaeological feature was noted on an aerial photograph (OS 4/2674). This location is named 'Quarry (disused)' on the OS 25-inch map. On inspection in July 2002 a large, elongated quarry (L c. 50m; max. D 1.2m) was noted.

14.3.3 Record of Monuments and Places

As detailed in **Section 14.4.2**, there are thirty-three recorded archaeological monuments located within 2km of the Site, and none are located within 235m of any proposed Development areas (**Table 14.6**). The nearest example to a turbine location is an earthwork (CL057-058----), which is located c.500m to the southwest of T3. None of these monuments are designated as National Monuments in State Ownership or Guardianship or have been assigned Preservation Orders but they are protected through their inclusion in the Record of Monuments and Places.

[14] https://www.clarelibrary.ie/eolas/coclare/history/osl/index.htm

Table 14.6: Recorded Archaeological Monuments within 2km of the Site

Monument No.	Classification	Condition	Townland	ITM E	ITM N	Approx. distance from nearest development areas
CL057-058----	Earthwork	No evident above ground remains visible on aerial images and not indicated on historic OS maps. Likely levelled pre-1842	Ballykett	501704	657499	500m southwest of T3 285m southwest of borrow pit
CL057-069----	Enclosure	Location now a modern forestry plantation and not indicated on historic OS maps. Likely levelled pre-1842	Ballykett	502001	657388	585m south of T3 360m south of borrow pit
CL057-071----	Fulacht fia	No evident above ground remains visible on aerial images and not indicated on historic OS maps	Moyadda Beg	502022	657293	680m south of T3 450m south of borrow pit
CL057-026----	Ringfort	Shown on historic OS maps and extant above surface remains are visible on aerial images	Ballykett	500596	658417	920m west of T1 840m west of access track
CL057-045----	Ringfort	Shown on 1842 OS map but absent on 1898 map. No evident above ground remains visible on aerial images. Likely levelled during 19th century land improvement works	Moyadda Beg	502363	657113	960m southeast of T3 775m southeast of borrow pit
CL057-028----	Ringfort	Shown on historic OS maps. No extant above surface remains are visible on aerial images. Likely levelled during 20th century	Gower South	501971	659562	1,140m northwest of T1 780m northwest of site entrance
CL057-044----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Ballykett	501707	656802	1,160m south of T3 920m south of borrow pit
CL057-047----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Moyadda More	502601	656983	1,170m southeast of T3 1.030m southeast of borrow pit
CL057-031----	Ringfort	Shown on historic OS maps and extant above surface remains are visible on aerial images	Gowerhass	503096	658806	1,190m east of T4
CL057-073----	Enclosure	No evident above ground remains visible on aerial images and not indicated on historic OS maps. Likely levelled pre-1842	Moyadda More	502927	657251	1,225m southeast of T3 1,125m southeast of borrow pit
CL057-066----	Crannog	Not depicted on 1842 OS map but visible as a lake island on 1898 OS map. Location now in dryland area following partial draining of lake. No extant above ground remains are visible on aerial images.	Tullabrack East	501720	659720	1,230m north of T1 735m northeast of site entrance

Monument No.	Classification	Condition	Townland	ITM E	ITM N	Approx. distance from nearest development areas
CL057-027----	Earthwork	Shown on 1842 OS map but absent on 1898 map. No evident above ground remains visible on aerial images. Likely levelled during 19th century land improvement works	Tullabrack West	501125	659714	1,250m north of T1 840m north of site entrance
CL057-046----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images	Moyadda Beg, Moyadda More	502453	656848	1,250m southeast of T3 1,030m southeast of borrow pit
CL057-029----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Gowerhass	502715	659568	1,360m northeast of T4
CL057-030----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Gowerhass	502993	659449	1,450m northeast of T4
CL057-032----	Ringfort	Shown on historic OS maps and extant above surface remains are visible on aerial images	Gowerhass	503236	659156	1,460m northeast of T4
CL057-025----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Tullabrack	500311	659469	1,500m north of T1 1,250m northwest of site entrance
CL057-042----	Enclosure	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Ballykett	500910	656750	1,520m southwest of T3 1,310m southwest of borrow pit
CL057-039001-	Burial Ground	Shown on historical OS maps. Modern graveyard visible on aerial images	Breaghva	499972	657887	1,525m west of T2
CL057-039002-	Enclosure	Shown on historical OS maps. Modern graveyard visible on aerial images	Breaghva	499972	657887	1,525m west of T2
CL057-061----	Redundant record	Not an archaeological site	Parknamoney	501243	656558	1,540m southwest of T3 1,300m southwest of borrow pit
CL057-041----	Castle	No evident above ground remains visible on aerial images and not indicated on historic OS maps. Likely levelled pre-1842	Ballykett	500680	656765	1,550m southwest of T2 1,470m southwest of borrow pit
CL057-060----	Quarry	Shown on historical OS maps. Location is infilled on recent aerial images	Moyadda More	503339	657274	1,585m southeast of T3 1,490m southeast of borrow pit

Monument No.	Classification	Condition	Townland	ITM E	ITM N	Approx. distance from nearest development areas
CL057-003----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Tullabrack West	501489	660210	1,690m north of T1 1,140m north of site entrance
CL057-005----	Enclosure	Potential above ground remains visible on aerial images. Not indicated on historic OS maps.	Tullabrack East	501786	660210	1,730m north of T1 1,210m north of site entrance
CL057-048001-	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Thomastown	502716	656345	1,770m southeast of T3 1,580m southeast of borrow pit
CL057-048002-	Souterrain	Sub-surface site not indicated on historical OS maps and aerial images	Thomastown	502709	656355	1,770m southeast of T3 1,580m southeast of borrow pit
CL057-043----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Parknamoney	501249	656287	1,780m southwest of T3 1,5300m southwest of borrow pit
CL057-065----	Ringfort	Shown extant on 1842 OS map and partially levelled on 1898 map. No extant above ground remains are visible on aerial images. Likely levelled.	Gowerhass	503482	659301	1,790m northeast of T4
CL057-040----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Durha	499959	657096	1,820m southwest of T2
CL057-004----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Tullabrack East	501694	660355	1,860m north of T1 1,330m north of site entrance
CL057-006----	Ringfort	Shown on historic OS maps and extant above ground remains are visible on aerial images.	Gower North	502124	660296	1,870m northwest of T1 1,4500m northwest of site entrance
CL057-062----	Redundant record	Not an archaeological site	Parknamoney	500775	656302	1,990m southwest of T3 1,745m southwest of borrow pit

14.3.4 Topographical Files of the National Museum of Ireland

The National Museum of Ireland (NMI) Topographical File archive, which is stored in the museum premises at Kildare Street, Dublin was inspected as part of the assessment and contains no files for any of the townlands within the Study Area.

14.3.5 Aerial/Satellite and LiDAR Imagery

A review of online aerial and satellite images published by Ordnance Survey Ireland, Bing and Google, revealed the presence of a modern forestry plantation and a remnant area of open heath within the Site. A review of LiDAR imagery of the Site, which was commissioned by the Developer, was also carried out and this included an appraisal of the ground surface within forested areas (**Volume III; Figure 14.4**). No potential unrecorded cultural heritage assets were noted within the Site during a review of the aerial, satellite and LiDAR imagery. Further details on the review of these sources in relation to the locations of various elements of the Development within the Redline Boundary are presented in **Table 14.10**.

14.3.6 County Clare Development Plan

The Record of Protected Structures published in the *Clare County Development Plan 2023-2029*, lists two buildings within the Study Area and the closest of these is located 1.2km from the Site (**Table 14.7**). In addition, the Site is not located within, or in the environs of, an Architectural Conservation Area.

Table 14.7: Protected Structures within 2km of the Site

RPS ref.	Name	Townland	Development Plan Description	ITM E	ITM N	Distance from Site
593	Brew's House	Ballykett	Detached three-bay two-storey house with hipped roof, built c.1892. Medieval fish pond, garden walls and vaulted tunnel, near site of castle. Restored 2010.	500901	657785	1.22km to southwest
529	Gower Hall	Gower	17th-18th century double pile two-storey three-bay house with unusual casement windows and hood mouldings.	502631	660414	2km to northeast

14.3.7 National Monuments in State Care

The nearest National Monument to the Site is an Early Medieval Ecclesiastical Site on Scattery Island (National Monument in State Ownership no.10, CL067-024001-), which is located c.6.8km to the southwest. This monument is also subject to a Preservation Order made under the National Monuments Acts 1930 to 2014 (PO no. 1/1971).

14.3.8 National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage does not list any structures or historic gardens within 2km of the Site.

14.3.9 Previous Archaeological Work in the Wider Area: Excavations Database

A review of the Database of Irish Excavation Reports, which contains summary accounts of licensed archaeological investigations carried out in Ireland from 1969 to present, revealed that two licensed archaeological site investigations have taken place within the Study Area. There were no finds or features of archaeological significance uncovered at either location and the relevant database entries are as follows:

Licence number:15E0107

Townlands: Tullabrack and Moanmore South.

Author: Laurence Dunne.

Testing excavations were undertaken at Tullabrack and Moanmore South townlands c. 5km north of Kilrush, Co. Clare, with regard to a planning application to construct a proposed wind farm. A series of eighteen test trenches (T1-18) were excavated with negative results.

Licence number: 04E1051

Townland: Moanmore South

Author: Ed Danaher

Archaeological work was carried out in association with a proposed wind farm at Moanmore South, Kilrush, Co. Clare. Monitoring of the groundworks associated with the construction of seven wind turbines and the laying of cables connecting these turbines to the nearby ESB substation was carried out during the topsoil-stripping phase of this development. No archaeological features or deposits were recovered during these works.

14.3.10 Ordnance Survey Maps

The first edition 6-inch Ordnance Survey (OS) map (published 1842) shows the Site location as part of a large vacant area of bogland with areas of reclaimed farm fields within the surrounding landscape (**Volume III; Figure 14.2**). The 25-inch OS map (published 1898) shows the layout of the Site in a similar form to the earlier edition but depicts an access track and a drain extending into the area which may potentially be associated with turf-cutting activity (**Volume III; Figure 14.3**). No potential features of archaeological or architectural heritage potential are depicted with the Site on either of the reviewed historic OS maps.

14.3.11 Undesignated Cultural Heritage Assets

While encompassing the protected archaeological and architectural heritage resources, cultural heritage also includes various undesignated assets such as demesne landscapes and vernacular structures as well as intangible assets such as folklore, placenames and historical events and associations.

The Site extends into three townlands, Ballykett, Gowerhass and Tullabrack East, and the Irish origins of these placenames presented in **Table 14.8** have been sourced from the Placenames Database of Ireland[15] and a publication by James Frost relating to Clare placenames which has been published on the County Clare Library website[16].

Table 14.8: Translation of Townland Names within Site

Townland	Irish Origin	Translation	Archaeological Indicator?
Ballykett	Baile Ui Cheit	O' Kett's town/homestead	No
Tullabrack East	An Tulaigh Bhreac Thoir	Speckled or brown hill	No
Gowerhass	Gabair Theas	'South Gower, or goat'	No

A review of the National Folklore Collection UCD Digitisation Project[17] revealed that it contains an entry in relation to an annual fair held at an unrecorded location within Ballykett townland. The review of Ordnance Survey historic maps did not reveal any written annotations within the townland that indicates the potential location of the fair. It is also noted that the depiction of the Site and its environs on these historic maps show it as vacant bogland, which was not likely a suitable location for a public fair.

14.3.12 Grid Connection

There are no recorded archaeological sites or designated architectural heritage structures located within a 100m wide corridor centred on the Grid Connection route to Tullabrack 110kV substation. A review of historic OS maps revealed that the public road which the route follows to this location was present in 1842 and no undesignated features of cultural heritage interest, such as road bridges, are depicted within the road corridor. A schoolhouse shown on the 25-inch OS map (1898) in an area to the north of the Tullabrack crossroads is no longer present and a modern dwelling house occupies its former location.

[15] https://www.logainm.ie/en/7051
[16] https://www.clarelibrary.ie/eolas/coclare/history/frost/appendix7_clare_local_names.htm
[17] https://www.duchas.ie/en

14.3.13 Turbine Delivery Route Work Areas

The delivery of turbines along the local road from the N68 to the site entrance will need to be widened into the road verges and will also require works in the island at the junction with the N68. A review of a 100m wide corridor centred on the section of the local road extending from the site entrance to the N8 junction revealed the presence of three early medieval ringfort sites within fields adjacent to this road (**Table 14.9** and **Volume III; Figure 14.5**). The National Monument Service's Historic Environment Viewer does not contain any inventory entries for these three sites, which are each located within private third-party lands. A review of online aerial and satellite images of their locations revealed that the enclosing earthen banks of all three sites remain extant. The existing local road is present on the 1st edition 6-inch map which also depicts the three ringforts in adjoining fields. The detail on this map indicates that the construction of the road truncated the north end of one of the ringforts (CL057-030----).

Table 14.9: Archaeological sites within 100m of TDR work areas

Monument No	Classification	Townland	ITM E	ITM N	Distance from work area
CL057-030----	Ringfort (Extant)	GOWERHASS	502992	659443	Adjacent
CL057-033----	Ringfort (Extant)	GOWERHASS	503875	659553	10m to south
CL057-034----	Ringfort (Extant)	GOWERHASS	504216	659586	25m to south

14.3.14 Field Work

Field surveys of the Development locations were carried out in May 2022 and January 2023 and extracts from the photographic record are provided in **Appendix 14.1**. The land use within the Site has been significantly altered since the publication of the historic OS maps following the planting of extensive forestry in recent decades and the only remnant area of open bogland is located within the northeast area. The ground surface within the forestry plantation areas have been impacted by cultivation and drainage works as well as by the subsequent development of extensive root systems. No surface traces of any potential unrecorded archaeological sites were identified within the open area of cutaway bogland within the northeast area of the Site. **Table 14.10** presents descriptions of the locations of various elements of the Development and also collates summary information on historical mapping as well as details on aerial, satellite and LiDAR imagery (where applicable) for each of these locations.

Table 14.10: Field Survey Results

Development Element	Nearest designated cultural heritage asset	Historic OS Map Detail	Aerial, Satellite & LiDAR imagery	Field Survey Notes
Turbine 1	Ringfort located 920m to the west (CL057-026----)	Shown within vacant area of marginal land on the 1842 and 1898 OS maps	Extensive forestry cultivation works are visible at location on a 2000 OSI aerial image and trees occupy the location on later images. LiDAR imagery shows ground disturbance associated with planting works at the location	The ground surface within this area of the forestry plantation been impacted by cultivation and drainage works as well as by the subsequent development of extensive root systems. The access route to the location extends through a section of the forestry plantation from the site entrance on the public road located c.580m to the north
Turbine 2	Earthwork located 640m to the south (CL057-058----)	Shown within vacant area of marginal land on the 1842 and 1898 OS maps	Shown within a forestry plantation on all reviewed aerial images from 1995 onward. LiDAR imagery shows ground disturbance associated with planting works at the location	A modern forest road extends to the location from the north and south and will form part of the site access route. The ground surface within the forestry plantation at the turbine location has been disturbed by extensive tree roots, drains and cultivation woks
Turbine 3	Earthwork located 500m to the southwest (CL057-058----)	Shown within vacant area of marginal land on the 1842 and 1898 OS maps	Extensive forestry cultivation works are visible at location on a 2000 OSI aerial image and trees occupy the location on later images. LiDAR imagery shows ground disturbance associated with planting works at the location	The ground surface within this area of the forestry plantation been impacted by cultivation and drainage works as well as by the subsequent development of extensive root systems.
Turbine 4	Earthwork located 900m to the southwest (CL057-058----)	Shown within vacant area of marginal land on the 1842 and 1898 OS maps	Shown within an unplanted, vacant area outside the forestry plantation. Ground disturbance works are visible within general environs on all images and are likely result of turf-cutting activity	The location comprises a remnant area of the open, level, vacant land shown on the historic OS maps with localised overgrown cut areas resulting from small-scale turf-cutting activity.
Electrical Substation, Blade Area and Temporary	Earthwork located 730m to northeast (CL057-027----)	Shown within vacant area of marginal land on the 1842 and 1898 OS maps	Forestry cultivation works are visible at location on a 2018 OSI aerial image. LiDAR imagery shows ground	The ground surface within this area of the forestry plantation been impacted by cultivation and drainage works as well as by the subsequent development of extensive root systems.

Development Element	Nearest designated cultural heritage asset	Historic OS Map Detail	Aerial, Satellite & LiDAR imagery	Field Survey Notes
Construction Compound			disturbance associated with planting works	
Borrow Pit	Earthwork located 235m to the southwest (CL057-058----)	Shown within a vacant field on the 1842 and 1898 OS maps	Within a vacant green field area on all reviewed images and no traces of potential unrecorded archaeological sites were noted.	The location remains as a vacant pasture field to the south of the forestry plantation
Met Mast	Earthwork located 490m to the southwest (CL057-058----)	Shown within vacant area of marginal land on the 1842 and 1898 OS maps	Extensive forestry cultivation works are visible at location on a 2000 OSI aerial image and trees occupy the location on later images. LiDAR imagery shows ground disturbance associated with planting works at the location	The ground surface within this area of the forestry plantation been impacted by cultivation and drainage works as well as by the subsequent development of extensive root systems.
Grid Connection	None within a 100m wide corridor centred on the public road that the route follows	The section of road that the route follows is shown on the 1842 and 1898 OS maps	No potential unrecorded archaeological sites within 100m of the route were noted during a review of these images	No potential unrecorded cultural heritage sites were noted during an inspection of the road margins.
Turbine Delivery Route work areas	See **Table 14.9**	The local road between the site entrance and the N8 which requires widening into the existing verge is present on all of the OS maps	No potential unrecorded archaeological sites within 100m of the road widening areas were noted during a review of aerial/satellite images	The location of a ringfort site (CL057-030----) adjacent to the south side of the section of road requiring widening survives as an overgrown, partially denuded, enclosing earthen bank. The south side of the road is bound by a c.2m wide grass verge with a hedgerow forming the field boundary. No surface traces of the ringfort were noted within the 2m grass verge but the potential for the presence of sub-surface features exist. The locations of two other ringforts (CL057-033---- and CL057-034----) within a 100m corridor centres on the local road requiring widening are also in fields to the south of the road. While the locations of both are obscured by overgrowth no surface traces of these sites were noted along the roadside (Figure 14.5).

14.3.15 Summary

Wind Farm Site

There are no recorded archaeological monuments or designated architectural heritage structures located within the Site. There are 33 recorded archaeological sites, two of which are redundant records, located within 2km of the Site and a review of aerial imagery indicates that 14 of these no longer retain above ground remains (**Table 14.6** and **Volume III**; **Figure 14.1)**. The nearest archaeological site to the Site is a levelled earthwork (CL057-058----) located 235m to the southwest of the borrow pit and the nearest extant example is a ringfort (CL057-026----) located 920m to the west of Turbine 1. The majority of the recorded archaeological sites within the Study Area comprise ringforts or enclosures of likely medium to high value and the area does not contain any recorded monument types with visually sensitive alignment attributes, such as megalithic tombs or stone circles. In addition, none of the archaeological sites within the Study Area are National Monuments in State Care. There are two Protected Structures located within 2km of the Site and these comprise two houses (RPS 593 and 529) located at distances of 1.22km and 2km outside its Redline Boundary (**Table 14.7** and **Volume III; Figure 14.1**). The National Inventory of Architectural Heritage does not list any structures or historic gardens within the Site or within 2km of its Redline Boundary. No potential undesignated features of cultural heritage interest, such as demesne lands or vernacular structures, were identified within the Site during the desktop study and field surveys carried out as part of this assessment.

Grid Connection Route

There are no recorded archaeological sites or designated architectural heritage structures located within a 100m wide corridor centred on the Grid Connection route to Tullabrack 110kV substation.

Turbine Delivery Route work areas

The road widening works within the existing verge of the local road between the site entrance and the junction with the N68 road will extend within the close environs of the north end of a ringfort enclosure in an area where it was truncated by the construction of the road in the period before the publication of the 1st edition 6-inch OS map in 1842. No surface traces of this site were noted within the grass verge along the roadside but the potential for the survival of sub-surface features within the verge exists. There are another two ringforts (CL057-033---- and CL057-034----) located within a 100m wide corridor centred on the section of the local road requiring widening and these are both set back from the road margin.

14.4 ASSESSMENT OF POTENTIAL EFFECTS

14.4.1 Introduction

The following section presents assessments of potential effects on identified cultural heritage assets within the Study Area. The values assigned to the various assets were determined based on their classifications, the results of the desktop study and inspections of accessible sites and follow the criteria guidelines outlined in **Table 14.2**. The known cultural heritage assets located within inaccessible privates lands surrounding the Development comprise features of medium-high values and their current condition and indicative values, as well as potential sensitivities to indirect effects of a visual nature, have been assessed based on their classifications, designations, and reviews of historical maps and modern aerial/satellite images. It should be noted that all archaeological sites, including levelled examples, have the potential to possess subsurface features, artefacts, human burials and other archaeological remains that may be of High or Very High values. While this cannot be ascertained without recourse to archaeological excavation, such attributes are unlikely to be subject to any effects in the absence of direct effects.

14.4.2 Construction Phase – Direct Effects

Wind Farm Site

The construction phase will have no predicted direct effects on the known archaeological monuments within the wider landscape surrounding the Site as no examples are located within 285m any proposed Development areas. In addition, there are no designated architectural structures located within the Site and no undesignated features of cultural heritage interest were identified within its Redline Boundary during the desktop study and field surveys carried out as part of this assessment.

The location of Turbine 4 extends into an area of cutaway bog and the location of the borrow pit is within a vacant, green field area and the potential exists for the survival of unrecorded, subsurface archaeological features in these areas. The planting and subsequent development of the forestry plantations that occupy three of the proposed turbine locations (T1, T2 and T3) and their associated Turbine Hardstands and sections of access routes, as well as at the locations of the Met Mast, blade laydown area, Temporary Construction Compound and Electrical Substation in recent decades have resulted in extensive ground disturbance at these locations. A Heritage Council of Ireland study on the impacts of forestry on the archaeological resource concluded that the processes involved in the planting, maturing and rotation of planted lands have a high potential to completely remove or to severely degrade any archaeological sites and associated sub-surface deposits that may

exist within plantations[18]. While there is a low potential for the survival of unrecorded, archaeological sites within these forested locations this cannot be completely discounted.

It is concluded that the construction phase within the Site will result in no predicted direct effects on the known cultural heritage resource. While the existence, location, extent and significance of any unrecorded, sub-surface archaeological remains that may be present within the Site is unknown, the potential exists for direct, adverse and permanent construction phase effects of medium to high magnitude on any such remains situated within the footprint of proposed construction areas and this will require mitigation.

Grid Connection

There are no known cultural heritage assets located within a 100m corridor centred on the grid route to Tullabrack 110kV Substation which extends along areas previously disturbed by the construction of existing roads. The construction of this route will result in no predicted direct effects on the known cultural heritage resource. While the existence, location, extent and significance of any unrecorded, sub-surface archaeological remains that may survive below the existing road is considered low due to the ground disturbance created by its construction, the potential for direct, adverse and permanent construction phase effects of potential medium to high magnitude on any such remains cannot be discounted and this will require mitigation.

Turbine Delivery Route work areas

The delivery of turbines along the local road from the N68 to the site entrance will need to be widened into the existing road verges and will also require works in the island at the junction with the N68. A review of a 100m wide corridor centred on the section of the local road extending from the site entrance to the N68 junction revealed the presence of three early medieval ringfort within fields adjacent to this road (**Volume III**; **Figure 14.5**). The road widening works will extend within the close environs of the north end of a ringfort (CL057-030----) in an area where it was truncated by the construction of the road in the period before the publication of the 1st edition 6-inch OS map in 1842. No surface traces of this site were noted within the grass verge along the roadside but, while the area was likely disturbed by the road construction, the potential for the survival of sub-surface features within the road verge cannot be discounted. The topsoil stripping within the road verge required to widen the road will have the potential to expose and result in adverse effects on any such features

[18] Johnson. G. (1998) *Archaeology and Forestry in Ireland.* The Heritage Council of Ireland.

and this will require mitigation. The widening works within the grass verge will not result in any predicted effects on the extant above ground remains of the ringfort enclosure.

There are another two ringforts (CL057-033---- and CL057-034----) located within a 100m wide corridor centred on the section of the local road requiring widening. These enclosures are both set back from the road margin and no direct effects on their extant remains are predicted.

14.4.3 Construction Phase – Indirect Effects

Wind Farm Site

There are no recorded archaeological monuments located within 285m of any Development area locations and the construction phase will, therefore, have no predicted indirect effects on the settings of any recorded archaeological monuments. There are no Protected Structures located within 1.22km of any proposed construction locations and there are no structures listed in the National Inventory of Architectural Heritage within the surrounding 2km Study Area. The construction phase of the Development will, therefore, have no predicted indirect effects on the settings of any designated architectural heritage structures.

Grid Connection route

Given the absence of any recorded archaeological sites, designated architectural heritage structures or historic settlements within the public roads that will form the Grid Connection route, no indirect effects on the cultural heritage resource are predicted to arise during the construction phase.

Turbine Delivery Route work areas

The road widening works along the section of the local road between the site entrance and the junction of the N68 road will be confined within existing road verges and will not result in any predicted indirect effects on archaeological sites within adjoining third part lands.

14.4.4 Operational Phase – Direct Effects

Wind Farm

Given the absence of any known cultural heritage constraints within 285m of any proposed Development areas, the operational phase of the wind farm will result in no predicted direct effects on the known archaeological, architectural and cultural heritage resources. In addition, the successful implementation of the construction phase mitigation measures

outlined in **Section 14.5** will result in the preservation in situ (by avoidance) or the preservation in record (by archaeological excavation) of any unrecorded, sub-surface archaeological sites or features that may exist within proposed construction areas. There will, therefore, be no predicted direct effects on any such potential unrecorded archaeological sites during the operational phase.

Grid Connection

The Grid Connection will comprise a buried cable within existing roadways and will, therefore, result in no predicted direct effects on the cultural heritage resource during the operational phase.

Turbine Delivery Route

In the event that any turbines are required to be replaced using the same Turbine Delivery Route during the operational phase, no likely direct effects on the cultural resource are predicted.

14.4.5 Operational Phase – Indirect Effects

Wind Farm

As detailed in **Table 14.6**, the nearest extant archaeological monument with above ground remains (Ringfort CL057-026----) is located 920m from the nearest turbine (T1). While the turbines will likely be visible from the locations of a variety of archaeological monuments located in private properties in the surrounding landscape, given their distances from the Site and the absence of examples with visually sensitive attributes, such as ritual alignments, this will not result in a noticeable change on their settings and will have low magnitude effects on their settings and sensitivities. The Development will, therefore, result in slight, indirect, long term, adverse effects on the wider settings of known cultural heritage assets located within the surrounding landscape during the operational phase (**Table 14.11**). The recorded archaeological resource within an area extending for 10km from the Site was reviewed to determine if any ritual monuments, such as stone circles, stone rows or megaliths, within the wider landscape have visual alignments set towards the Site and none were identified. A review of the locations of National Monuments within the surrounding landscape revealed the presence of one example within 10km of the Site and this comprises the Early Medieval Ecclesiastical Site on Scattery Island (National Monument in State Ownership no.10, CL067-024001-), which is located c.6.8km to the southwest of the Site (**Volume III; Figure 14.6**). A review of the Landscape and Visual Amenity assessment (**Chapter 11**) was carried out and it was noted that the north facing

side of Scattery Island is within the bare ground Zone of Theoretical Visibility for the proposed Development (**Figure 11.7**). The landscape and visual specialists were consulted in relation to potential visual effects from the island and concluded that the turbines will be seen from the location at a small scale and with a low degree of contrast against the sky such that a low magnitude of visual effect is predicted. Given this conclusion, in combination with the distance of Scattery Island from the Development, no likely significant adverse effects on this National Monument are predicted during the operational phase.

Grid Connection

As the Grid Connection will comprise a buried cable within existing roads it will, therefore, result in no predicted indirect effects on the cultural heritage resource during the operational phase.

Turbine Delivery Route

In the event that any turbines are required to be replaced using the same Turbine Delivery Route during the operational phase, no likely indirect effects on the cultural resource are predicted.

Table 14.11: Summary of operational phase indirect effects on cultural heritage assets with 2km of Site

Designation	Classification	Approx. distance from development	Indicative value range	Quality of effect	Magnitude of effect	Duration of Effect	Significance of effect
CL057-003----	Ringfort (Extant)	1,690m north of T1 1,140m north of site entrance	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-004----	Ringfort (Extant)	1,860m north of T1 1,330m north of site entrance	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-005----	Enclosure (Extant)	1,730m north of T1 1,210m north of site entrance	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-006----	Ringfort (Extant)	1,870m northwest of T1 1,4500m northwest of site entrance	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-025----	Ringfort (Extant)	1,500m north of T1 1,250m northwest of site entrance	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-026----	Ringfort (Extant)	850m west of T1 840m west of access track	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-027----	Earthwork (Levelled)	1,250m north of T1 840m north of site entrance	Medium	Neutral	n/a	n/a	None predicted
CL057-028----	Ringfort (Levelled)	1,140m northwest of T1 780m northwest of site entrance	Medium	Neutral	n/a	n/a	None predicted
CL057-029----	Ringfort (Extant)	1,360m northeast of T4	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-030----	Ringfort (Extant)	1,450m northeast of T4	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-031----	Ringfort (Levelled)	1,190m east of T4	Medium	Neutral	n/a	n/a	None predicted
CL057-032----	Ringfort (Extant)	1,460m northeast of T4	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-039001-	Burial Ground (modern graveyard at location)	1,525m west of T2	Medium to High	Neutral	n/a	n/a	None predicted

Designation	Classification	Approx. distance from development	Indicative value range	Quality of effect	Magnitude of effect	Duration of effect	Significance of effect
CL057-039002-	Enclosure (modern graveyard at location)	1,525m west of T2	Medium	Neutral	n/a	n/a	None predicted
CL057-040----	Ringfort (Extant)	1,820m southwest of T2	Medium to High	Negative	Low	Long term (reversible)	Slight
CL057-041----	Castle (levelled)	1,550m southwest of T2 1,470m southwest of borrow pit	Medium to High	Neutral	n/a	n/a	None predicted
CL057-042----	Enclosure (Extant)	1,520m southwest of T3 1,310m southwest of borrow pit	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-043----	Ringfort (Extant)	1,780m southwest of T3 1,5300m southwest of borrow pit	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-044----	Ringfort (Extant)	1,160m south of T3 920m south of borrow pit	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-045----	Ringfort (Levelled)	960m southeast of T3 775m southeast of borrow pit	Medium	Neutral	n/a	n/a	None predicted
CL057-046----	Ringfort (Extant)	1,250m southeast of T3 1,030m southeast of borrow pit	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-047----	Ringfort (Extant)	1,170m southeast of T3 1.030m southeast of borrow pit	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-048001-	Ringfort (Extant)	1,770m southeast of T3 1,580m southeast of borrow pit	Medium to High	Adverse	Low	Long term (reversible)	Slight
CL057-048002-	Souterrain (subsurface)	1,770m southeast of T3 1,580m southeast of borrow pit	Medium to High	Neutral	n/a	n/a	None predicted
CL057-058----	Earthwork (levelled)	500m southwest of T3 235m southwest of borrow pit	Medium	Neutral	n/a	n/a	None predicted
CL057-060----	Quarry (infilled)	1,585m southeast of T3 1,490m southeast of borrow pit	Low	Neutral	n/a	n/a	None predicted
CL057-061----	Redundant record	1,540m southwest of T3 1,300m southwest of borrow pit	Negligible	Neutral	n/a	n/a	None predicted

Designation	Classification	Approx. distance from development	Indicative value range	Quality of effect	Magnitude of effect	Duration of effect	Significance of effect
CL057-062----	Redundant record	1,990m southwest of T3 1,745m southwest of borrow pit	Negligible	Neutral	n/a	n/a	None predicted
CL057-065----	Ringfort (levelled)	1,790m northeast of T4	Medium	Neutral	n/a	n/a	None predicted
CL057-066----	Crannog (levelled)	1,230m north of T1 735m northeast of site entrance	Medium to High	Neutral	n/a	n/a	None predicted
CL057-069----	Enclosure (levelled)	585m south of T3 360m south of borrow pit	Medium	Neutral	n/a	n/a	None predicted
CL057-071----	Fulacht fia (levelled or low remains)	680m south of T3 450m south of borrow pit	Medium to High	Neutral	n/a	n/a	None predicted
CL057-073----	Enclosure (levelled)	1,225m southeast of T3 1,125m southeast of borrow pit	Medium	Neutral	n/a	n/a	None predicted
RPS 593	Brew's House	680m west of T2	Medium to High	Adverse	Low	Long term (reversible)	Slight
RPS 529	Gower Hall	2,245m northeast of T1 1,870m northeast of site entrance	Medium to High	Adverse	Low	Long term (reversible)	Slight

14.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

14.5.1 Construction Phase

An inspection of forested areas within the Site will be carried out following felling works to confirm the absence of any cultural heritage assets within such areas. Ground works during the construction phase of the Development will then be subject to archaeological monitoring under licence by the National Monuments Service and this will include ground works within the Site, as well as the Grid Connection and Turbine Delivery Route, which will include monitoring of topsoil stripping along the road verge close to the north end of ringfort CL057-030----. In the event that any archaeological features are identified during monitoring they will be recorded and then securely cordoned off while the National Monuments Service are consulted to determine further appropriate mitigation measures, which may include preservation in situ (by avoidance) or preservation by record (archaeological excavation).

The Development will result in no predicted effects on any architectural or other cultural heritage assets and no mitigation measures for these elements of the resource are required.

14.5.2 Construction Phase Residual Effects – Direct

The mitigation measures presented in **Section 14.5.1** will provide for either the preservation in situ of any currently unknown, sub-surface archaeological features within the Site by avoidance or the proper and adequate recording of this resource by full archaeological excavation. Preservation in situ shall allow for a negligible magnitude of effect resulting in a potential not significant/imperceptible significance of effect in the context of residual effect on the unrecorded archaeological resource. Preservation by record shall allow for a high magnitude of effect, albeit ameliorated by the creation of a full and detailed archaeological record, the results of which shall be publicly disseminated. This shall result in a potential slight/moderate range of significance of effect in the context of residual effects on the unrecorded archaeological resource.

14.5.3 Construction Phase Residual Effects – Indirect

No residual construction phase indirect effects are predicted following the implementation of the mitigation measures described in **Section 14.5.2**.

14.5.4 Operational Phase

Following the implementation of the mitigation measures presented in **Section 14.5.1**, the operational phase of the Development will result in no predicted direct effects on the archaeological, architectural and cultural heritage resources and, therefore, no mitigation measures for direct operational phase effects will be required.

As detailed in **Section 14.4.5**, the operational phase of the Development will result in long term, slight, indirect, adverse effects of a visual nature on the wider setting of archaeological sites within the surrounding landscape. Given the nature of the wind farm turbines there are no mitigation measures that can ameliorate these visual effects, but it is noted that they will be reversed following the decommissioning phase.

14.5.5 Operation Phase Residual Effects - Direct

Following the implementation of the mitigation measures presented in **Section 14.5.1**, the operational phase of the Development will result in no predicted direct residual effects on the archaeological, architectural and cultural heritage resources.

14.5.6 Operation Phase Residual Effects - Indirect

The operational phase of the Development will result in long term, slight, indirect, adverse residual effects of a visual nature on the wider setting of archaeological sites within the surrounding landscape. Given the nature of the wind farm turbines, there are no mitigation measures that can ameliorate these indirect residual effects, but it is noted that they will be reversed following the Decommissioning phase. In addition, a review of the Landscape and Visual Amenity assessment (**Chapter 11**) was carried out and this revealed that no significant residual indirect visual effects on any cultural heritage receptors are predicted in that assessment.

14.5.7 Monitoring of Mitigation Measures

There are a number of obligatory processes to be undertaken as part of archaeological licence applications which will allow for monitoring of the successful implementation of the archaeological mitigation measures. These include the submission of method statements detailing the proposed strategy for all site investigations for the approval of the National Monuments Service as part of the licence application. A report will be compiled on all site investigations to comply with the licensing process which will clearly present the results in written, drawn and photographic formats and copies will be submitted to the National Monuments Service, the Planning Authority and the National Museum of Ireland.

14.6 CUMULATIVE EFFECTS

A review of operational, consented and proposed wind farm developments within 20km of the Site was carried out in order to assess potential cumulative effects on the cultural heritage resource (**Table 14.12**). This included a review of information contained in the online planning files published on the Clare, Limerick and Kerry County Councils' planning enquiry systems as well as the results of any archaeological site investigations at their

locations published in the Database of Irish Excavation Reports. A review of other developments within 10km of the Project (see **Chapter 2; Section 2.3.3**) was also undertaken and the results are presented below.

Table 14.12: Review of wind farm developments within 20km of the Turbines

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Cultural Heritage Review
Moanmore	Operational	7	c. 1.31km west	A review of the online County Clare planning enquiry system revealed that it does not contain a cultural heritage impact assessment for this development. The ABP grant of permission for this development (P00-0952) included a condition requiring archaeological monitoring of the construction phase. The Excavations Database does not contain any entries describing the discovery of archaeological features at this location
Tullabrack	Operational	6	c. 1.52km northwest	The Cultural Heritage chapter in the EIS prepared for this development was reviewed on the online County Clare planning enquiry system and does not predict any significant effects on the cultural heritage resource[19]. The Clare County Council grant of permission for this development (ref. 10/64) included a condition requiring archaeological monitoring of the construction phase. The Excavations Database does not contain any entries describing the discovery of archaeological features at this location
Beal Hill	Operational	6	c. 16.06km southwest	A review of the online County Kerry planning enquiry system revealed that it does not contain a cultural heritage assessment report for this development. A review of the Excavations Database revealed that archaeological monitoring of the construction phase which was carried out to comply with a planning condition uncovered nothing of archaeological significance[20]
Booltiagh	Operational	18	c. 17.42km northeast	The Cultural Heritage chapter in an EIS prepared for an element of this development was reviewed on the online County Clare planning enquiry system and does not predict any significant effects on the cultural heritage resource[21]. A review of the Excavations Database revealed that archaeological monitoring of construction works, which was carried out to comply with a planning condition, uncovered nothing of archaeological significance[22]
Cahermurphy	Operational	4	c. 13.07km northeast	A review of the online County Clare planning enquiry system revealed that it does not contain a cultural heritage impact assessment for this development. A review of the Excavations Database revealed that archaeological monitoring of construction works, which was carried out to

[19] http://193.178.30.219/iDocsWebDPSS/ViewFiles.aspx?docid=243208&format=jpeg
[20] https://excavations.ie/report/2000/Kerry/0005244/
[21] http://193.178.30.219/iDocsWebDPSS/ViewFiles.aspx?docid=171678&format=jpeg
[22] https://excavations.ie/report/2012/Clare/0023723/

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Cultural Heritage Review
				comply with a planning condition, uncovered nothing of archaeological significance[23]
Carrownaweelaun	Operational	2	c. 18.08km west	A review of the online County Clare planning enquiry system revealed that it does not contain a cultural heritage impact assessment for this development. A review of the Excavations Database revealed that archaeological monitoring of construction works, which was carried out to comply with a planning condition, uncovered nothing of archaeological significance[24]
Curraghgerrig	Operational	2	c. 15.11km southwest	A review of the online County Kerry planning enquiry system revealed that it contains a report on the archaeological monitoring of the construction of this development[25]. The report states that nothing of archaeological significance was identified at the location,
Glenmore	Operational	3	c. 15.18km northeast	A review of the online County Clare planning enquiry system revealed that it does not contain a cultural heritage impact assessment for this development. A review of the Excavations Database revealed that archaeological monitoring of construction works, which was carried out to comply with a planning condition, uncovered nothing of archaeological significance[26]
Kiltumper	Operational	2	c. 12.98km northeast	The Cultural Heritage chapter in an EIS prepared for an element of this development was reviewed on the online County Clare planning enquiry system and does not predict any significant effects on the cultural heritage resource[27] The Clare County Council grant of permission for this development (ref. 09/358) included a condition requiring archaeological monitoring of the construction phase. The Excavations Database does not contain any entries describing the discovery of archaeological features at this location
Lahra	Operational	2	c. 16.47km south	A review of the online County Kerry planning enquiry system revealed that it does not contain a cultural heritage assessment report for this development. The Excavations Database does not contain any entries describing the discovery of archaeological features at this location
Leanamore	Operational	9	c. 11.57km southeast	The Cultural Heritage chapter in an EIS prepared for this development was reviewed on the online County Kerry planning enquiry system and it does not predict any significant effects on the cultural heritage resource[28]. A review of the Excavations Database revealed that archaeological monitoring of construction works, which was carried out to comply with a planning condition, uncovered nothing of archaeological significance[29]

[23] https://excavations.ie/report/2019/Clare/0029148/
[24] https://excavations.ie/report/2014/Clare/0026547/
[25] http://193.178.30.14/iDocsWEB/ViewFiles.aspx?docid=376203&format=djvu
[26] https://excavations.ie/report/2019/Clare/0029151/
[27] http://193.178.30.219/iDocsWebDPSS/ViewFiles.aspx?docid=215090&format=jpeg
[28] http://193.178.30.14/iDocsWEB/ViewFiles.aspx?docid=371512&format=djvu
[29] https://excavations.ie/report/2017/Kerry/0025960/

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Cultural Heritage Review
Moneypoint	Operational	5	c. 5.47km south	A review of the online County Kerry planning enquiry system revealed that it does not contain a cultural heritage assessment report for this development. The Excavations Database does not contain any entries describing the discovery of archaeological features at this location
Shronowen	Proposed	12	c. 16.86km south	The ABP Inspector's Report for this proposed development includes a review of the Cultural Heritage EIAR chapter. The ABP report concludes that the development would not have any unacceptable cumulative impacts on the cultural heritage of the area[30]. The ABP grant of permission for this development (PA08.309156) included a condition requiring archaeological monitoring of the construction phase. The Excavations Database does not currently contain any entries describing the discovery of archaeological features at this location
Tullahennel South Tullahennel North	Operational Operational	9 2	c. 15.58km south c. 15.72km south	An Archaeological and Architectural Heritage impact assessment prepared for this development was reviewed on the online County Kerry planning enquiry system and it does not predict any significant effects on the cultural heritage resource, A review of the Excavations Database revealed that a combined archaeological monitoring project was carried within the boundaries of these two wind farm sites in order to comply with planning conditions and uncovered nothing of archaeological significance at their locations[31]
Moanmore South	Proposed	3	c. 3.27km west	A review of the emerging layout of this proposed development revealed no recorded cultural heritage assets located within its footprint

Given the absence of any predicted direct effects on the recorded cultural heritage resource arising from the Project, in combination with the results of the above review of wind farms, it is concluded that the Project is not predicted to contribute to any significant direct cumulative effects on the cultural heritage resource of the wider area.

It is noted that, while the Development will result in slight, indirect, adverse effects on the settings of cultural heritage sites within 2km of the Site (**Table 14.11**), none of these are site types which possess visually sensitive attributes such as ritual alignments across the wider landscape. In addition, none of the reviewed wind farm developments are located within 1km of the locations of any of the cultural heritage sites within the 2km study area. As described in **Section 14.4.5**, a review of archaeological monument types with visual alignment attributes within the 10km of the Site revealed that one example with a potential

[30] https://www.pleanala.ie/anbordpleanala/media/abp/cases/reports/309/r309156.pdf?r=224948407778
[31] https://excavations.ie/report/2017/Kerry/0027150/

alignment attribute was identified. This is a standing stone pair (CL048-060----) in Kilmihil townland, located c.9.7km to the northeast and the Development will not result in any predicted adverse effects on its setting or alignment. Given the distances and locations of the reviewed developments listed in **Table 14.12** from the Development and the absence of known cultural heritage sites with notable visual sensitivities, such as ritual alignments, within the Study Area, it is concluded that they will not act in combination to result in significant indirect cumulative effects on the settings of recorded cultural heritage sites.

The locations of other developments, including infrastructure, energy supply, sports and agricultural projects, within 10km of the Site were also reviewed (**Chapter 2; Section 2.3.3**). None of these developments are located with 2.5km of the Site and will have no likely direct or indirect effects on any cultural heritage constraints within the Study Area. The review did not identify any examples that will combine with the Development to result in any likely significant cumulative effects on the cultural heritage resource.

As described in **Section 14.4**, the Grid Connection route and the Turbine Delivery route work areas are not predicted to result in any likely direct or indirect effects on known cultural heritage sites.

14.7 DECOMMISIONING EFFECTS

No direct effects on known elements of the cultural heritage resource are predicted during the Decommissioning phase as there are no recorded cultural heritage sites located within the footprint, or within 285m, of the various elements of the Project that will be subject to Decommissioning. Any previously unrecorded archaeological remains identified during archaeological monitoring of the construction phase will either be preserved by avoidance or preserved by record (excavation) and no Decommissioning effects on such potential features are predicted. The Decommissioning phase will result in the reversal of the long term, slight, indirect, adverse visual effects archaeological monuments located within the wider landscape.

14.8 CONCLUSIONS

The Project will not result in any direct adverse effects to any known archaeological monuments, designated architectural heritage structures or undesignated cultural heritage assets. The potential exists for the presence of unrecorded, sub-surface archaeological features within proposed construction areas. In the event that any sub-surface archaeological remains are identified during archaeological monitoring of the construction phase, they will be cleaned, recorded and left to remain in situ within cordoned off areas

while the National Monuments Service are notified and consulted in relation to appropriate future mitigation strategies, which may entail preservation in situ by avoidance or preservation by record by archaeological excavations.

The Project will result in slight indirect, adverse effects on the settings of cultural heritage assets located in private properties within the surrounding landscape during the operational phase. These indirect effects will be long term in duration but will be reversed following the Decommissioning phase.

14.9 SUMMARY OF SIGNIFICANT EFFECTS

While the Project will result in slight indirect, adverse effects on the settings of cultural heritage assets within the surrounding landscape during the operational phase, no predicted significant (direct, indirect or cumulative) effects on the Cultural Heritage resource arising from the Project have been identified.

14.10 STATEMENT OF SIGNIFICANCE

An assessment has been made of the potential for significant effects of the Project on the cultural heritage resource. Following the application of effective mitigation measures based on best practice guidelines, which included specialist archaeological inputs during the Project design process combined with archaeological monitoring of the construction phase, the Project is not predicted to result in any likely significant effects on the cultural heritage resource.

15 MATERIAL ASSETS AND OTHER ISSUES

15.1 INTRODUCTION

This chapter assesses the impacts of the Project on material assets. The Project refers to all elements of the application for the construction of Ballykett Wind Farm (**Chapter 2: Project Description**). The assessment will consider the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.4.** This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **Appendix 15.1 Ai Bridges Telecommunications Impact Study**
- **Appendix 15.2 Veon Forestry Report**

15.2 STATEMENT OF AUTHORITY

This chapter has been prepared jointly by Ms. Sarah Moore, with the assistance of Mr. Darren Timlin of Jennings O'Donovan & Partners Limited. The Telecommunications Impact Survey (**Appendix 15.1**) was carried out by Mr. Kevin Hayes and Mr. Patrick Tinney in Ai Bridges Ltd. All contributors to this EIAR chapter have contributed their expertise to EIAR's for other renewable energy projects, including commercial sized wind farms.

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Mr. Darren Timlin is a Graduate Environmental Scientist with a Bachelor (Hons.) Degree in Environmental Science from the Atlantic University of Sligo. Darren's key capabilities are in report writing, assisting Senior Consultants and GIS.

Kevin Hayes is the Founding Director and Engineering Contracts Manager in Ai Bridges Ltd. Kevin has over 20 years' experience in Telecommunications Network Design and Project Management. Kevin has a B.Eng Hons in Electronic Engineering – Communications

& Industrial Automation and M.Eng Hons in Electronic Engineering- Communications & Communications Engineering. He also managed and designed the software prediction model for the TVI & Broadband EMI Interference Studies for Wind Farms.

David McGrath is a Radio Planning Engineer in Ai Bridges Ltd. David has a Bachelor of Science degree in Computing and has received a Bachelor of Engineering in Electronic Engineering. David has experience in analysing Radio Frequency issues, research and development in varying wireless network projects and supervision of Dublin Institute of Technology Master's degree students.

Patrick Tinney is a Communications Engineer in Ai Bridges Ltd. with a B.Eng. in Electronics, Occupational First Aid and 3 years' experience as a Health and Safety representative. He has received a B.Eng. in Computer and IT Systems. Patrick has experience in conducting site surveys and RF. He provides on-site support for the roll-out of fixed wireless access in Ireland.

15.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

Following preliminary consultations with key consultees during the scoping process, desk-based assessments, site visits and field surveys were undertaken. In line with the EIA Directive 2011/92/EU as amended by EIA Directive 2014/52/EU and current EPA Guidelines, this chapter of the EIAR aims to focus the assessment solely on those elements likely to have a significant effect on the environment. Economic assets of natural heritage include non-renewable resources such as minerals or soils, and renewable resources such as wind and water. These assets are addressed in **Chapter 8: Soils and Geology**, **Chapter 9: Hydrology and Hydrogeology**, and **Chapter 12: Air and Climate**. Peat and spoil are assessed in **Chapter 8: Soils and Geology**. Amenity resources and tourism are addressed in **Chapter 5: Population and Human Health**. The cultural assets of Archaeology and Cultural Heritage are addressed in **Chapter 14: Cultural Heritage** and traffic is addressed in **Chapter 16: Traffic and Transportation**. Utilities such as water, wastewater and waste services are addressed in this chapter and in **Chapter 2: Project Description**.

The material assets considered in this chapter include:

- Land Use - Agriculture
- Land Use - Forestry
- Telecommunications
- Air Navigation
- Quarries
- Utilities (gas, water, waste)

15.3.1 Evaluation of Potential Effects

Following on from the identification of the baseline environment, the available data was utilised to identify and categorise potential effects likely to affect identified material assets as a result of the Project.

The statutory criteria (EPA, 2002; EPA, 2003) for the assessment of effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transboundary nature (if applicable). The descriptors used in this Environmental Impact Assessment Report (EIAR) are those set out in EPA (2002) 'Glossary of Impacts'.

Effects may be categorised as follows:

- Direct: where the existing traffic and transport environment in proximity to the Development is altered, in whole or in part.
- Indirect: where the traffic and transport environment beyond the Development is altered by activities related to the construction or operation of the Development.
- No Effect: where the Development has neither negative nor positive effect upon the traffic and transport environment.

15.4 LAND USE - AGRICULTURE

15.4.1 Baseline Environment

The Site, located 3.5km north-east of Kilrush, Co. Clare, is characterised as being generally cutaway bog, conifer forestry plantation and agricultural land. There are also a number of residential properties and established wind farms in the region. The Site as a whole is characterised by elevations of between 32m and 34m AOD and a spatial area of 38 hectares. Most of the Site is located above the 34m AOD mark.

The agricultural land is predominantly utilised for livestock grazing. The commercial forestry is mainly made up of a Sitka Spruce conifer plantation plant and areas of cutover bog and is further detailed in **Section 15.5.**

15.4.2 Assessment of Potential Effects

The total land-take of the Project, including the Site Access Roads, Turbine Hardstands, Turbine Foundations, Grid Connection Route cabling, permanent Turbine Delivery Route works, Electrical sub-station and Borrow Pit is 4.7Ha. The area within the Red-Line Boundary is 31.1Ha therefore the total land take is 15% of the Red Line Boundary. The proposed Site

Access Roads and upgrade to existing roads will improve access for surrounding agricultural use.

The construction, operational and decommissioning phase of the Project will result in a change of 3.40Ha of land use in areas where new Site Access Roads, wind turbine bases, hardstanding areas, Met Mast, the Onsite Electrical Substation, blade set down area and associated drainage infrastructure will be located. The immediate surrounding agricultural grasslands will remain in agricultural use.

The construction of the Grid Connection Route and Turbine Delivery Route will only require relatively localised excavation and enabling works within the curtilage of the public road network, with no excavation or enabling works envisaged in private lands outside of the Redline Boundary. Full reinstatement will occur where such excavation or enabling works are undertaken.

There will be no wind turbines located on, or partly on agricultural lands. This will result in no change of use from agricultural pastureland to wind farm use. The extraction of stone material from the proposed borrow pit will exert the only direct agricultural land take. The affected area is equivalent to 1.2Ha. This will have a short - medium slight, negative impact on agricultural land use due to the removal of grazing lands for the duration of the Project during the construction phase of the project. However, it is proposed to infill the borrow pit with reserve spoil from the wind farm construction process at the end of the construction phase to enable the borrow pit area be reinstated to agricultural use.

The approach proposed for decommissioning is one of minimal intervention:

- Decommissioning works will be limited to action necessary to remove the wind farm structures, i.e., removal of turbines and monitoring mast, extraction of cables but leaving ducting in-situ.
- Roads and associated drainage systems will remain in place to serve ongoing agriculture activity in the area.
- Hardstanding areas will be allowed to revegetate naturally.
- Turbine plinths will be removed, and the hardcore covering Turbine Foundations will be allowed to revegetate naturally.
- Soil disturbance will be avoided as much as possible.

The current land -use within the wind farm area footprint is non-agricultural, and presently used primarily for forestry or presents as cutaway bog historically used for peat cutting. Therefore,

the effects of the decommissioning phase on agriculture will be less than those during the construction phase and not significant.

15.4.3 Mitigation Measures and Residual Effects

The construction and operational footprint of the Project has been kept to the minimum necessary to avoid impact on existing agricultural land use in the area. Temporary loss of agricultural productivity will result from the loss of approximately 1.2Ha of existing agricultural land in the formation of a borrow pit to serve the construction of the Development. However, at the conclusion of the construction phase the borrow pit is to be backfilled and returned to agricultural use.

Implementation of the measures outlined above will ensure that residual impacts will be slight negative to neutral for the duration of the construction and operational lifespan of the Project.

There are no worse residual impacts predicted, with respect to agricultural land use, arising from the operational phase.

All existing access points (i.e., to domestic premises, business, farms) are to remain accessible during temporary road closures and diversions in place as a result of enactment of traffic management plans associated with the construction of the Project. This is to maintain local access and avoid impacts on other various land uses. **Chapter 16: Traffic and Transportation** refers to all proposed works and deliveries along the Turbine Delivery Route to avoid undue impact to adjacent land uses. This is also considered for the Decommissioning phase for which traffic will be required along the Construction Haul Route.

During the operational phase of the Development the Turbine Delivery Route will no longer be needed except in such cases where a blade or other component may be required to be replaced. The turbine delivery and maintenance requirements process is further detailed in **Chapter 2: Project Description**. Thus, the residual impact on surrounding agricultural land uses along the turbine delivery route is negligible during construction, operation and Decommissioning.

15.4.4 Cumulative Effects

Due to the localised nature of the proposed construction/decommissioning works, there is no potential for significant cumulative effects in-combination with other local developments on the agricultural land use as all effects are directly within the Site.

Other projects outside the Site do not have the potential to reduce or increase the magnitude of effects of the Project on agricultural land use within the Site. Therefore, this will not contribute to any significant cumulative effects during the construction/decommissioning or operational phases.

Land management practices in the wider area which are considered to have potential for cumulative effects with the Project are primarily agriculture and forestry. All existing and approved projects in **Appendix 1.2** were considered. There are no applications for large-scale commercial or industrial activities near the Site. Minor domestic and agricultural development will not introduce potential for cumulative effects during the construction, operational or decommissioning phases as the impacts will be localised and not significant.

The nearest wind farm is located approximately 1.52km to the northwest of the Development (Tullabrack Wind Farm). Surrounding agricultural activities can and will continue during the construction, operational and Decommissioning phases of the Development when fencing around the Site has been fully established.

15.4.5 Statement of Significance

No significant effects are predicted on agricultural land use.

15.5 LAND USE - FORESTRY

15.5.1 Baseline Environment and Description of Project

Permission is being sought by the Developer for the construction of 4 No. wind turbines, a met mast, an Electrical Substation and all ancillary works, works along the Turbine Delivery Route and the construction of an underground Grid Connection to Tullabrack 110kV substation, Co. Clare. A full description of the Development can be found in Chapter 2: Project Description.

The Site contains 28.5ha of forestry which is classified as commercial forestry. The proposed wind farm infrastructure layout (i.e., tracks, Turbine Hardstands, etc.) affects forestry and 3 No. turbines are located within forestry. A summary of the forestry affected is provided in **Table 15.1** with Site access tracks and the Temporary Construction Compound also cutting through some of these plots.

Table 15.1: Summary of Removal of Forestry to facilitate The Development

Infrastructure	Area of forestry lost (Ha)	Species present
Turbines 1, 2, 3,	14.89	Sitka spruce
Temporary Construction Compound		
Blade set down area		
Site access tracks		
Bio Enhancement Area	2.69	Sitka spruce
Totals	**17.58**	

Detailed consideration of the approach to afforestation requirements associated with the Project is attached in **Appendix 15.2**. It should be noted that the clear-felling of trees in the State requires a felling licence. The associated afforestation of alternative lands equivalent in area (17.58 hectares) to those lands being permanently clear-felled is also subject to licensing ('afforestation licensing'). The Forest Service of the Department of Agriculture, Food & the Marine is Ireland's national forest authority and is responsible for all forest licensing. In light of the foregoing and for the purposes of this Project, the Developer commits that the location of any replanting (alternative afforestation) associated with the Project will be greater than 10km from the wind farm Site and also outside any potential hydrological pathways of connectivity i.e., outside the catchment within which the proposed project is located.

15.5.2 Assessment of Potential Effects

The removal of 17.58 hectares (61.7%) of 28.5 hectares of commercial forestry lands within the Site will have a permanent moderate, negative effect on the existing forestry land use during the construction, operation and Decommissioning of the Development, both due to the direct loss of this land-use and the potential opportunity loss in not harvesting wood at full maturation.

15.5.3 The 'Do-Nothing' Impact

If the Development does not proceed, lands in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This would have a neutral effect.

15.5.4 Mitigation Measures and Residual Effects

Existing forestry tracks have been incorporated into the design to minimise the construction of new Site access tracks and minimise the removal of forested areas. New Site access tracks have been sensitively designed to minimise impact on forestry. Electricity cables will be installed underground in or alongside Site access tracks to avoid and minimise negative

impact. The construction and Decommissioning works will be planned and managed under a Construction and Environmental Management Plan (CEMP) (**Appendix 2.1**). 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 surrounding lands. This will be communicated to members of the public through a community liaison officer employed for the duration of the construction period.

The impact on land take during construction is likely to have a permanent moderate, negative impact on the forestry, in that it alters the character of the environment, albeit in a manner consistent with existing and emerging wind farm trends in the surrounding area.

During the operational phase, the impact on forestry land take is likely to have a moderate negative permanent impact on the environment of the area (in that it alters the character of the environment); however, this change is consistent with existing and emerging trends.

15.5.5 Cumulative Effects

Due to the localised nature of the proposed construction works which will be kept within the Site Redline Boundary, there is no potential for significant cumulative effects in-combination with other local developments on commercial forestry as all effects are directly within the Site.

The surrounding commercial forested area adjacent to the Development will continue its ongoing commercial maintenance, felling and replanting schedule throughout the operational life of the Project.

As forestry activity is expected to continue on surrounding lands throughout the lifespan of this Project, no potential significant cumulative effects are considered likely.

15.5.6 Statement of Significance

No significant impacts are predicted on commercial forestry outside of the Site.

15.6 TELECOMMUNICATIONS

Microwave links need an unobstructed line of sight from end to end because blocked links will perform inadequately. It is therefore necessary to ensure tall wind turbines will not interrupt links. Impacts can include reflection, diffraction, blocking and radio frequency interference.

During operation, wind turbines have the potential to interfere with electromagnetic signals passing above the ground due to the nature and size of the wind farm.

Ireland saw the roll out of Digital Terrestrial Television, locally known as Saorview TV, in October 2010, incorporating the switchover from analogue to digital television. According to Ofcom (a regulatory UK body) (2009), *digital television signals are much better at coping with signal reflections, and digital television pictures do not suffer from ghosting*[1]. Ghosting is the replica of a transmitted image which is offset in position and is superimposed on top of the main image.

Since digital switchover, there have been very few reported cases of wind turbine interference with domestic analogue reception. Modern turbine blades are also typically made of synthetic materials which have a minimal impact on the transmission of electromagnetic radiation. Therefore, potential effects on television and radio signals from the Development will be negligible and are not considered further, given the advancements in technology.

15.6.1 Guidance

Potential telecommunication effects generated by the Development have been assessed with reference to the following documents.

- Clare County Development Plan 2023 – 2029.
- 'Best Practice Guidelines for the Irish Wind Energy Industry', published by the Irish Wind Energy Association (2012).
- Information about Electric & Magnetic Fields and the Electricity Transmission System in Ireland, EirGrid[2]
- Wind Energy Development Guidelines: Planning Guidelines, Department of Environment, Heritage and Local Government (DHPCLG) 2006[3]

15.6.2 Scoping and Consultation

Telecommunications providers were consulted about the Project. A summary of responses is outlined in **Table 15.2** and **Appendix 1.3** outlines full consultation responses.

[1] Ofcom (2009) *Tall Structures and Their Impact on Broadcast and Other Wireless Services*, OFCOM, United Kingdom. Available online at: https://www.ofcom.org.uk/__data/assets/pdf_file/0026/63494/tall_structures.pdf [Accessed 11/11/2023]
[2] Eirgrid (2014) *Information on Electric and Magnetic Fields*. Available online at : http://www.eirgridgroup.com/site-files/library/EirGrid/Information%20on%20Electric%20and%20Magnetic%20Fields.pdf [Accessed on 11/11/2023]
[3] Department of Housing, Planning, Community and Local Government (2006) Planning Guidelines. Available online at: https://www.gov.ie/en/publication/f449e-wind-energy-development-guidelines-2006/ [Accessed 11/11/2023]

Table 15.2: Summary of Consultations

Consultee	Response Date	Response
RTÉ Donnybrook Dublin 4 (*2RN is the trading name of RTÉ Transmission Network DAC*)	20/04/2022	*"Both of the sites in your email will have no impact on our fixed linking. Due to the risk of interference to broadcast services from Maghera we would ask that a protocol be signed between the developer and 2rn should the site go ahead".*
Virgin Media Television Westgate Business Park Ballymount Dublin 24	04/11/2022	*Virgin Media does not have any record of underground services at this location as indicated by your drawing.* *The actual position of underground services must be verified and established on site before any mechanical plant is used.* AI Bridges EMI Impact Assessment Report 2022 Consultation Response – Virgin Media have raised a concern regarding one Licensed PTP microwave radio link.
Vodafone Netshare Ireland Iveagh Buildings Carrickmines Dublin 18	14/04/2022	*"I see NO issue with either. There is decent distance from the proposed developments, so plenty of room for movement".*
Three Ireland, 28/29 Sir John Rogerson's Quay, Dublin 2, Ireland	14/04/2022	*"3Ireland have no Microwave transmission links that could potentially be affected".*
Tetra Ireland	19/04/2022	*"We anticipate no impact from the development as proposed."*
ENET	08/06/2022	AI Bridges EMI Impact Assessment Report 2022 Consultation Response – Enet have raised a concern regarding two licensed PTP microwave radio links.
Eir	19/04/2022	*"We have no transmission links within either if the proposed areas and at has no risk to the network"*

15.6.3 Assessment Methodology

Following scoping, AI Bridges were commissioned to undertake a telecommunications impact assessment of the operation phase of the Development, which is attached as **Appendix 15.1**.

There are four primary stages in preparing and compiling a communication impact study:

- Telecom Operator Consultations
- Field Surveys
- Desktop Survey Network Modelling and Analysis
- Report Generation.

AI Bridges assessed the impact of the Development on two telecommunication mast-sites through a field survey and desktop impact analysis using 3D network modelling,

15.6.4 Assessment of Potential Effects

All potential effects, which are associated with the operational phase of the Development, are classified as long-term effects.

15.6.4.1 The 'Do-nothing Impact'

If the Project does not proceed, there will be neutral impacts on telecommunications. This 'do-nothing' scenario would result in no interference in electromagnetic signals subject to the continuation of current activities and practices.

15.6.4.2 Construction Phase

During the construction phase, there are likely to be several sources of temporary electromagnetic emissions. Chief among these will be the brief use of electrical power tools and the use of electrical generators which may be brought onsite before mains electricity is provided. These devices are required by Irish and European law to comply with the EMC Directive 2014/30/EU. Compliance with this Directive will mean that the electromagnetic emissions from these devices will not cause interference to other equipment and therefore no significant effects are likely.

Other potential effects during the construction phase are likely to be as a result of tall cranes used for erecting the turbines. These cranes will be beside the proposed turbines on the Turbine Hardstands. There is potential for cranes operating at T2 to interfere with signals from the 2 links which pass through the area. However, any effect will be temporary in nature as it will only last while T2 is being erected (approximately 2-3 days). The effect can be classed as moderate negative, but short-term in nature.

A number of telegraph poles will likely need to be temporarily removed along the L6132 Local Road (Derreen Road) from the N68 to the Site to facilitate the transport of turbine components. This will have temporary, short-term effects on telecommunications in the locality which can be described as not significant.

15.6.4.3 Operational Phase

The telecoms impact assessment carried out by AI Bridges identified two radio link links that could potentially be impacted by the Development. AI Bridges identified two microwave radio links that could potentially be impacted by the Development. Potential impacts are

predicted on the Enet licenced Point to Point (PTP) microwave radio link from Knockanore to Slievecallan W.F and the Virgin Media licenced PTP microwave radio link from Knockanore to Slievecallen W.F. Following the feedback from the link operators, the location of T4 was moved southeast so that it is located outside of the fresnal zone of the links. Therefore, no impacts are predicted on the 2 links. Refer to Chapter 3: Alternatives. RTÉ did not anticipate any effects on their network but a Protocol agreement will be agreed with 2RN prior to construction. A detailed assessment of the effects of the Development on telecommunications can be found in **Appendix 15.1: Telecommunications Impact Study**.

No other potential links were identified, and it is considered that operational phase effects of the wind farm on existing radio links are avoided through mitigation by avoidance (see **Section 15.6.5**). No significant effects are likely.

15.6.4.4 Final Decommissioning Phase

When Decommissioning of the Development takes place, effects associated with this phase on telecommunications will be similar to those at the construction phase. No significant effects are likely.

15.6.5 Mitigation Measures

All electrical elements of the Development are designed to ensure compliance with Electro-Magnetic Fields (EMF) standards for human safety. The effects on human health are assessed in **Chapter 5: Population and Human Health**.

Mitigation measures were undertaken in the design phase through mitigation by avoidance i.e., the known routes of the telecommunication links were plotted, and a buffer was applied to them, outside of which the proposed turbines were located during the design process and located outside the identified fresnal zones. T2's location was moved south-east outside of the PTP radio link (Knockanore to Slievecall W.F) Fresnel zone. Any potential impacts as a result of the Development on any PTP radio link is considered negligible. Compliance with the EMC Directive 2014/30/EU (as amended) will mean that the electromagnetic emissions from devices used will not cause interference to other equipment.

15.6.6 Cumulative Effects

There are 17 No. proposed, permitted or operational wind farms within 20km of the Development (**Appendix 1.2**). The 20km radius area is considered an appropriate study area extent to rule out the potential for overlapping impacts on 3rd party material assets /

critical infrastructure. Each Developer is responsible for engaging with all relevant telecommunications operators to ensure their proposals will not interfere with television or radio signals by acting as a physical barrier. Therefore, as each project is designed and built to avoid impacts arising, a cumulative impact cannot arise.

Other proposed developments in the area other than wind farms were evaluated not to impose a cumulative effect in respect to interfering with telecommunications.

There will be no cumulative impacts relating to the Project and surrounding projects in relation to telecommunications.

15.6.7 Statement of Significance

The implementation of mitigation measures will ensure no interference with communication links. Therefore, no significant effects are predicted on telecommunications or radio reception as a result of the Project.

15.7 ELECTRICITY NETWORKS

15.7.1 Introduction

This section describes the transmission network and the anticipated connection option. It is not proposed to utilise any elements of the distribution network.

The nationwide electricity transmission system allows for the transport of large volumes of electricity from generation stations, including wind farms, to bulk supply points near the main population centres where it interconnects with the distribution system.

An existing overhead 110kV transmission line runs through the northern part of the Site. The existing overhead line currently connects the Tullabrack 110kV substation to the Booltiagh to Moneypoint 110kV transmission line. The distance between the overhead line and T1 (approx. 230m) and T4 (approx. 300m) is in excess of the required clearance as calculated in the EirGrid policy document "*Policy on Wind Turbine Clearance to OHL's Rev 1*".

The following grid connection route was assessed as part of the Development:

- The on-site substation will connect via 1 no. 38kV underground cable to the existing Tullabrack 110kV substation. At the existing Tullabrack 110kV substation, the cable will connect into existing infrastructure within the confines of the substation and its compound. An update of the existing transformer in Tullabrack substation is likely to be required.

This Grid Connection will be located entirely along public roads/verges. and constructed and installed according to the requirements and specifications of EirGrid and ESB Networks.

15.7.2 Assessment Methodology

Mullan Grid prepared a technical report to determine Grid Connection options for the proposed Development. BFA Consulting prepared a technical report on the three potential Grid Connection options for the Development. Civil and Structural Due Diligence Report which assesses utilities along the Grid Connection route and can be found in **Appendix 2.2**. The report assesses the impacts based on desktop study, consultation and site visit.

Mullan Grid undertook a grid study in November 2022. This found that the most likely connection method for the proposed Ballykett wind farm appears to be a 38kV connection to the Tullabrack 110kV substation via a 110/38kV transformer upgrade from 31.5MVA to 63MVA.

15.7.3 Assessment of Potential Effects

Due to the fact that all on-site internal cabling will be underground as will the Grid Connection from the onsite substation to the Tullabrack 110kV substation.

The Development will contribute directly and in the long term to the electricity network by strengthening it through additional renewable energy generation.

If connected to the Tullabrack 110kV substation the underground cable will connect into existing structures within the confines of the substation and its compound. An upgrade of the existing transformer of the Tullabrack substation is likely to be required and thus will have a slight, positive short-term effect in terms of upgrading of critical infrastructure.

15.7.4 The 'Do-nothing' Impact

If the Project does not proceed, there will be no offset to fossil fuel usage, and no provision of additional electricity in the local area.

15.7.5 Mitigation Measures

Mitigation by design and avoidance will minimise impacts on existing electricity networks.

- Confirmatory drawings for all existing services will be sought upon consultation with ESB Networks.

- Immediately prior to construction taking place, the area where excavation is planned will be surveyed by CAT scan (sub-surface survey technique to locate any below-ground utilities) and all existing services will be verified. Temporary warning signs will be erected.
- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to record the exact location of the ducts. The co-ordinates will be plotted on as-built record drawings for the Grid Connection cable operational phase.
- Clear and visible temporary safety signage will be erected all around the perimeter of the live work area to visibly warn members of the public of the hazards of ongoing construction works.

15.7.6 Cumulative Effects

All existing and approved projects in **Appendix 1.2** have been considered. There are 17 No. proposed, permitted or operational wind farms within 20km of the Development. There will be no cumulative impacts relating to the Development and surrounding projects in relation to existing electricity transmission networks during the construction phase.

Potential negative cumulative effects on electricity networks are unlikely during the operational and Decommissioning phases. This will be achieved through adopting mitigation by design and avoidance as set out in **Section 15.7.5**.

15.7.7 Statement of Significance

No significant negative impacts on the Grid Connection or grid network are anticipated. There will be a long-term slight positive residual impact on transmission infrastructure in the area (due to the installation of new infrastructure and provision of additional renewable electricity) and no impact on distribution. It is not proposed to utilise any elements of the distribution network.

15.8 AIR NAVIGATION

15.8.1 Introduction

Operating wind farms have the potential to cause a variety of adverse effects on aviation. Rotating wind turbine blades may have an impact on certain aviation operations, particularly those involving radar. The physical height of turbines can cause obstruction to aviation and the overall performance of communications, navigation and surveillance equipment. All structures over 150m in height are required to have lighting to warn aviation traffic. The Development's ground to blade tip height of the wind turbines stands at 150m during

operation. This will necessitate the installation of aviation warning lighting for Ballykett wind farm.

The closest international airport is Shannon Airport, approximately 35km to the east of the Development. The closest regional airport is Kerry Airport, 53km to the south of the Development. The closest aerodrome is the Abbeyfeale Airfield, 30km to the south/south-east of the Development.

15.8.2 Consultation

Consultation with the relevant aviation organisations was initiated during the scoping process, to identify any potential aviation issues that could be affected by the Development. The findings are summarised in **Table 15.3**.

Table 15.3: Summary of Consultation Response

Consultee	Response Date	Response
Irish Aviation Authority The Times Building 11-12 D'Olier Street Dublin 2	21/09/2022	1. *Agree an aeronautical obstacle warning light scheme for the wind farm development.* 2. *Provide as-constructed coordinates in WGS84 format together with ground and tip height elevations at each wind turbine location.* 3. *Notify the Authority of intention to commence crane operations with at least 30 days prior notification of their erection.*
Shannon Airport Authority DAC Shannon Airport Co. Clare V14EE06	No Response	None

15.8.3 Assessment of Potential Effects

AI Bridges Ltd carried out a review of the possible impacts of Development on aviation systems in the vicinity of the Development. Potential impacts were analysed on the nearest significant aviation installation at Shannon Airport. A review of Annex 14 Obstacle Limitation Surfaces (OLS) shows the proposed wind farm would be located outside the Outer Horizontal Surface of the Shannon OLS, as defined in the International Civil Aviation Organization (*ICAO) Annex 14. As the proposed wind farm is situated outside the Outer Horizontal Surface and there is no penetration of the take-off or approach surfaces, it is unlikely that there will be any impact to the OLS surfaces for Shannon Airport[4].

[4] International Civil Aviation Organization (2004), Aerodromes – Annex 14 of the Conventional on International Civil Aviation, Volume I Aerodrome Design and Operations. Available at: https://skylibrarys.files.wordpress.com/2016/07/annex-14-aerodromes.pdf [Accessed on: 11/11/23]

A review of "Terrain and obstacles requirements Area 1" as defined in ICAO Annex 15 (Aerodrome Surfaces), states that "wind turbines need to register if they are more than 100m above terrain". Should the turbines be permitted, the turbines would be within 45km of Shannon Airport's Airport Reference Point (ARP) and would be greater than 100m in height. On this basis the turbines would be required to be included in the Irish Aviation Authority (IAA) Electronic Air Navigation Obstacle Dataset.

The Minimum Sector Altitudes (MSA) is the lowest altitude which may be used that will provide a minimum obstacle clearance of 1000ft above all obstacles within a sector of 25 nautical miles (46km) from the VOR/DME at Shannon Airport. The maximum turbine tip-height at the proposed wind farm could be up-to 688ft above mean sea level (AMSL). There is over 1000ft from the maximum height of the wind farm to the MSA altitude and therefore there would appear to be no impact on the published MSA altitudes for Shannon Airport. On this basis, no significant effects on Shannon Airport are likely.

There are 9 Instrument Flight Procedures for flights to/from Shannon Airport. Due to the distance of the proposed wind farm from the airport and as there are existing obstacles closer to the airport than the Development there should be no impacts to these flight procedures. On this basis, no significant effects on Shannon Airport are likely.

As the proposed wind farm is approximately 34km from the Localiser and transmitting antenna at Shannon Airport, it is very unlikely that the proposed wind turbines will have any impact on these Air Traffic Service (ATS) communications and radio navigational aids.

EUROPCONTROL Guidelines require a 16km safe distance from the surveillance radar system (SSR), for a "Zone 4 – No Assessment" condition. The proposed turbines would be located at a minimum distance of 35km from the PDR/SSR radar stations at Shannon Airport. As turbines are located in Assessment Zone 4, a detailed impact assessment on Radar Surveillance Systems will not be required by the IAA.

It is unlikely that Flight Inspection Procedures carried out by the IAA will be impacted as the proposed wind farm is sufficiently far from the airport runways and the flight inspection procedures should already account for the existing obstacles (e.g. existing wind farms). On this basis, no significant effects on Shannon Airport are likely.

The Development is over 30km from the extended centreline of Runway 08/26 (Kerry Airport) and over 30km from the Kerry Aerodrome Reference Point. No potential effects are predicted. On this basis, no significant effects on Kerry Airport are likely.

Shannon Airport were consulted; however, no response was received at the time of writing. The airport is over 45km from the Development. The civil aviation guidelines for wind turbines covers a 30km radius[5]. Therefore, no potential effects to air navigation were identified.

15.8.4 The 'Do-Nothing Impact'

If the Development were not to proceed, there would be no impact on aviation operations in the area.

15.8.5 Mitigation Measures

Although no potential effects were identified, the following mitigation measures proposed by the Irish Aviation Authority (IAA) and Kerry Airport will be implemented:

- An aeronautical lighting scheme for the Development will be agreed with the IAA and will be installed.
- As-constructed coordinates in WGS84 format together with ground and tip height elevations at each wind turbine location will be provided to the IAA.
- The IAA will be notified of intention to commence crane operations with at least 30 days prior notification of their erection.

15.8.6 Cumulative Effects

All existing and approved projects in **Appendix 1.2** have been considered. There are 17 No. proposed, permitted or operational wind farms within 20km of the Development. Each Developer is responsible for engaging with the aviation authority to ensure the proposals will not interfere with aviation radio signals by acting as a physical barrier. Therefore, as each project is designed and built to avoid impacts arising, a cumulative impact cannot arise. Other developments have also been assessed in terms of their potential to impose a cumulative effect on aviation assets in conjunction with Ballykett wind farm. No likely significant effects have been identified. Therefore, it is considered there will be no cumulative impacts relating to the Development and surrounding projects in relation to aviation during the construction phase.

[5] Safeguarding of Aerodromes, Safety and Airspace Regulation Group, UK Civil Aviation Authority, 2020 https://publicapps.caa.co.uk/docs/33/CAP738%20Issue%203%20cor%20(1022).pdf . [Accessed online: 11/11/2023]

Potential negative cumulative effects on aviation are unlikely during the operational and Decommissioning phases.

15.8.7 Statement of Significance

No significant effects are likely in terms of air navigation. In adherence to IAA Safety Regulations and ICAO Annex 15, aeronautical obstacle warning light schemes will be installed as requested by IAA. Co-ordinates of ground and tip height elevations at each wind turbine location as constructed will be provided to the IAA. IAA will be notified of the provision of the intention to commence crane operations within a minimum of 30 days prior to erection.

15.9 QUARRIES

15.9.1 Introduction

The total rock requirements for the Project is approximately 43,870m^3. An estimated 11,590m^3 will need to be imported to construct the L6132 site entrance, temporary construction compound, access road from the L6132 site entrance leading to the onsite borrow pit, site access road and turbine hardstand surface layers and temporary and permanent works along the L6132. The remaining rock required for construction of the Development is 32,280m^3 and this will be sourced from the on-site borrow pit which will be approximately 12,000m^2 with a depth of approximately 2.69m.

The crushed stone (11,590m^3) for construction of the Project will come from licenced quarries in the locality such as:

- Ballykett Quarry, Ballykett
- Derrynalecka Quarry, Derrynalecka
- Glenmore Quarry, Glenmore
- Hehir Quarry, Bollyneaska
- Letterkelly Quarry, Letterkelly
- Liscormick Quarry, Liscormick
- Nagle Stone Quarry, Liscannor
- Luogh and Lisacannor Stone Company Ltd. Luogh Quarry, Doolin
- Ryans Quarry (Roadstone Ltd), Ennis
- Bunratty Quarry (Roadstone Ltd), Bunratty
- Bobby O'Connell and Sons Ltd Ballycar Quarry, Ardnacrusha
- Esker Readymix, Athenry

Concrete for the Turbine Foundations will also be sourced from one of the local providers listed above. The locations of these quarries in relation to the Project can be seen in **Figure 15.1**.

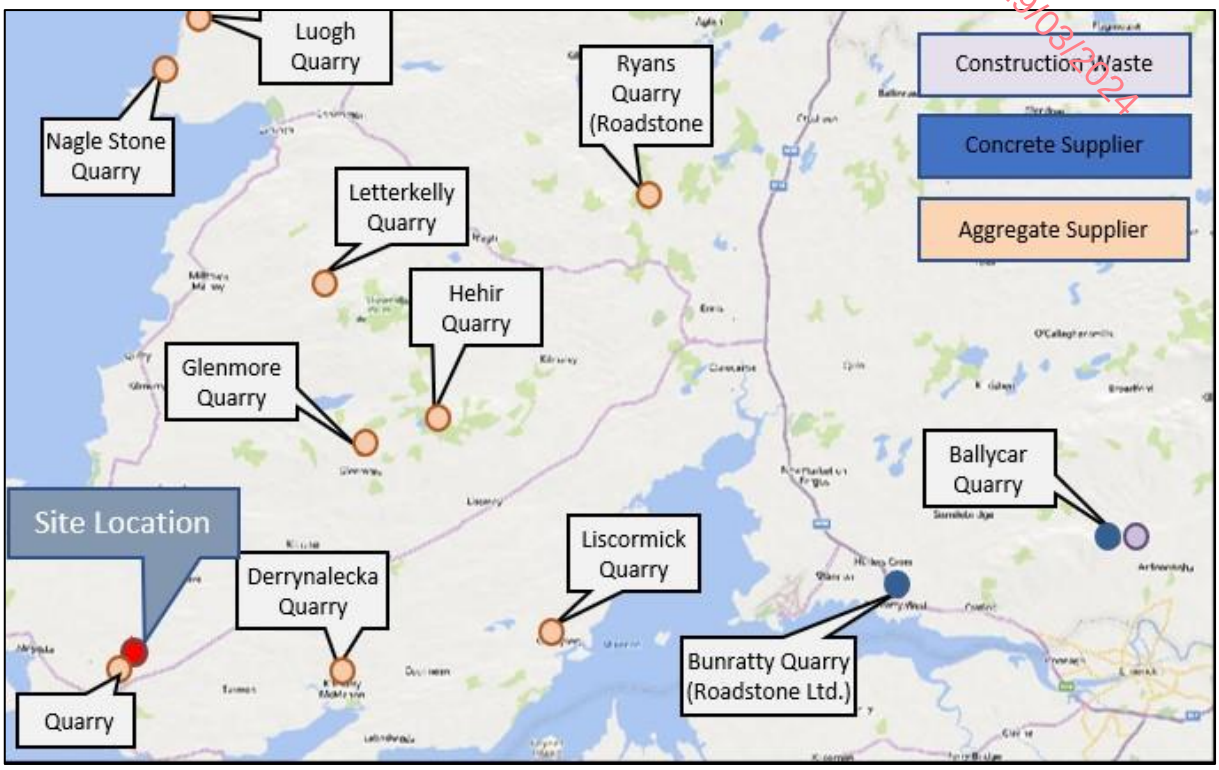


Figure 15.1: Concrete and Aggregate Suppliers

15.9.2 Assessment of Potential Effects

The construction of the Project will have a likely significant effect on natural resources such as aggregates which will be sourced from the quarries in proximity to the Site.

It is likely that a small amount of granular material may be required to maintain access tracks during operation which could affect the source quarry. However, the Decommissioning phase will have no effects on the source quarry.

The use of imported material will have a slight, permanent negative effect on non-renewable resources of the area as a result of denudation of existing natural resource reserves for other economic activities. This effect is considered to be imperceptible in the long-term.

15.9.3 The 'Do-Nothing Impact'

If the Project were not to proceed, there would be no likely significant effect on quarry operations in the area and quarrying activities would be subject to less extraction activity and longer period of use or close.

15.9.4 Mitigation Measures

- 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 such stone material.
- One on-site borrow pit will provide a total volume of 32,280m3. The quarry will only be used for material (11,590m3) to construct the L6132 site entrance, temporary construction compound, access road from the L6132 site entrance leading to the onsite borrow pit, site access road and turbine hardstand surface layers and temporary and permanent works along the L6132. Local quarries have been identified to reduce impact on transportation.
- The source quarry will be chosen based on stone which is chemically similar to that occurring at the Development. This will reduce hydrogeochemical impacts. (Please see **Chapter 8: Soils and Geology**)

15.9.5 Cumulative Effects

All existing and approved projects in **Appendix 1.2** have been considered.

The very nature of a quarry is that it will be subjected to cumulative effects as it is the source of stone for almost all developments in the area.

Therefore, there will be cumulative impacts relating to the Project and surrounding projects in relation to quarries during the construction phase. This will primarily be in the form of depletion of existing natural resource reserves in the locality.

Potential negative cumulative effects on quarries are none / imperceptible during the operational and Decommissioning phases.

15.9.6 Statement of Significance

No significant negative impacts on local quarries are anticipated. There will be a slight, permanent negative residual impact on natural resources in the area.

This impact is considered to be imperceptible in the long-term.

15.10 UTILITIES

15.10.1 Introduction

In order to assess the potential for significant effects on built services gas, water and waste in the vicinity of the Project, scoping requests were made to Irish Water and Clare County Council including Water Services and Environment departments. Refer to **Chapter 1: Introduction** of this EIAR for details in relation to the EIA scoping exercise.

15.10.2 Assessment Methodology

A desk study of available information from the EPA did not identify any waste facilities, illegal waste activities, chemical monitoring points or industrial EPA licensed facilities within a 2km radius of the Site. This confirms there will be no direct effects on waste activities, chemical monitoring points or industrial licensed facilities. The nearest waste facility to the Project is a site at Creegh to the north.

15.10.3 Assessment of Potential Effects - Gas, Water Utilities

There are no gas mains located within the Site Boundary. There is therefore no potential for significant effects to occur. Gas Networks Ireland have responded to a consultation request illustrating there are no existing services along the Grid Connection Route. Areas along the Construction Haul Route where gas infrastructure is present does not require any works and will remain undisturbed.

Given the detailed information has been provided by Irish Water relation to water services within the Redline Boundary, it has been assumed that there is no potential to encounter local water services within the Development.

BFA Consulting survey of the Grid Connection Route, reviewed the locations of existing services and separation distances were identified.

Potential impacts arising from the Project relating to existing water services have been assessed and are detailed in **Chapter 9: Hydrology and Hydrogeology.**

15.10.4 Assessment of Potential Effects - Waste

Staff Facilities

During the construction, operational and Decommissioning phases of the Project, there will be the typical waste generated in an office such as left-over food and sandwich wrappers. This is a non-hazardous waste. All such waste will be stored appropriately and safely from wind, rain and wild animals that often tear apart rubbish bags and disposed of via a licensed waste handler Due to the low volume of such waste anticipated to be generated through the construction phase of the Project the effects of this waste generation will be not significant as it will be of relatively small quantity and treated with residual residential waste at a licensed waste facility

Waste generated on site is estimated to range between 0.005 kg and 0.189kg per person per day.[6]

Sewage

The self-contained welfare cabins or "*port-a-loo*" units installed at the construction/ Decommissioning phase which will be managed and serviced regularly (by removal of the contents by tanker to a designated sewage treatment plant such as Kilrush/Kilmihil/Kilkee Wastewater Treatment Plant and removed off site on completion of construction. The effects will be temporary in nature and comprise a limited land-take on Site and production of relatively small amounts of sewage waste, which will be removed for treatment at a municipal sewage treatment plant in the locality. Toilet waste is a non-hazardous waste and effects will be a slight negative and short-term effect.

The maximum wastewater production during construction is estimated to be the same as the maximum water consumption (2,000 litres per day)[7].

All wastewater will be tankered off-site by a licensed waste collector to the nearest wastewater treatment plant, Kilrush/Kilmihil/Kilkee Wastewater Treatment Plant. There will be no on-site treatment of wastewater and effects will be not significant.

Concrete

The use of concrete (construction of Turbine Foundations, Substation foundations etc.) onsite will have slight and permanent effects. It is expected that a small volume of concrete washout will be produced during the construction phase.

There will be no need for the use of concrete during the operational phase and effects are imperceptible.

Concrete structures will be left in place during Decommissioning and will be covered in peat/topsoil and allowed to naturally revegetate over time. This is the least impactful process of Decommissioning. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or

[6] Based on 1 hour a day within communal facilities. Worldwide, waste generated per person per day averages 0.74 kilogram but ranges widely, from 0.11 to 4.54 kilograms. (World Bank) Available Online: https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html [Accessed 11/11/2023]

[7] Table 3 of the EPA WW treatment Manual (Treatment systems for Small Communities, Business, Leisure Centres and Hotels), Environmental Protection Agency, 1999. Quarry (Excluding Canteen) best reflects a construction site. [Available online: https://www.epa.ie/publications/compliance--enforcement/wastewater/EPA_water_treatment_manual_-small-comm_business.pdf]

vibration. As the Site will have already been altered, the impacts are imperceptible and permanent.

Chemicals, Fuels and Oils

Oil waste and diesel are classified as hazardous waste/dangerous substance. There is no expected chemical/fuel/oil waste other than from rags and residual amounts in containers. Without mitigation, the effects would be slight and medium-term in duration. This would be in the form of leaching of chemical or fossil fuel contaminants into the soil, groundwater and/or surface waters on Site. However, through the implementation of the mitigation measures set out in **Section 15.10.7,** the residual effects will be not significant in the construction/Decommissioning phase. The storage/use of such liquids is not seen necessary on site during the operational phase; thus, the effects are imperceptible.

Packaging

Packaging will be brought on site during the construction, operational and Decommissioning phases and can include cardboard, wood and plastics used to package turbine components. Packaging waste will be dealt with in accordance with the European Union (Packaging) Regulations 2014 to 2022.

'A producer who supplies to another producer packaging material, packaging or packaged products shall comply with any reasonable request from the latter producer for data on the weight of the material or packaging concerned sufficient to enable the latter producer to comply with these Regulations.'

The occurrence of 10kg of plastic per turbine blade, between 14 and 15 pallets and 17 to 18 cable drums are expected. This will be removed from site for re-use by an authorised person(s).

This waste is non-hazardous, and the effects of this waste are not significant. This is on account of the fact the packaging waste will be of a low quantity and will be removed from the Site and recycled and/ or disposed of at a licensed waste facility with a reduced impact on the environment than if it were not mitigated for.

Metals

During Decommissioning, it is expected that some steel will be removed from surface level concreted plinths supporting the turbine tower sections. Steel can be reclaimed for re-use in future steel making production where required. However, steel enclosed in the reinforced concrete Turbine Foundation bases will remain in-situ. This waste is non-hazardous, and

effects of leaching into the soil and water table are considered not significant due to the differential placing of steel set within the concrete foundation formations as well as the gradual nature of any natural breakdown products.

Excavated Materials

Excavated materials will be required for habitat and ecological restoration, reprofiling and backfilling in accordance with the Peat and Spoil Management Plan in **Appendix 2.1**. As such, excavated materials will not be classified as waste except along the Grid Connection Route.

An estimated 1,020m^{3}of material will be excavated along the Grid Connection Route to Tullabrack 110kV Substation and will be transported by an authorised waste permit holder to a local licensed waste disposal facility.

The effects of this are not likely to be significant however there will be a slight to moderate effect in terms of waste material volume generated and the need to send this material for suitable disposal at a waste reception facility licenced for disposal of hazardous bituminous materials.

15.10.5 The 'Do-Nothing Impact'

If the Project were not to proceed, there would be no impact on the utilities or waste in the area.

15.10.6 Mitigation Measures - Utilities

Mitigation measures relating to existing water services have been assessed and are detailed in **Chapter 9: Hydrology and Hydrogeology.**

15.10.7 Mitigation Measures - Waste

Staff Facilities

Provision for separation of waste streams will be provided so that e.g., paper, and cardboard waste and bottles may be recycled.

Sewage

It is proposed to install a rainwater harvesting system as the source of water for toilet facilities for the operational phase. Wastewater from the staff welfare facilities in the control building will be collected in a sealed storage tank, fitted with a high-level alarm. This is a device installed in a fuel storage tank that is capable of sounding an alarm, during a filling operation, when the liquid level nears the top of the tank.

Concrete

During the construction phase:

- Precast concrete will be used wherever possible i.e., formed offsite. Elements of the Project where precast concrete will be used have been identified and are indicated in the CEMP. Elements of the Project where the use of precast concrete will be used include structural elements of the watercourse crossing (Bridge) as well as cable joint bays associated with the Grid Connection. Elements of the Project where the use of precast concrete is not possible include Turbine Foundations and joint bay pit excavations. Where the use of precast concrete is not possible the following mitigation measures will apply.
- The acquisition, transport and use of any cement or concrete on site will be planned fully in advance and supervised at all times.
- Vehicles transporting such material will be relatively clean upon arrival on site, that is; vehicles will be washed/rinsed removing cementitious material leaving the source location of the material. There will be no excess cementitious material on vehicles which could be deposited on trackways or anywhere else on site. To this end, vehicles will undergo a visual inspection prior to being permitted to drive onto the proposed site or progress beyond the contractor's yard. Vehicles will also be in good working order.
- Any shuttering installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- Concrete will be poured during metrological dry periods/seasons. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. This will require limiting these works to dry meteorological conditions i.e. avoid foreseen sustained rainfall (any foreseen rainfall event longer than 4 hour duration) and/or any foreseen intense rainfall event (>3mm/hour, yellow on Met Éireann rain forecast maps), and do not proceed during any yellow (or worse) rainfall warning issued by Met Éireann. This also will avoid such conditions while concrete is curing, in so far as practical.
- Ground crew will have a spill kit readily available, and any spillages or deposits will be cleaned/removed as soon as possible and disposed of appropriately.
- Pouring of concrete into standing water within excavations will be avoided. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- Temporary storage of cement bound sand (if required) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g., using sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.

- No surplus concrete will be stored or deposited anywhere on site. Such material will be returned to the source location or disposed of off-site appropriately.

Upon implementation of the above mitigation measures, the effects of the construction of the Project are considered to be not significant.

Chemicals, Fuels and Oils

All storage containers of over 200 litres will have a secondary containment of 110% capacity to ensure that any leaking oil is contained and does not enter the aquatic environment.

A **Chemical and Waste Inventory will be kept**. This inventory will include:

- List of all substances stored on-site (volume and description)
- Procedures and location details for storage of all materials listed
- Waste disposal records, including copies of all Waste Transfer Notes detailing disposal routes and waste carriers used
- Any tap or valve permanently fixed to the mobile unit through which oil can be discharged to the open or when delivered through a flexible pipe which is fitted permanently to the mobile unit, will be fitted with a lock and locked shut when not in use
- Sight gauges will be fitted with a valve or tap, which will be shut when not in use Sight gauge tubes, if used will be well supported and fitted with a valve
- Mobile units must have secondary containment when in use/out on site

Under the EU Directive 2008/68/EC/55/EC all such dangerous substances will be conveyed in a container that compiles with the ADR. As such the manufacturer of each bowser will provide certification to contractors that the following:

- A leak-proof test certificate
- A copy of the IBC approval certificate
- An identification plate attached to the container

Where mobile bowsers are used on site, guidelines will be followed so that:

- Any flexible pipe, tap or valve will be fitted with a lock where it leaves the container and be locked shut when not in use;
- Flexible delivery pipes will be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use. Where possible, a nozzle designed to dispense oil is used;
- The pump or valve will have a lock and be locked shut when not in use.

Packaging

In accordance with the waste hierarchy, packaging will be returned to the originator ahead of re-use or recycling. Where this is not possible, waste will be separated as appropriate and safely stored on site appropriately in anticipation of recycling.

Metals

Waste metals from concrete reinforcing during construction and removal of metals during Decommissioning etc. will have commercial value and will be re-used or recycled with the appropriate licensed waste contractor.

15.10.8 Statement of Significance

There are no gas mains located within the Site Boundary. There is therefore no potential for impact.

It has been assumed that there is the potential to encounter local water services within the Development. Potential impacts arising from the Project relating to existing water services have been assessed and are detailed in **Chapter 9: Hydrology and Hydrogeology**.

There are no EPA-licensed or local authority-authorised waste facilities or activities located within the EIAR Site Boundary. The closest, authorised municipal waste facility is located approximately 7.37km north of the Development in the townland of Ballynagun West, Co. Clare.

The residual effects of waste produced as a result of the construction, operational and Decommissioning phases of the Project are considered to be not significant.

16 TRAFFIC AND TRANSPORT

16.1 INTRODUCTION

16.1.1 Background and Objectives

This chapter assesses the potential traffic and transport effects of the Project, describes the existing transport network, identifies whether there is any potential for significant effects to arise (both in isolation and in combination with other developments) and outlines any mitigation measures as required. The assessment will consider the potential effects during the following phases of the Project:

- Construction of the Project,
- Operation of the Project, and
- Decommissioning of the Project.

This Chapter follows the guidelines set out by Transport Infrastructure Ireland (TII) in their document TII PE – PAV- 02045 "Traffic and Transport Assessment Guidelines", May 2014 (The TII Guidelines)

The TII Guidelines aim to provide a framework to promote an integrated approach to development, which ensures that proposals promote more efficient use of investment to transportation infrastructure, reduce travel demand and promote road safety.

The guidelines are intended to provide guidance for developers and their agents, planning authorities and the National Roads Authority (NRA) (now TII) to assist in:

- Scoping and conducting studies for traffic and transport assessment in relation to future development and also development areas in proximity to national roads.
- Defining thresholds at which studies are recommended as part of a planning proposal to minimise the impact of future proposals on the national roads network.
- Contributing to the provision of sustainable forms of development and better-informed planning decisions.

Section 1.3 of the TII Guidelines require that a Traffic and Transport Assessment should comprise a comprehensive review of all the potential transport impacts of a proposed development or re-development, with an agreed plan to mitigate any adverse consequences.

It is essential that the developer or promoter should provide a full and detailed assessment of how the trips to and from the development might affect the transport network. The

assessment should be an impartial description of the impacts of the proposed development and should outline both its positive and negative aspects.

The content of a Traffic and Transport Assessment Report is specified on Section 3.3 of the TII Guidelines as follows:

- Non-Technical Summary
- Existing Conditions – Current traffic, critical links and junctions, committed transport proposals in the area, other surrounding proposed development.
- Proposed Development – Size and use.
- Person Trip Generation – identifying the total number of person trips by all modes by peak and variation over days of week.
- Traffic Forecasting – methodology used, reason for the determination of growth rates applied.
- Modal Split – allocating the person's trips to the modes of travel using an evidence-based approach.
- Trip Distribution – Catchment area, transfer trips, pass-by trips, combined trips.
- Trip Assessment – Turning movements at site entrance and at critical junctions in area.
- Assessment – Analytical assessment of the impact of the development proposals on the transport network should be presented.
- Road Impact – Analysis of junction capacity, including queue lengths and reserve capacity at base year, year of opening, year of opening plus 5 years and year of opening plus 15 years. Alternative designs for critical junctions should be detailed where necessary.
- Cumulative Impacts – Analysis of all committed developments in the area.
- Road Safety – Historical data, effect of development. Road Safety Impact Assessment (RSIA) and Road safety audit will be required for any proposed changes to the road layout in some circumstances.
- Environmental Impact – including measures to mitigate impact.
- Internal Layout – Circulation, pedestrian routes, visibility and road width, traffic management and speed control measures.
- Parking – Numbers, special needs percentage, layout, and service areas.
- Public Transport – Provision, access from site.
- Pedestrians/Cyclists – Accessing the site, routes through the site and cycle parking.
- Accessibility and Integration – Access to local area, community severance.
- Access for People with Disabilities – Any specific provisions.

- Mitigation – Range of solutions to reducing transport impact of the proposal.

These requirements have been taken into account in the preparation of this chapter as outlined below:

- Non-Technical Summary – A separate EIAR Volume comprises the Non-Technical Summary which includes a specific section on Traffic and Transport.
- Existing Conditions – These are discussed in Sections 16.2.5, 16.3.1, 16.3.2 and 16.3.6 of this chapter.
- Proposed Development – This is discussed in Section 16.3.1, 16.3.3 and 16.3.5 of this chapter.
- Person Trip Generation – This is included in Sections 16.5.1 and 16.5.4 of this chapter.
- Traffic Forecasting – This is presented in sections 16.3.7 and 16.5.1 of this chapter.
- Modal Split – This is included in Sections 16.5.1 and 16.5.4 of this chapter.
- Trip Distribution – This is included in sections 16.3.1 and 16.5.1 of this chapter.
- Trip Assignment – This is included within Sections 16.3.1 and 16.5.8 of this chapter.
- Assessment – This is included within Section 16.5.8 of this chapter.
- Road Impact – This is included in Section 16.3.1, 16.5.2, 16.5.3 and 16.5.8 of this chapter.
- Cumulative Impacts – These are assessed in Section 16.7 of this chapter.
- Road Safety – This is discussed in Section 16.3.8 of this chapter.
- Environmental Impact – This is considered in the other chapters of the EIAR.
- Internal Layout – This is discussed in Section 16.3.1 of this chapter.
- Parking – This is discussed in Section 16.3.1 of this chapter.
- Public Transport – Not relevant to the proposed development.
- Pedestrians/Cyclists – Not relevant to the proposed development.
- Accessibility and Integration – Discussed in Section 16.5.9 of this chapter.
- Access for People with Disabilities – Not relevant to the proposed development.
- Mitigation – Included in Section 16.6 and Table 16.7 of this Chapter.

The TII PE-PAV-02045 Guidelines referred to above do not cover the identification of sensitive receptors or the methodology of assessing the magnitude of effects on these receptors. Accordingly, reference is made to IEMA Institute of Environmental Assessment (1993). Guidelines for the Environment Assessment of Road Traffic which include guidance on how the sensitivity of receptors should be assessed. This is discussed in Section 16.2.8 of this chapter.

This chapter outlines potential effects of traffic associated with the proposed Development on the public road network and associated junctions during the life of the wind farm. During the construction phase of the Development, traffic will include HGV's delivering construction materials to and from Site, abnormal load vehicles transporting turbine components from Foynes Port to Site, HGV's removing unsuitable material from Site excavations and Grid Connection works, HGV's and plant involved with Grid Connection works on the public road and construction operatives visiting the Site in cars and light goods vehicles. During the operations phase of the wind farm, traffic will include cars and light goods vehicles involved with Site maintenance, servicing, and repair. Traffic during the Decommissioning of the wind farm will be similar to the construction phase and will consist of HGV's and abnormal load vehicles removing turbine components and electrical installations from Site and HGV's importing materials for landscaping.

Common acronyms used throughout this EIAR can be found in **Appendix 1.4** in **Volume III** of this **EIAR**. This chapter of the EIAR is supported by the following Appendix documents provided in **Volume IV** of this EIAR:

- **Appendix 16.1** Turbine Delivery Route Works
- **Appendix 16.2** Traffic Management Plan

16.1.2 Statement of Authority

This chapter of the EIAR has been prepared by John Doogan of Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo. Established in Sligo in 1950, Jennings O'Donovan & Partners Limited is a clean tech company providing consulting engineering services in the areas of renewable energy, civil and structural engineering, road design, water supply, wastewater collection and treatment, environmental resource management and impact assessment and in the area of housing and commercial development.

The chapter has been reviewed by Mr. David Kiely of Jennings O'Donovan & Partners Ltd. Mr. Kiely has over 40 years' experience in the civil engineering and environmental sector. He has obtained a Bachelor's Degree in Civil Engineering and a Masters in Environmental Protection, has overseen the construction of over 60 wind farms and has carried out numerous soils and geology assessments for EIAR's. He has been responsible in the overall preparation of in excess of 40 EIA Reports (EIAR's).

16.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

16.2.1 Assessment Methodology

This environmental assessment has involved the following elements, which are in line with best practice for wind farm developments:

- Legislation and guidance review
- Desk study, including review of available maps and published information
- Swept path analysis (SPA) of the Turbine Delivery Route
- Detailed Topographical and Lidar Survey
- Establishment of Baseline Scenario, including baseline traffic volumes and capacity of existing roads and junctions to cater for development traffic.
- Evaluation of potential effects
- Evaluation of the significance of these effects
- Identification of measures to avoid and mitigate potential effects.
- Evaluation of residual effects following implementation of mitigation measures
- Evaluation of cumulative effects of the proposed development in combination with consented and planned developments in the area.

16.2.2 Planning Policy and Guidelines / Guidance

This assessment has been prepared and carried out in accordance with guidance contained in the documents shown in **Table 16.1**.

Table 16.1: Policy and Guidance

Policy / Author	Title	Policy
Environmental Protection Agency (May 2022)	Guidelines on the information to be contained in an Environmental Impact Assessment Reports (EIAR)	Guidelines For the Preparation of EIA reports.
Government of Ireland	The Design Manual for Urban Roads and Streets (DMURS)[1]	This Manual offers a holistic approach to the design of urban streets in cities, towns, suburbs and villages in Ireland.
Department of Transport, Tourism and Sport and Department of Environment, Community and Local Government	The Design Manual for Urban Roads and Streets (DMURS)	This document outlines guidelines on the design of urban roads and streets in terms of street networks, street signage, pedestrians and cyclists, carriageways (widths, surfaces, junctions etc.), policies and plans, design process and audits (safety and quality).

1 http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C32669%2Cen.pdf

Policy / Author	Title	Policy
Institute of Environmental Management & Assessment (IEMA	Guidelines for the Environment Assessment of Road Traffic (1993)	The purpose of these Guidelines is to provide the basis for a systematic, consistent and comprehensive coverage for the appraisal of traffic impacts for a wide range of development projects. The Guidelines are intended to complement professional judgement and the experience of trained assessors
Transport Infrastructure Ireland (TII)	Traffic and Transport Assessment Guidelines (PE-PDV-02045, May 2014)	The guidelines provide guidance for developers, planning authorities and the National Roads Authority (NRA) for: • Scoping for traffic and transport assessment for future development and development areas, particularly areas in proximity to national roads, • Defining thresholds where studies are recommended to minimise the impact of future proposals on the national road network, • Contributing to the provision of sustainable forms of development and better-informed planning decisions.
Transport Infrastructure Ireland (TII)	Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated, and compact grade separated junctions) DN-GEO-03060, June 2017)	Design Standards for Junction Design, excl. major interchanges.
Transport Infrastructure Ireland (TII)	Rural Road Link Design (DN-GEO-03031 June 2017)	This Standard applies to Single and Dual Carriageway roads (including Motorways) in rural areas. It also applies to single carriageway Urban Relief Roads and Urban Dual Carriageways and Motorways. The Standard shall be used to derive the Design Speed, and the appropriate values of geometric parameters for use in the design of the road alignment. It sets out the basic principles to be used in co-ordinating the various elements of the road layout, which together form the three-dimensional design of the road.
Transport Infrastructure Ireland (TII)	Design Phase Procedure for Road Safety Improvement Schemes (DN-GEO-03030, April 2021)	This Standard sets out the procedures to be followed for the technical aspects of the Design Phase of the following scheme types: • Road Safety Improvement Schemes • Urban Road Schemes • Road Safety Improvements aspects

Policy / Author	Title	Policy
		• Local authority general improvement schemes which have not been identified as Road Safety Improvement Schemes, schemes led, funded or partly funded by other agencies, development led schemes and/or community schemes.
Transport Infrastructure Ireland (TII)	Project Appraisal Guidelines for National Roads Unit 5.3 – Travel Demand Projections (PE-PAG-02017, May 2019)	This document provides guidance on the development of transport models for use in the appraisal of transport infrastructure. The guidance addresses the scoping and construction of transport models which reflect transport demand and supply in a 'Base Year'. It provides guidance on the preparation of future travel demand projections for use in modelling and appraisal.
Transport Infrastructure Ireland (TII)	Expansion Factor for Short Period Traffic Counts (PE-PAG-02039, October 2016)	This document aims to support the conversion of short period traffic counts to annual average daily traffic (AADT).
Transport Infrastructure Ireland (TII)	Road Safety Audit (GE-STY-01024, December 2017)	This Standard outlines the requirements for Road Safety Audits in the management of the national road infrastructure. It sets out the procedures required to implement Road Safety Audits and defines the relevant schemes and stages in the design and construction at which audits shall be undertaken.
Department of the Environment and Local Government and Department of Transport	Traffic Management Guidelines 2012	This document outlines guidelines for traffic management and sustainability, consultation and monitoring, speed management, junctions, vulnerable road users, public transport and parking. The guidelines recommend that consultation is carried out for schemes that involve a long construction period or area. The guidelines outline the relevant legislation governing different types of road works. The guidelines outline safety measures to be taken in the design of roads and junctions. The guidelines outline the arrangements for temporary traffic management where

Policy / Author	Title	Policy
		construction and improvement of roads is taking place and who should be consulted in planning for roadworks and the factors to consider.
Department of Transport, Tourism and Sport	Guidelines for Managing Openings in Public Roads (Second Edition, April 2017)	The document prescribes standards in respect of the work of forming openings, backfilling and the reinstatement of road surfaces and the associated materials to be used on all roads other than National Roads. It also prescribes procedures and requirements in relation to the use of MapRoad Roadworks Licensing (MRL) and its use for all road openings in public roads other than those openings carried out by a road authority.
Transport Infrastructure Ireland (TII)	Spatial Planning and National Roads Guidelines	It is in the public interest, in so far as is reasonably practicable, that the national road network continues to serve its intended strategic purpose. The EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network, in order to demonstrate that the development can proceed complementary to safeguarding the capacity, safety and operational efficiency of that network.
Transport Infrastructure Ireland (TII) Specification For Works	SPW Series	Specification for Road Works and Materials
Department For Transport	Traffic Signs Manual	Signs and Road markings for Public Roads. Temporary Traffic Measures for Roadworks
Government of Ireland	Traffic Management Guidelines 2012	This document outlines guidelines for traffic management and sustainability, consultation and monitoring, speed management, junctions, vulnerable road users, public transport and parking. The guidelines recommend that consultation is carried out for schemes that involve a long construction period or area. The guidelines outline the relevant legislation governing different types of road works. The guidelines outline safety measures to be taken in the design of roads and junctions.

Policy / Author	Title	Policy
		The guidelines outline the arrangements for temporary traffic management where construction and improvement of roads is taking place and who should be consulted in planning for roadworks and the factors to consider.
Department For Transport	Guidance for Managing Openings in Public Roads	Guidance for the Opening, Backfilling and Reinstatement of openings in Public Roads.
Clare County Council	Clare County Development Plan (CDP) 2023 - 2029	The Clare County Development Plan 2017-2023 and the adopted Clare County Council Development Plan 2223-2029 set out an overall strategy for the proper planning and sustainable development of the functional area of Clare County Council. Volume 1, chapter 11 – Physical Infrastructure, Environment and Energy. Volume 6– Clare Wind Energy Strategy

16.2.3 Study Area

The Study Area for this Traffic and Transport assessment is focused on the public road network which will be used for the following construction operations:

- Transportation of building materials and electrical components.
- Transportation of granular materials for wind farm access road and Turbine Hardstand construction.
- Transportation of concrete and steel reinforcement for the construction of Turbine Foundations.
- Transportation of turbine components using abnormal load vehicles from Foynes Port, Co. Limerick to Site.
- Works at junctions and pinch points on the Turbine Delivery Route between Foynes Port to the Site entrance on the L6132 to facilitate the swept path of abnormal load vehicles delivering turbine components to Site.
- Works associated with the connection of the wind farm to the national electricity grid, which will be via a 38kV connection to the existing Tullabrack 110kV substation.

16.2.4 Desk Study

A desk study of the existing infrastructure in the vicinity of the proposed development was completed in order to select haul routes and Turbine Delivery Route associated with the construction of Ballykett Wind Farm. The desk study involved using Google Maps, Streetview, Bing Maps, OSI mapping and topographical survey information in conjunction

with autotrack analysis to assess the road network from the N68 national secondary road to the Site entrance on the L6132 local road for the transportation of turbine components and general construction traffic. Consultations with Clare County Council roads and planning departments, Department for Transport, TII and roads stakeholders were carried out by the Developer regarding the use of the public road network for turbine delivery and general construction traffic haul routes, Turbine Delivery Routes and Grid Connection routes to the proposed wind farm Development. Details of the consultations are included in **Table 16.5** of this report. Traffic count data from the TII traffic counter on the N68 at Ballyduneen, between Ennis and Kilrush was used to inform the location and duration of classified traffic counts carried out on the road network.

16.2.5 Field Work

An analysis of the Turbine Delivery Route between the N68 / L6132 junction and the wind farm Site entrance was carried out by JOD. The analysis outlines works which are required to facilitate the swept path of abnormal load vehicles transporting turbine components to the Site. The Turbine Delivery Route analysis is included in **Appendix 13.1.**

Classified traffic counts were carried out by Jennings O'Donovan on 11th January 2023 at two locations in the vicinity of the wind farm Site to determine baseline traffic volumes on the N68 and R482 for junction capacity analysis. The location of the traffic counts correspond to junctions where development traffic is likely to exceed 10% of the existing traffic movements in the area. The traffic counts were carried out at the following locations and are shown on **Figure 16.1.**

- N68 National Secondary Road / L6132 Local Road Junction (Junction 1)
- R482 Regional Road / L6132 Local Road Junction at Tullabrack Cross (Junction 2)

Figure 16.1: Traffic Count Locations

16.2.6 Evaluation of Potential Effects

Following on from the identification of the baseline environment, the available data was utilised to identify and categorise potential effects likely to affect the local road network used for the Turbine Delivery Route and Construction Haul Route as a result of the Development.

The statutory criteria (EPA, 2002; EPA, 2003) for the assessment of effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transboundary nature (if applicable). The descriptors used in this Environmental Impact Assessment Report (EIAR) are those set out in EPA (2002) 'Glossary of Impacts'.

Effects may be categorised as follows:

- Direct: where the existing traffic and transport environment in proximity to the Development is altered, in whole or in part.
- Indirect: where the traffic and transport environment beyond the Development is altered by activities related to the construction or operation of the Development.
- No Effect: where the Development has neither negative nor positive effect upon the traffic and transport environment.

16.2.7 Sensitivity

The sensitivity of the local transport infrastructure has been identified utilising the criteria outlined within the TII Guidance. These criteria are outlined within **Table 16.2** below.

Table 16.2: Receptor Sensitivity

Importance	Description
High	Receptors of greatest sensitivity to changes in traffic flow including: People whose livelihood depends upon unrestricted movement within their environment including commercial drivers and companies who employ them, local residents, schools and colleges.
Medium	Traffic flow sensitive receptors including: People who habitually pass through the area, but whose livelihoods are not dependent on free access. Would also generally include: congested junctions, community services, parks, businesses with roadside frontage and recreation facilities.
Low	Receptors with some sensitivity to changes in traffic flow: People who occasionally use the road network. Would also include: public open spaces, nature conservation areas, listed buildings, tourist attractions, residential roads with adequate footway provision and churches.
Negligible	Receptors with very low sensitivity to traffic flows: People not sensitive to transport effects. Would also refer to receptors that are sufficiently distant from the affected roads and junctions.

16.2.8 Magnitude

The magnitude of potential effects has been defined in accordance with the criteria provided in the 2022 EPA publication 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' as outlined within **Table 16.3**

The Institute for Environmental Management and Assessment (IEMA) Guidelines[2] contains two broad principles to determine the scale and extent of an assessment, which are:

- Principle 1 – include road links where traffic flows are predicted to increase by more than 30% (or where the number of heavy goods vehicles is predicted to increase by more than 30%).
- Principle 2 – include any other specifically sensitive areas where traffic flows are predicted to increase by 10% or more.

If the predicted increase is lower than these thresholds, then the effects can be considered to be low or not significant. If the increases are above the thresholds, then the increase can potentially be significant.

The assessment of potential effects of major developments are not provided for in the TII Guidelines. The IEMA Guidelines have been developed to assess the potential effects of major developments on the road network during their operation and not for short-term

[2] The Institute of Environmental Management and Assessment (1993), Guidelines for the Environmental Assessment of Road Traffic

construction or decommissioning. In the absence of such guidance the IEMA guidelines have been used to assess both the short-term construction and Decommissioning phases and the operational phase of the Development. On roads where existing traffic levels are generally low, any increase would be higher than the thresholds in the guidelines and in such cases, it is necessary to consider the overall increase in traffic flows and the capacity of the road before making a conclusion on effects.

Table 16.3: Magnitude of Change

Magnitude of Effect	Description
Significant	The Development could result in a change of length or duration to the current traffic routes or schedules which could result in hard-ship.
Moderate	The Development could result in delays or the need to resched-ule which may cause inconvenience.
Slight	The Development could occasionally cause minor modifications to routes, or slight delays in current schedules, or on activities in the short-term.
Imperceptible	The Development does not cause an effect on movement of road traffic above normal levels.

16.2.9 Significance of Effects

The magnitude of the effect on the road network will determine the significance of any effects associated with the increase. An increase in traffic flows on existing roads with a low level of service which are experiencing capacity issues will result in significant effects on the road network. An assessment has been made of the significance of effects taking into account the sensitivity of the receptor, effect magnitude, duration, and the likelihood of the effect. Professional judgement, knowledge of the area from previous projects and experience on similar projects have also been used to assess the significance of effects.

16.3 BASELINE DESCRIPTION

16.3.1 Site Location, Context and the Development

The proposed wind farm Site is located in south-west County Clare 3.5km north-east of the town of Kilrush and 3km south west of Cooraclare village. The wind farm Site is located within the townlands of Ballykett and Tullabrack East. It is located within an area comprised of agricultural livestock grazing farmland, cutaway bog and conifer forestry plantation.

The townlands through which the proposed Grid Connection will transect include the townlands of Tullabrack West, Tullabrack East and Tullabrack.

Vertical realignment works will be undertaken on a small section of the L6132. These works are located in the townland Gower South.

Temporary works may be required at intervals on the L6132 to accommodate the delivery of the turbine components and HGV vehicles. These temporary works are included as part of this application and are located in the townlands of Tullabrack East, Gower South, Gowerhass, Tullagower and Derreen.

The wind farm will consist of 4 No. 4-5MW wind turbines with an overall ground to blade tip height of 150m. The candidate wind turbine will have a rotor diameter of 136m and a hub height of 82m. Each turbine will be erected on an in-situ concrete foundation with steel reinforcement and will have a Turbine Hardstand constructed from granular material. The Turbine Hardstand will be used to store turbine components and to support a crane during the erection of the turbine. Each Turbine Hardstand will be linked to the Site entrance on the L6132 by a network of access roads constructed from granular materials with associated drainage and fencing. The turbines will be linked to the Onsite Electrical Substation by electrical cabling laid in buried ducts alongside the access roads.

The Electrical Substation will be linked to the national grid via a 38kV connection to the existing Tullabrack 110kV substation. A permanent Met Mast with a height of 82m for monitoring wind speeds will be constructed within the wind farm Site. Surplus material arising from excavations at the wind farm Site will be stored on Site at specified spoil deposition areas and also used to backfill the onsite borrow pit. The Location and layout of the wind farm Site is shown on **Figure 16.2**. The location of the wind farm Grid Connection is shown on **Figure 16.3.**

The internal layout of the wind farm and associated roads is such that there is one main spine road with no branches.

At the proposed site entry point from the L6132, the junction will be constructed with an overrun area to accommodate the swept path of abnormal load deliveries associated with the transportation of turbine components. On completion of abnormal load deliveries to the wind farm site, the overrun area will be landscaped to reduce the footprint of the L6132 site entrance junction. Visibility at the L6132 site entrance junction will be available at a distance of 160m in both directions measured from a 3.0m setback from the L6132 carriageway edge. Just south of the entrance, a temporary set down area will be provided. This will be used for the management of delivery vehicles during busy periods (e.g., while placing

concrete to turbine foundations) and for turbine blade storage during turbine erection. The site road will then continue southwards to give access to the temporary site compound and the site substation. It will then cross two watercourses by clear span culvert/bridges before reaching turbine T1. The road will then continue further southwards to turbine T2, eastwards to turbine T3 and access to the borrow pit. It will then proceed north-eastwards to turbine T4. Lorries delivering stone or concrete can turn at the nearest hardstand. A turning head will be provided at turbine T4 for turbine delivery vehicles. At turbines T1, T2 and T3, the turbine delivery vehicles can turn at the junction to each hardstand.

During the construction stage, parking space for up to 10 vehicles will be provided within the temporary site compound. The hardstands will provide parking for persons working at the turbine locations. Additional parking will be provided at the set down area.

During the operational phase, parking for six vehicles will be provided adjacent to the substation using part of the site compound. The balance of the site compound will be reinstated.

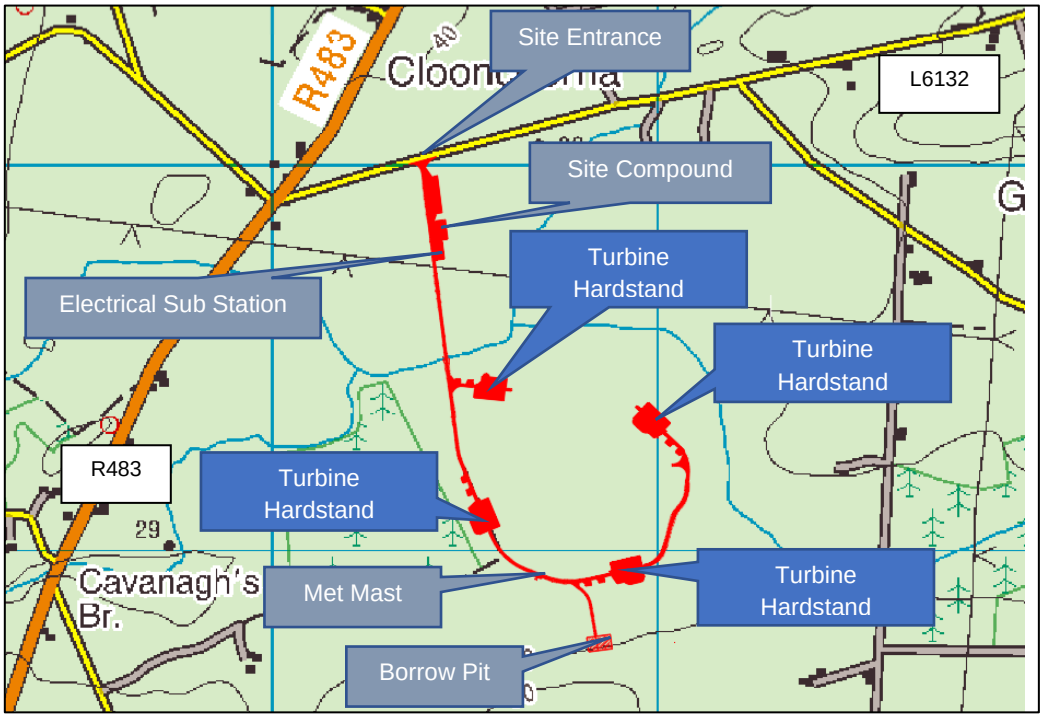


Figure 16.2: Wind Farm Site Location

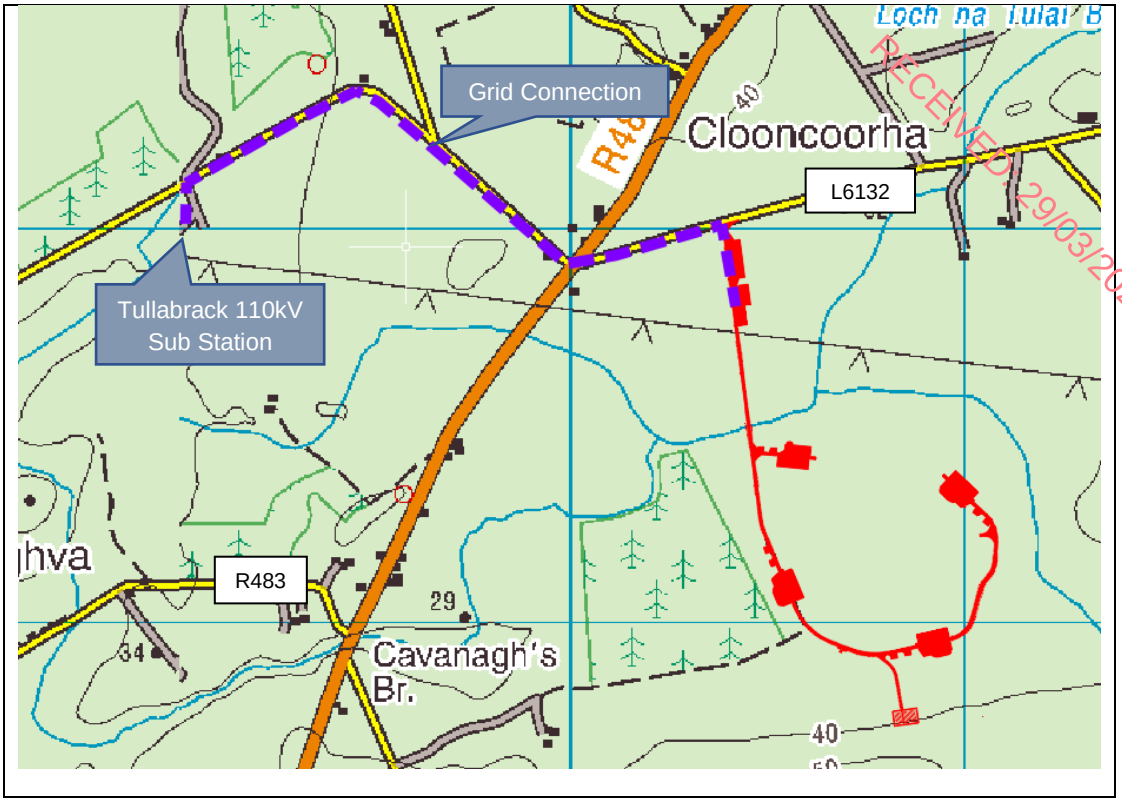


Figure 16.3: Location of Wind Farm Grid Connection

It is proposed that the turbine components including rotor blades, towers, nacelles, hubs and drivetrains will be landed by ship and stored for transportation at Foynes Port, Co. Limerick. From Foynes Port, they will be transported to the Site using specialised abnormal load vehicles. Turbine delivery vehicles will travel eastbound on the N69 towards Limerick City and join the N18, delivery vehicles which satisfy the 4.65m height restriction in Limerick tunnel will continue on the N18 northbound through the tunnel. Delivery vehicles with high loads will join the R510 at junction 2 on the N18, cross the River Shannon on the R527, join the R445 at Coonagh roundabout and re-join the N18 at junction 4. On the N18 / M18 delivery vehicles will travel northbound towards Ennis and join the N85 at Junction 9. Vehicles will travel westbound on the N85 to the N68 junction where they will join the N68 and continue southbound towards Kilrush to the L6132 junction. Delivery vehicles will travel westbound on the L6132 to the wind farm site entrance. The proposed Turbine Delivery Route traffic from Foynes Port is shown on **Figure 16.4**, The Turbine Delivery Route in the vicinity of the Site is shown on **Figure 16.5**.

Detailed analysis of the proposed Turbine Delivery Route between the N68 / L6132 and the Site entrance have been carried out by Jennings O'Donovan and are included in **Appendix 16.1**.

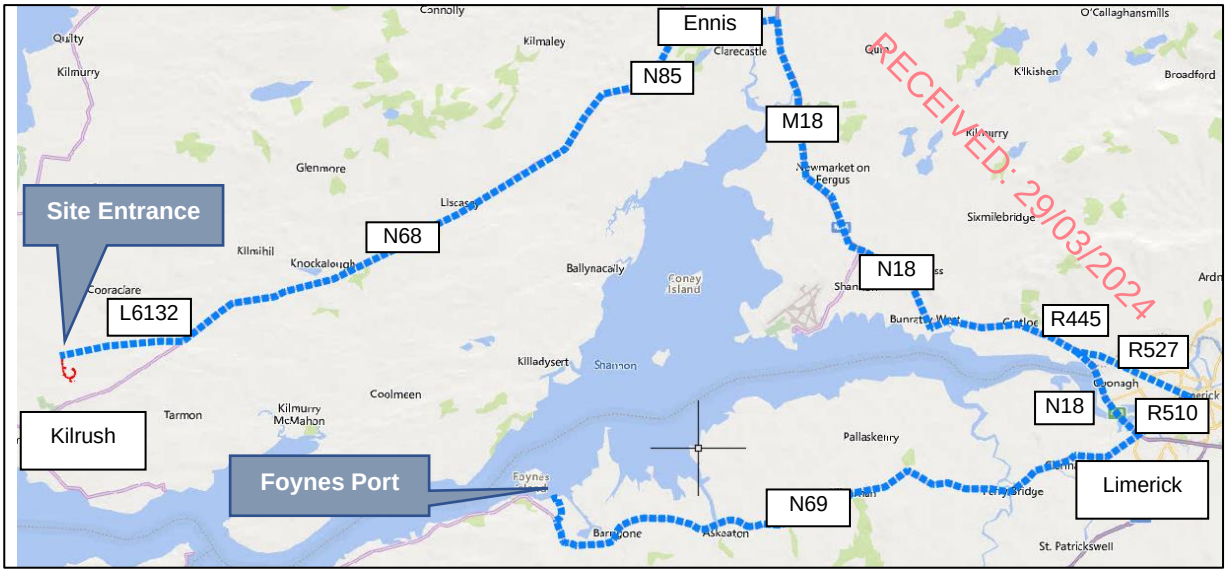


Figure 16.4: Turbine Delivery Route

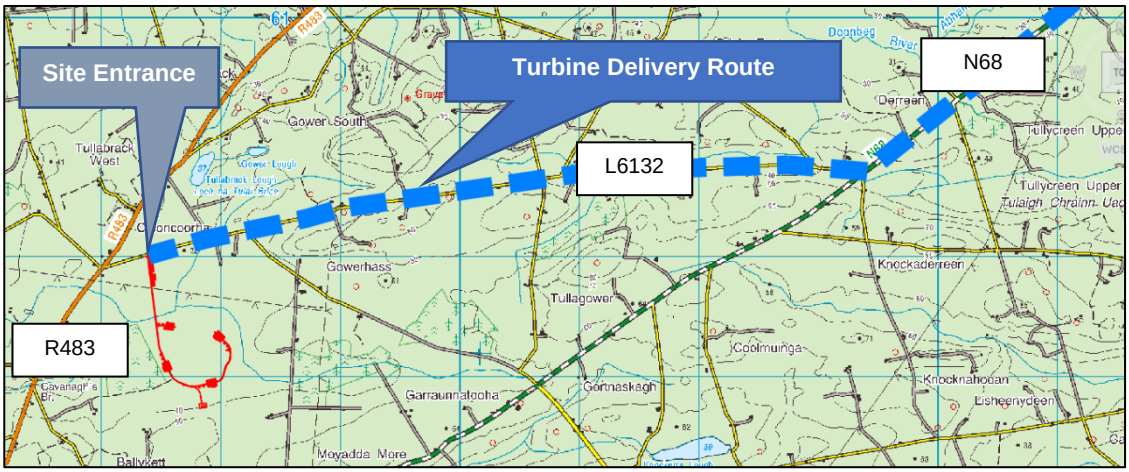


Figure 16.5: Turbine Delivery Route from N68 to Site

The Turbine Delivery Route for turbine delivery and general wind farm construction traffic will use the national and regional road network to access the Site via the L6132. The verges of the L6132 will be strengthened to withstand wheel loading from abnormal load vehicles. The use of local roads for construction traffic will be prohibited unless the local road is part of an agreed Haul Route or provides access to a licenced suppliers facility such as an existing quarry or concrete batching plant. Haul roads for general construction traffic are shown in **Figure 16.6.** Earthworks calculations carried out for the wind farm Site have shown that the majority of granular materials for site access track and Turbine Hardstand construction will be sourced from the borrow pit within the Site. It is also envisaged that ready-mix concrete for Turbine Foundation construction and Electrical Substation foundations will be sourced from a local authorised batching plant. The location of aggregate suppliers, concrete suppliers and waste disposal facilities in the vicinity of the

proposed wind farm are shown in **Figure 16.7.** Distances to concrete and aggregate suppliers from the wind farm Site are shown in **Table 16.4.** Construction workers will use the Site entrance on the L6132 to access the Site but will need to have flexibility in the roads they use to reach the Site.

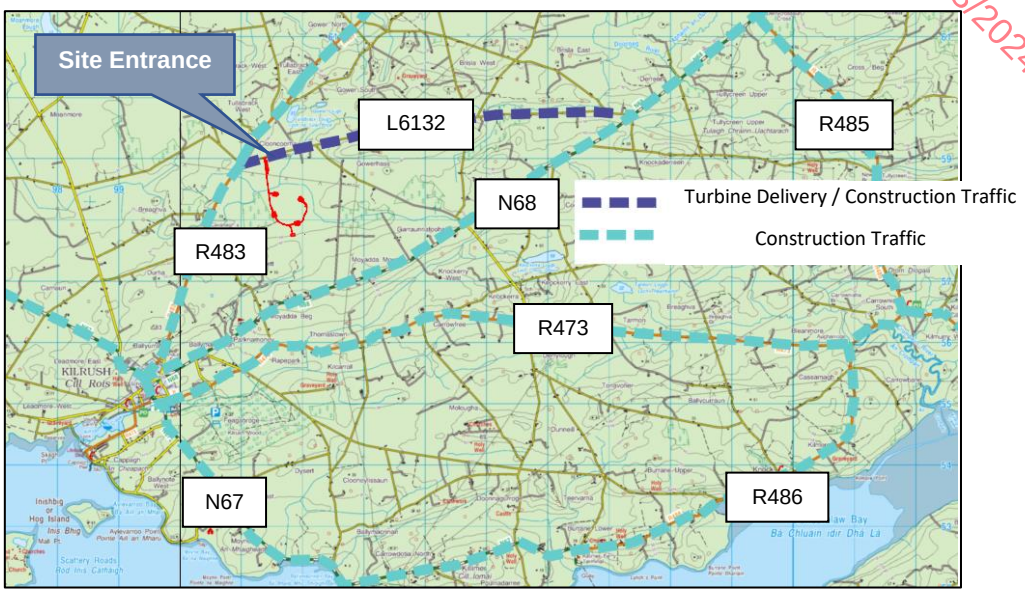


Figure 16.6: Construction Traffic Haul Routes

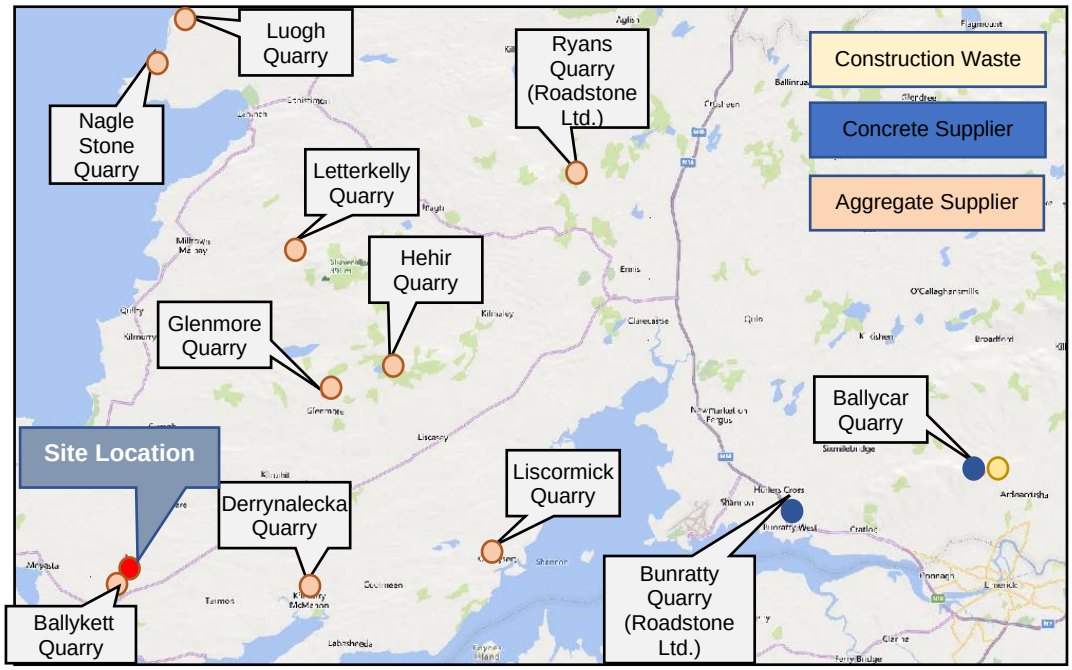


Figure 16.7: Concrete and Aggregate Suppliers

Table 16.4: Distances to local Quarry's and Concrete Suppliers

Quarry	Distance
Ballykett Quarry	1km
Derrynalecka Quarry	11.2km
Glenmore Quarry	16.4km
Hehir Quarry	20.8km
Letterkelly Quarry	22.3km
Liscormick Quarry	22.7km
Nagle Stone Quarry	31.5km
Luogh and Lisacannor Stone Company Ltd. Luogh Quarry	35.0km
Ryans Quarry (Roadstone Ltd.)	38.0km
Bunratty Quarry (Roadstone Ltd.)	42.0km
Bobby O'Connell and Sons Ltd. Ballycar Quarry	55.0km
Esker Readymix, Athenry	86.0km
McGraths Quarry	54.0km

The internal layout of the wind farm and associated roads is such that there is one main spine road with no branches.

At the proposed site entry point from the L6132, the junction will be constructed with an overrun area to accommodate the swept path and wheel loading of abnormal load vehicles associated with the transportation of turbine components. Just south of the entrance, a temporary set down area will be provided. This will be used for the management of delivery vehicles during busy periods (e.g. while placing concrete to turbine foundations) and for turbine blade storage during turbine erection. The site road will then continue southwards to give access to the temporary site compound and the site substation. It will then cross two watercourses by clear span culvert/bridges before reaching turbine T1. The road will then continue further southwards to turbine T2, eastwards to turbine T3 and access to the borrow pit. It will then proceed north-eastwards to turbine T4. Lorries delivering stone or concrete can turn at the nearest hardstand. A turning head will be provided at turbine T4 for turbine delivery vehicles. At turbines T1, T2 and T3, the turbine delivery vehicles can turn at the junction to each hardstand.

During the construction stage, parking space for up to 10 vehicles will be provided within the temporary site compound. The hardstands will provide parking for persons working at the turbine locations. Additional parking will be provided at the set down area.

During the operational phase, parking for six vehicles will be provided adjacent to the substation using part of the site compound. The balance of the site compound will be reinstated.

16.3.2 Sensitive Receptors

The Site is generally served by the N68 national secondary road, the R483 regional road and the L6132 local road. The N68 runs in a north-south west direction from Ennis to Kilrush in County Clare. The R483 runs in a north-south direction from the N67 Junction near Quilty to the N67 junction in Kilrush. The L6132 runs in an east-west direction between the N68 and the R483 and will be used by all construction and wind farm operations traffic to access the Site via the site entrance which is located on the L6132 near Tullabrack cross. The construction of the wind farm will require works to be carried out on the public road network which may impact on sensitive receptors listed in **Table 16.6.** The works on the public road network and their potential impact on sensitive receptors are listed in **Table 16.5.** Mitigation measures to reduce the impact of construction works at isolated locations on the public road network are discussed in detail in **Section 16.6** of this chapter and summarised in **Table 16.7**.

Table 16.5: Works Location and Potential Impact on Sensitive Receptors

Construction Activity	Potential impact on Sensitive Receptors	Impact of works on Sensitive Receptors and Public Road Users
Construction of L6132 Site Entrance	Low Impact / Short Term	Road will not be closed but will be subject to traffic management for a duration of 3 – 4 weeks. Increased journey times due to traffic management. Increased Noise and vibration due to construction works
Local Road Widening and verge strengthening for turbine delivery on the L6132	Low Impact / Short Term	Increased journey times due to traffic management and traffic diversions for a duration of 6 – 8 weeks. Local residents will continue to have local road access. Increased Noise and vibration due to construction works
HGV and Abnormal Load Vehicle Deliveries to Site	Low Impact / Medium term	Increased journey times due to slow-moving traffic. 40 week period of Site deliveries.
Construction of 38kV Grid Connection between Site and	Medium Impact / Medium Term	Increased journey times due to traffic management and traffic diversions over a 12-week period with road closure and traffic management access to be

Construction Activity	Potential impact on Sensitive Receptors	Impact of works on Sensitive Receptors and Public Road Users
Tullabrack 110kV Substation.		maintained to local residents, farmers, and wind and solar farm construction personnel. Increased Noise and vibration due to construction works involving saw cutting, excavation, trench reinstatement and surfacing.
Haul Route enabling Works at the N68 / L6132 Junction	Medium Impact / Short Term	Increased journey times due to traffic management required to modify the junction over a period of 1 – 2 weeks with traffic management measures in place. Increased noise and vibration due to construction activities during verge strengthening / surfacing works, removal of signs and street furniture. The works at the junction will be carried out within the existing road boundary to accommodate the swept path of abnormal load vehicles delivering turbine components.
Haul Route enabling Works on the L6132	Medium Impact / Short Term	Increased journey times due to traffic management and traffic diversions for a period of 2 – 4 weeks. Increased Noise and vibration due to construction works involving saw cutting, excavation, surfacing and removal of vegetation. Works on the L6132 will be carried out within the existing road boundary and will involve verge strengthening to accommodate the track width of abnormal load vehicles delivering turbine components.
Turbine Delivery Route (TDR) enabling works between Foynes Port and the N68/L6132 Junction	Medium Impact / Short Term	The section of the haul route between Foynes Port and the N68 has been used previously for the transportation of turbine components. Existing junctions on the route have been modified to accommodate abnormal load vehicles transporting turbine components. Works on this section of the haul route will involve preparation of existing junction modifications for re use. Increased journey times due to traffic management required to modify junctions on the TDR for abnormal load vehicle This work phase is anticipated to take 1 – 2 weeks to complete. Increased journey times due to traffic management required for removal of signs and street furniture. Increased noise and vibration surfacing and reinstatement works. Parking restrictions in towns and villages. Increased journey times due to traffic management required for hedge trimming and boundary realignment works. The turbine delivery period of works is anticipated to take 2 – 4 weeks.

Table 16.6: Sensitive Receptors

Receptor	Sensitivity	Reason for Inclusion
Hospitals, Medical Centres	High	Medical centres are likely to be highly sensitive to changes in traffic density, noise and vibration from HGVs and construction activities. Access will be required at all times for general and emergency access
Private dwellings located along the Turbine Delivery Route the construction haul route and Grid Connection route.	High	There are numerous residential properties which front directly on to the proposed Turbine Delivery Route, construction stage haul route roads and the Grid Connection route. Residents of these properties are likely to require unrestricted access to the roads in order to access their place of employment and/or local services. These properties are also likely to be highly sensitive to changes in traffic density, noise and vibration from HGVs etc.
Care Homes	High	Care Homes are likely to be highly sensitive to changes in traffic density, noise and vibration from HGVs and construction activities. Access will be required at all times for general and emergency access
Schools	High	Schools are likely to be highly sensitive to changes in traffic density, noise and vibration from HGVs and construction activities during school hours. Access will be required at all times
Churches	Moderate	Churches are likely to be sensitive to noise and vibration from HGVs and construction activities during church services. Access will be required at all times.
Hotels and B&B's	Moderate	Hotels and B&Bs are likely to be sensitive to noise and vibration from HGVs and construction activities. Access will be required at all times.
Businesses and Shops	Moderate	Businesses and Shops are likely to be sensitive to noise and vibration from HGVs and disruption from construction activities during business hours. Access will be required at all times.
Farms	Low	Farm operations may be sensitive to noise and disruption from construction activities.
Solar and Wind Farms	Low	Solar and Wind Farms may be sensitive to disruption from construction activities.
Public Amenities	Low	Entrance to public amenities may be sensitive to disruption from construction activities.

Table 16.7: Mitigation Measures for Isolated Works Carried out on the Public Road Network

Item	Mitigation Measure
Public Safety	All works on the public road network shall be carried out under a road opening licence and an approved Traffic Management Plan. A TMP for the development has been completed and accompanies this submission (See **Appendix 16.2**), The location of works shall be signposted in accordance with the Traffic Signs Manual. Works shall be carried out within a dedicated work zone and fenced to prevent unauthorised access.

Item	Mitigation Measure
Public and Emergency Access	Access for the public and emergency services shall be provided at all times through the works.
Public liaison	The contractor shall appoint a liaison officer who will inform the public of the location and expected duration of works on the public road network.
Vehicle noise, emissions, and loading	All vehicles used during the construction, operation and Decommissioning phases of the wind will be road legal vehicles subject to HCV, LCV and NCT requirements for noise, axle loading and emissions.
Haul Routes for construction traffic	Construction vehicles will be prohibited from using the local road network and will use the national and regional road network to access the wind farm Site.
Parking for construction Vehicles	Construction vehicles shall be parked in dedicated parking areas within the work zone when working on the public road.
Noise, vibration and dust	Works on the public road will be carried out during normal working hours in order to minimise disruption from noise and vibration. Dust and debris resulting from construction activities shall be controlled by wetting down and street sweeping.
Traffic delay	Turbine deliveries will be carried out during off peak hours at times agreed with An Garda Síochána and Clare County Council to minimise disruption. The movement of abnormal loads to Site will be subject to abnormal load permits and vehicles will be escorted by support teams and An Garda Síochána who provide routine and emergency traffic management for the convoy vehicles in sensitive areas

16.3.3 Road Access to the Site

Access to the wind farm Site will be from a new priority T-junction constructed on the L6132. The junction will be constructed to accommodate the swept path of abnormal load vehicles accessing the Site during the delivery of turbine components. The junction will be a stop-controlled junction with priority for L6132 traffic. Visibility splays of 160m will be available in both directions from a 3.0m setback in accordance with TII specifications DN-GEO-03060. The location of the junction will be signposted in accordance with Chapter 8 of the Traffic Signs Manual during the construction of the wind farm. The location of the wind farm Site entrance junction is shown on **Figure 16.2,** the layout of the Site entrance junction is shown in **Figure 16.7.**

Figure 16.7: Site Entrance Junction

16.3.4 Scoping Responses and Consultation

Consultation responses are shown in **Table 16.8**.

Table 16.8: Consultation Responses

Consultee	Type & Date	Summary of Response	Response to Consultee
Transport Infrastructure Ireland (TII)	Email 23/09/2022	TII provides the following observations with respect to the EIAR scoping: • Consultations should be had with the relevant Local Authority/National Roads Design Office with regard to locations of existing and future national road schemes, • TII would be specifically concerned as to potential significant impacts the development would have on the national road network (and junctions with national roads) in the proximity of the proposed development; N68, N85, national roads. In addition, in accordance with official policy, proposals shall not result in the creation of new direct access to a national road or the intensification of existing direct access to national roads, • The developer should assess visual impacts from existing national roads, • The developer should have regard to any EIAR/EIS and all conditions and/or modifications imposed by An Bord Pleanála regarding road schemes in the area. The developer should in particular have regard to any potential cumulative impacts,	There is no future national road scheme in n the vicinity of the wind farm Site. No new direct access onto the N68 or any other national road network in the area are set out wihin the Development proposal. Adressed in Chapter 11 (Landscape and Visual Impact Assessment) of the EIAR. Addressed in Section 16.7 of this EIAR. Included in the assessments within this EIAR chapter -

Consultee	Type & Date	Summary of Response	Response to Consultee
		• The developer, in preparing EIAR, should have regard to TII Publications (formerly DMRB and the Manual of Contract Documents for Road Works).	relevant publications listed in table 16.1
		• The developer, in preparing EIAR, should have regard to TII's Environmental Assessment and Construction Guidelines, including the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (National Roads Authority, 2006),	Air quality is assessed in Chapter 12 of the EIAR.
		• The EIAR/EIS should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1st Rev., National Roads Authority, 2004)),	Noise is assessed in Section 16.5.6 of this chapter and in Chapter 10 of the EIAR – Noise.
		• It would be important that, where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment (TTA) be carried out in accordance with relevant guidelines, noting traffic volumes attending the Site and traffic routes to/from the Site with reference to impacts on the national road network and junctions of lower category roads with national roads. In relation to national roads, TII's Traffic and Transport Assessment Guidelines (2014) should be referred to in relation to proposed development with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of the NRA/TII TTA Guidelines which addresses requirements for sub-threshold TTA. Any improvements required to facilitate development should be identified. It will be the responsibility of the developer to pay for the costs of any improvements to national roads to facilitate the private development proposed as TII will not be responsible for such costs,	See Section 16.2.1 of this EIAR chapter.
		• The designers are asked to consult TII Publications to determine whether a Road Safety Audit is required,	See Section 16.5.13 of this EIAR chapter
		• In the interests of maintaining the safety and standard of the national road network, the EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network,	Minor verge widening works are proposed at intervals of the L6132 and at a road junction with the L6132 which is offfset from the N68 road. See Drawing 6777-JOD-XX-DR-C-HR-263 Rev P01.2 Further confirmatory surveys to be undertaken prior to construction to pick up any

Consultee	Type & Date	Summary of Response	Response to Consultee
		• TII recommends that that applicant/developer should clearly identify haul routes proposed and fully assess the network to be traversed. TII notes that preliminary haul route proposals outlined in the EIAR Scoping Report include the N/M6, M18, N85 and N68, national roads. Where abnormal 'weight' loads are proposed, separate structure approvals/permits and other licences may be required in connection with the proposed haul route. All structures on the haul route through all the relevant County Council administrative areas should be checked by the applicant/developer to confirm their capacity to accommodate any abnormal 'weight' load proposed. In addition, the haul route should be assessed to confirm capacity to accommodate abnormal 'length' loads and any temporary works required.	changes in the intervening period between planning and construction stage. Abnormal load permits will be required to be applied fro by the turbine transport company. Noted.
		• The national road network is managed by a combination of PPP Concessions, Motorway Maintenance and Renewal Contracts (MMaRC) and local road authorities in association with TII.	The Developer undertakes to complete same together with the turbine transport company to ascertain any operational requirements which may pertain at that time.
		• The applicant/developer should also consult with all PPP Companies, MMaRC Contractors and road authorities over which the haul route traverses to ascertain any operational requirements, including delivery timetabling, etc. to ensure that the strategic function of the national road network is safeguarded.	Noted, and agreed.
		• Additionally, any damage caused to the pavement on the existing national road arising from any temporary works due to the turning movement of abnormal loads (e.g. tearing of the surface course, etc.) shall be rectified in accordance with TII Pavement Standards and details in this regard shall be agreed with the Road Authority prior to the commencement of any development on Site.	The preferred grid connection route is to Tullabrack 110kV substation which avoids national road infrastructure.
		• Any grid connection and cable routing proposals should be developed to safeguard proposed road schemes as TII will not be responsible for costs associated with future relocation of cable routing where proposals are catered for in an area of a proposed national road scheme. In that regard, consideration should be given to the routing option, use of existing crossings, depth of cable laying, etc.	Noted. There are no proposals related to the Development which wil lreduce the strategic capacity and safety of the national road network.
		• In the context of the existing national road network, in accordance with the National Planning Framework National Strategic Outcome no. 2 'Enhanced Regional Accessibility', there is a requirement to maintain the strategic capacity and safety of the network. This requirement is further reflected in the National Development Plan, the National Investment Framework for Transport in Ireland and also the	

Consultee	Type & Date	Summary of Response	Response to Consultee
		existing Statutory Section 28 Spatial Planning and National Roads Guidelines for Planning Authorities. • There is around 99,000km of roads in Ireland, the national road network which caters for strategic inter-urban travel consists of only approx. 5.4% of this. There is a critical requirement to ensure the strategic capacity and safety of this national road network is maintained and significant Government investment already made in the national road network is safeguarded. • The provision of cabling along the national road network represents a number of significant implications for TII and road authorities in the management and maintenance of the strategic national road network and TII is of the opinion that grid connection cable routing should reflect the foregoing provisions of official policy. Therefore, TII advises that grid connection cable routing should seek to utilise available alternatives, as opposed to the strategic national road network contrary to the provisions of official policy. • Other consents or licences may be required from the road authority for any trenching or cabling proposals crossing the national road. TII requests referral of all proposals agreed and licensed between the road authority and the applicant which affect the national road network. • Cable routing should avoid all impacts to existing TII infrastructure such as traffic counters, weather stations, etc. and works required to such infrastructure shall only be undertaken in consultation with and subject to the agreement of TII, any costs attributable shall be borne by the applicant/developer. The developer should also be aware that separate approvals may be required for works traversing the national road network.	Noted. There are no proposals related to the Development which will reduce the strategic capacity and safety of the national road network. The preferred grid connection route option is to Tullabrack 110kV substation which avoides national road infrastructure. A road openign license will be applied for and complied with prior to any construction, in line with the requiremetns of Clare County Council. The preferred grid connection route option is to Tullabrack 110kV substation which avoides national road infrastructure.
Clare County Council Roads Department	Email 11/04/2022	Clare County Council Roads Department provided typical requirements for wind farm developments relating to visibility, drainage, structures, signage, waste management plan, autotrack analysis, junction design, traffic management, emergency services and road condition surveys.	Noted, and taken account of in the road related drawings.
Department of Transport	Email 13/10/2022	The Department of Transport provides the following information to be included in the preparation of an Environmental Impact Assessment (EIA) for Ballykett Wind Farm It should be noted that the department considers the construction involved in providing this development and especially, the connection cables to the national grid may	The Developer agrees to the inclusion of planning conditions as part of planning permission, if granted. Any road opening or trenching works will be carried out in compliance with "Guidelines for

Consultee	Type & Date	Summary of Response	Response to Consultee
		have effects on both the environment and the Regional and Local Road network. Where the developer proposes the placement of any cables (or additional cables) in one or more trenches within the extents of the (regional and local) public road network, it is necessary to consider the following: • Their presence within the public road could significantly restrict the Road Authority in carrying out its function to construct and maintain the public road and will likely add to the costs of those works. • Their installation within the lands associated with the public road may affect the stability of the road. In particular where the road is a "legacy road" (where there is no designed road structure and the subgrade may be poor or poorly drained) the design needs to take account of all the variable conditions and not be based on a sample of the general conditions. • The possible effect on the remaining available road space (noting that there may be need to accommodate other utilities within the road cross-section in the future). • The necessity to have the power in the cables switched off where the Road Authority considers this necessary in order to carry out its function to construct and maintain the public road. • The department consider it important that the examination of the proposal should include consideration of the following: • Examination of options other than the routing of cables along the public road, • Examination of options for connection to the national grid network at a point closer to the wind farm in order to reduce the adverse impact on public roads. • Details of where within the road cross section cables are to be placed so as to minimise the effect on the Roads Authority in its role of construction and maintenance, • Examination of details of any chambers proposed within the public road cross section so as to minimise the effect on the Roads Authority in its role of construction and maintenance and, • Rationalisation of the number of cables involved (including existing electric or possible future cables) and their diversion into one trench, in order to minimise the impacts on the road network and the environment along the road boundary (hedgerows). The Department considers the following should be considered when applying conditions to any approval. 1. A condition requiring the specific approval of the local authority to the detail of the final route of cables through the public road space. If during construction there is a need to deviate from the detailed design then the approval of the local authority would again	managing openings in public roads, 2017" See Section 16.5.2 of this EIAR Chapter

Consultee	Type & Date	Summary of Response	Response to Consultee
		be sought. This would assist in minimising the impact on the public road. 2. A condition requiring the developer to comply with all appropriate standards and, inter alia the Guidelines for Managing Openings in Public Roads, 2017 in order to ensure orderly development. 3. A condition requiring that the location of the cables would be recorded as exactly as possible (maybe using BIM type technology) so as to facilitate the further use of road space for utilities and the maintenance/construction of the public road by the Roads authority. This record should be lodged with the local authority and with the ESB Networks for retention on their records. 4. A condition requiring the developer to route cables away from bridge structures and specifically preventing the developer from attaching cables to road bridges. This would allow for the future maintenance of bridges without interruption of the electricity supply along the cables. 5. A condition requiring the developer to notify the Roads Authority of the owner of the cables (Owner) and the controller (Power Controller) of the power transmitted along the cables. In addition, the condition should require Owner and Power Controller to notify the Roads Authority of any change in ownership of the cables or change of Power Controller transmitting power along the cables. In all instances the Owner and Power Controller should be required to maintain an agreed contacts list with the Roads Authority.	RECEIVED: 29/03/2024

16.3.5 Delivery Vehicle Specification

Delivery of road construction materials, concrete for turbine foundations, building materials, drainage, ducting and cables will be carried out using standard heavy goods vehicles (HGV). Delivery of turbine components will be carried out using specialist abnormal load vehicles. Turbine blades measuring 67m in length will be delivered on an extendable semi-trailer, one per trailer. Approximately 15.0m of the blade will over- hang the rear of the trailer. Following delivery to the Site, the trailer will be retracted for the return trip. An indicative blade delivery vehicle schematic is shown in **Plate 16.1** below.

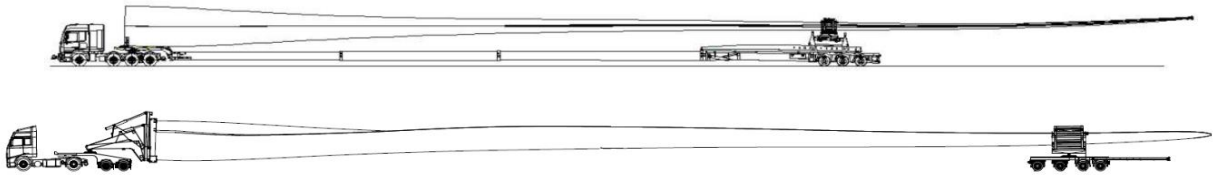


Plate 16.1: Indicative Turbine Delivery Vehicle for Turbine Rotor Blades

Wind turbine blades may also be delivered to Site using a blade lifter vehicle, the use of a blade lifter vehicle will reduce the extent of widening and strengthening works required at junctions and acute bends on the Turbine Delivery Route due to its reduced wheelbase and ability to adjust the blade in the vertical plane. Each turbine tower will be delivered to Site in four sections on extendable semi-trailers, the tower sections range in length from 20.0m to 35.00m with a maximum width of 4.5m. An Indicative tower transporter vehicle is shown in **Plate 16.2**.

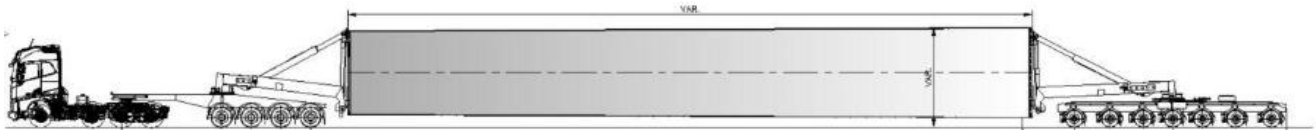


Plate 16.2: Indicative Turbine Tower Section Delivery Vehicle

All material deliveries will have a maximum axle load of up to 12 tonnes per axle, and a maximum total truck weight 65 tonnes approx. The main crane for turbine erection will have a maximum axle loading of 12 tonnes per axle and a maximum total weight of 100 tonnes approx. Vehicles delivering counter-weights for the crane will have a maximum axle loading of up to 12 tonnes per axle. The transport vehicles used for transportation of components may differ from those shown below depending on the haulage contractor's preferences.

16.3.6 Existing and Forecast Traffic Volumes

Jennings O'Donovan & Partners carried out classified traffic counts at two locations in the vicinity of the proposed wind farm to determine baseline traffic volumes and junction capacity on the public road network at locations which will be directly affected by construction traffic during the wind farm construction period. The traffic count periods were selected using information from the TII automatic traffic counter at Ballyduneen which is located on the N68 between Ennis and Kilrush to the north of L6132 / N68 junction. Data from the TII traffic counter taken during an average workday in May 2022 is shown in **Table 16.9,** The traffic data shows that peak traffic occurs between 07.30 and 08.30 in the morning and between 17.15 and 18.15 in the evening. HGV traffic accounts for approximately 3.4% of the total traffic volume on the N68 at the Ballyduneen traffic counter.

The locations of the classified traffic counts are shown in **Figure 16.1.** The classified traffic counts were carried out during the morning and evening peak hour traffic periods obtained from the TII traffic counter to record maximum traffic levels on the road network. The classified traffic counts were carried out at the following locations:

- N68 / L6132 Junction 1

- R483 / L6132 Junction 2

Existing traffic volumes on the N68, R483 and L6132 were obtained from the classified traffic counts carried out by JOD in January 2023 at the locations shown in **Figure 16.1**. Using the methodology from TII publication PE-PAG-02039 to calculate Annual Average Daily Traffic (AADT) from short period traffic counts, the resulting AADT on the N68, R483 and L6132 are calculated as follows:

The N68 regional road has an AADT of 2,870 vehicles near its junction with the L6132 which equates to a two-way traffic flow of approximately 300 vehicles during peak hour traffic periods. The L6132 has an AADT of 170 vehicles near its junction with the N68 which equates to a two-way traffic flow of approximately 20 vehicles during peak hour traffic periods. HGV traffic accounts for approximately 5% of the total traffic on the N68 passing the L6132 junction. The R483 regional road has an AADT of 1,370 vehicles at its junction with the L6132 corresponding to a two-way traffic flow of approximately 150 vehicles during peak hour periods. The L6132 local road has an AADT of 135 vehicles at the R483 junction which equates to a two-way traffic flow of 20 vehicles during peak hour traffic periods. HGV traffic accounts for approximately 1% of the total traffic on the R483 passing the L6132 junction.

Traffic analysis carried out at the N68 / L6132 junction and the R483 / L6132 junction show that the junctions are operating within capacity and can accommodate additional traffic growth in the future. A summary of the analysis is shown in **Table 16.10**.

Table 16.9: N68 Traffic Volumes 2022

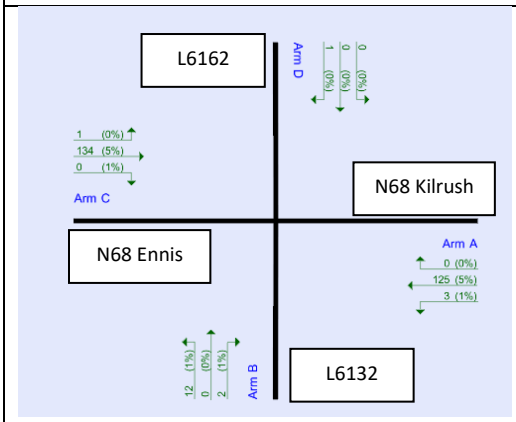
Time	Eastbound	Westbound	Total Traffic	HGV Traffic
07.00 – 08.00	167	117	324	10
08.00 – 09.00	169	141	464	11
09.00 – 10.00	127	115	331	8
10.00 – 11.00	120	106	307	8
11.00 – 12.00	120	110	317	8
12.00 – 13.00	132	112	340	8
13.00 – 14.00	141	123	352	9
14.00 – 15.00	147	128	387	9

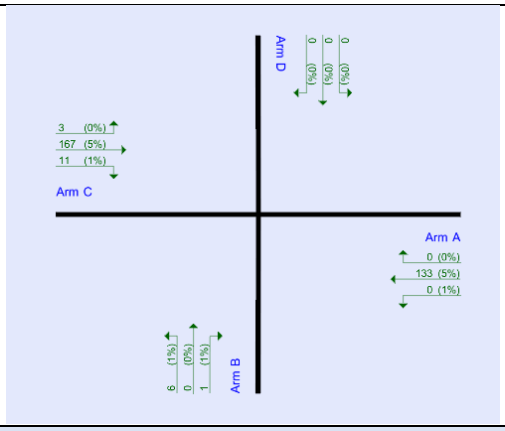
Time	Eastbound	Westbound	Total Traffic	HGV Traffic
15.00 – 16.00	172	150	421	11
16.00 – 17.00	196	174	456	13
17.00 – 18.00	177	237	498	14
18.00 – 19.00	118	206	390	11
19.00 – 20.00	80	120	258	7

Table 16.10: Traffic Analysis – 2023 Traffic Volumes

N68 / L6132 / L6162 Junction – 2023 Traffic Analysis and Turning Movements

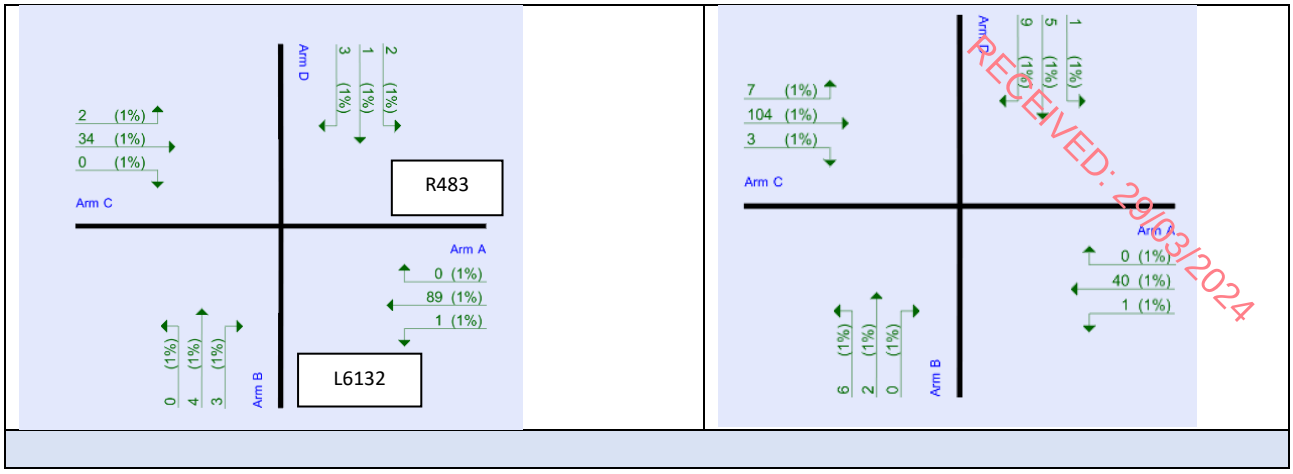
	AM									PM							
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
2023 Existing Traffic - N68 / L6132 / L6162 Junction																		
Stream B-ACD	D1	0.0	0.5	7.07	0.03	A	0.36	A	688 % [Stream B-ACD]	D2	0.0	0.5	7.02	0.01	A	0.39	A	604 % [Stream B-ACD]
Stream A-BCD		0.0	~1	0.00	0.00	A					0.0	~1	0.00	0.00	A			
Stream D-ABC		0.0	~1	0.00	0.00	A					0.0	~1	0.00	0.00	A			
Stream C-ABD		0.0	~1	0.00	0.00	A					0.0	0.5	5.29	0.02	A			





R483 / L6132 Junction – 2023 Analysis and Turning Movements

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
2023 Existing Traffic - R483 / L6132 Tullabrack Cross																		
Stream B-ACD	D1	0.0	0.5	8.79	0.02	A	0.79	A	900 % []	D2	0.0	0.5	7.06	0.02	A	1.18	A	630 % [Stream D-ABC]
Stream A-BCD		0.0	~1	0.00	0.00	A					0.0	~1	0.00	0.00	A			
Stream D-ABC		0.0	0.5	7.93	0.01	A					0.0	0.5	8.96	0.04	A			
Stream C-ABD		0.0	~1	0.00	0.00	A					0.0	0.5	5.42	0.01	A			



16.3.7 Predicted Future Traffic Volumes

TII publication PE-PAG-20217 forecasts traffic growth for regions in Ireland by applying growth factors to baseline traffic volumes to predict future traffic flows. TII forecast annual traffic demand in the Mid-West region to increase by 1.0% annually for light good vehicles and 2.0% annually for HGV's using the "Central Growth" scenario. Forecast traffic demand on the N68 national secondary road and the R483 regional road are shown in **Table 16.11.** Traffic projections on the public roads are used for analysis in conjunction with traffic generated by wind farm construction to determine if junctions will continue to operate within capacity in 2025/26 when wind farm construction is likely to occur. The change or rate of increase year on year is marginal such that any impacts of the Development for 2027 or 2028 will be similar to 2026.

Table 16.11: Future Traffic Growth on The Public Road Network

Year	N68 Without Development			R483 Without Development			L6132 Without Development		
	AADT	HGV's Per Hour	%HGV	AADT	HGV's Per Hour	%HGV	AADT	HGV's Per Hour	%HGV
2023	2,870	15	5.0%	1,370	1	1.0%	170	1	<1.0%
2024	2,890	16	5.00%	1,385	1	1.0%	175	1	<1.0%
2025	2,930	17	5.00%	1,400	2	1.0%	180	1	<1.0%
2026	2,960	18	5.00%	1,415	2	1.0%	185	1	<1.0%

16.3.8 Accident Statistics

The Road Safety Authority publish tables on "Road Casualties and Collisions in Ireland" each year. The last published table for National Routes is for 2017.

Statistics are divided into those occurring "Inside Built-up Areas" and those occurring "Outside Built-up Areas". **Table 16.12** below presents a summary of accidents for the N68 for the years 2013 to 2017.

Table 16.12: Summary of Accidents for the N68 for the years 2013 to 2017

Year	Inside Build Up Areas			Total	Outside Built Up Areas			Total	Overall Total	Collision Rate per km
	F	SI	MI		F	SI	MI			
2017	0	0	1	1	0	3	3	6	7	0.17
2016	0	0	0	0	0	2	3	3	5	0.12
2015	0	0	1	1	0	2	5	7	8	0.12
2014	0	0	0	0	0	1	3	4	4	0.1
2013	0	0	1	1	0	0	6	6	7	0.09

F = Fatal

SI = Significant Injuries

MI – Minor Injuries

For the N68, the historical accident levels are low but were more prevalent outside built-up areas than inside them.

16.4 PROPOSED WORKS

16.4.1 Construction Phase

The construction period of the Development is anticipated to take approximately 10 months, the majority of HGV deliveries to Site will take place during the first 6 months of the project and will be associated with site roads and Turbine Hardstand construction, construction of Turbine Foundation bases and Electrical Substation building.

It is expected that construction hours will be between 07:00 and 19:00 Monday to Friday and 08:00 – 16:30 on Saturdays with no working on Sundays or on Bank or Public Holidays unless agreed otherwise with Clare County Council. Some special deliveries such as turbine components and concrete for Turbine Foundations may be required to be delivered outside of these times in consultation with Clare County Council.

16.4.2 Construction Haul Route

Road widening between Tullabrack Cross and the wind farm site entrance will be carried out to accommodate increased volumes of HGV vehicles associated with the construction of the wind farm. The road widening and verge strengthening are temporary works.

Road widening works will be carried out in the existing road verge to increase the running width of the L6132 local road to 4.0m and 5.5m at passing locations. The road widening will

be constructed to withstand wheel loading from HGV delivery vehicles. The works will involve excavating a trench in the verge, placing geotextile and geogrid at the base of the trench and backfilling the trench with granular material compacted in layers. See Drawings 6777-JOD-XX-DR-C-HR-251 and 6777-JOD-XX-DR-C-HR-252 in **Appendix 16.1** for details of the work.

16.4.3 Turbine Delivery Route

Modifications to the public road network for the transportation of abnormal loads, between Foynes Port and the Site, works will be required to facilitate turbine component deliveries.

Temporary removal of street furniture and temporary modifications to traffic islands will be required between Foynes Port and the junction with the L6132.

Road widening, verge strengthening and vertical realignment of the L6132 local road is required to facilitate the delivery of turbine components using abnormal load vehicles. Road widening between Tullabrack Cross and the wind farm site entrance will be carried and to accommodate increased volumes of HGV vehicles associated with the construction of the wind farm. The road widening and verge strengthening are temporary works. The vertical realignment works are permanent.

The verge strengthening and widening of the L6132 will be carried out in the existing road verge to increase the running width of the L6132 local road to 4.5m and will be constructed to withstand wheel loading from abnormal load vehicles delivering turbine components to the wind farm site. The works will involve excavating a trench in the verge, placing geotextile and geogrid at the base of the trench and backfilling the trench with granular material compacted in layers.

There are three watercourse crossings along the L6132. At these three locations steel plates will be placed on the verge for 10m each side of watercourse crossings to avoid excavation and disturbance of the existing ground. Upon completion of the wind farm construction the L6132 verge will be reinstated by removing approximately 150mm of granular material from widened sections and replaced with topsoil, steel plates will also be removed from the verge at this stage. See Drawings 6777-JOD-XX-DR-C-HR-270 and 6777-JOD-XX-DR-C-HR-271 for details of watercourse crossings along the L6132.

Road widening works will be carried out in the existing road verge to increase the running width of the L6132 local road to 4.0m and 5.5m at passing locations. The works will involve

excavating a trench in the verge, placing geotextile and geogrid at the base of the trench and backfilling the trench with granular material compacted in layers.

Vertical realignment of the L6132 will be required at one location between the N68 and the wind farm site entrance. Realignment works will involve reducing the road level by approximately 150mm at an existing crest curve to reprofile the road for abnormal vehicles maintain axle loading and prevent grounding. Realignment works will be carried out within the existing road boundary with surfacing to match the existing L6132. Realignment works at this location will remain in situ following the construction of the wind farm.

See Drawings 6777-JOD-XX-DR-C-HR-250 and 6777-JOD-XX-DR-C-HR-263 in **Appendix 16.1** for details of the work.

16.4.4 Grid Connection Works

The Ballykett wind farm grid connection will be constructed between the substation located on the wind farm site and Tullabrack substation. The construction of the Grid Connection will be carried out in the public road network. Grid Connection works will be carried out under a number of phased operations which will involve traffic management. The first phase of the works will involve the excavation of a 0.6m wide cable trench, construction of 2m wide x 6m long joint bays, installation of cable ducting, backfilling of trench and temporary reinstatement of road surfacing. The second phase of the works will involve installing the 38kV or 20kV cables in the ducting. During the cable installation traffic management will be required at the joint bays to allow cable pulling and jointing. The final phase of the works will involve permanent reinstatement of the road surfacing and surface dressing.

16.5 ASSESSMENT OF POTENTIAL EFFECTS

16.5.1 HGV Movements

The estimated timescale for the completion of the construction phase is 10 months, inclusive of all works to site access tracks, Turbine Hardstands, drainage, Electrical Substation, Grid Connection works and erection and commissioning of turbines. **Table 16.13** contains details of the estimated HGV deliveries to the Site during the construction period. The expected HGV volumes are based on earthworks calculations for the Ballykett Wind Farm Site, the plant used and trips generated during the construction of similar sized wind farms.

There will be approximately 43,870m^3 of rock required during the construction phase. A borrow pit will be developed on-site to extract rock (32,280m^3) for most of the site

infrastructure requirements; this will help to limit the volume of HGV traffic associated with wind farm construction on the local road network. Rock (c. 11,590m³ or 11.59tonnes) will be imported to construct the L6132 site entrance, temporary construction compound, access road from the L6132 site entrance leading to the onsite borrow pit, site access road and turbine hardstand surface layers and temporary and permanent works along the L6132.

Table 16.13: HGV and Abnormal Load Deliveries

Materials	Quantity	No. Of Deliveries	Timeframe (Week)	Maximum Loads / Day	Vehicle Type
Mobilise on Site		14	1	5	OGV1
Construction of L6132 Site Entrance	700m³	70	1-2	10	OGV1
Construction of Temporary Construction Compound	1,000m³	100	1-2	10	OGV1
Construction of Floating site access roads leading to borrow pit	3,000m³	300	2-8	10	OGV1
Clause 804 Material for Surfacing site access tracks, Turbine Hardstands and staging area	2,300m³	230	6-10	10	OGV1
Construction of 0.4km Road Widening (Site Entrance to Tullabrack Cross)	250m³	25	2-8	10	OGV1
Construction of L6132 verge strengthening on Turbine Delivery Route 5.16km (Site Entrance to N68) Spoil Removal (3,800m³) + Granular Material (3,800m³)	7, 600m³	760	8-16	20	OGV1
Vertical realignment of L6132 crest curve on Turbine Delivery Route Spoil Removal (18m³) + Asphalt Surfacing (12m³)	30m³	5	8	1	OGV1
Site drainage and fencing		20	8-16	2	OGV2
Ready-mix concrete for Turbine Foundations	2,400m³	300	12-20	75	OGV2
Steel reinforcement for Turbine Foundations	200T	10	8-16	3	OGV2
Foundation bolts	4 Turbines	4	8-16	1	OGV2
Substation building materials		15	8-20	1	OGV2
Electrical switchgear		2	20-38	1	OGV2
Electrical cables		5	4-20	1	OGV2
Grid Connection works	1.8km (540m³)	220	20-28	12	OGV2
Wind turbine components	4 Turbines	40	20-28	3	OGV2
Crane		10	20	5	OGV2

Materials	Quantity	No. Of Deliveries	Timeframe (Week)	Maximum Loads / Day	Vehicle Type
Reinstatement of L6132 verges, 5.16km (Site Entrance to N68) Material Removal (1,260m^3) + Topsoil (1,260m^3)	2,520m^3	252	30-38	10	OGV1
General reinstatement and demobilisation		90	28-40	5	OGV2
Total		**2,472**			

It is estimated that during the wind farm construction, an approximately total of 2,472 loads of material and building supplies will be delivered and removed from the Site. The majority of granular materials for access road and Turbine Hardstand construction will be sourced from the borrow pit and processed on Site. The majority of HGV movements to and from Site will occur during the first six months of the construction period and will be associated with the construction of Site roads, Turbine Hardstands, public road widening, Grid Connection works and Turbine Foundations. **Table 16.14** shows a schedule of maximum predicted daily traffic movements to Site over the 12-month construction period.

Table 16.14: Schedule of Maximum Predicted Daily Traffic Movements to Site Over 10 Month Construction Period

Activity	Weeks 1-4	Weeks 4-8	Weeks 8-12	Weeks 12-16	Weeks 16-20	Weeks 20-24	Weeks 24-28	Weeks 28-32	Weeks 32-36	Weeks 36-40
Mobilise on Site	5									
Construction of L6132 Site Entrance	10									
Construction of Site Compound	10									
Construction of Floating Site Access Roads Leading to Borrow Pit – (1.3km)	10	10								
Clause 804 Material for Surfacing Site Access Tracks, Turbine Hardstands and Staging Area		10	10	10						
Construction of 0.4km Road Widening (Site Entrance to Tullabrack Cross)	10	10								
Construction of L6132 Verge Strengthening and widening on Turbine Delivery route 5.16km (Site Entrance to N68)			20	20						
Vertical realignment of L6132 crest curve on Turbine Delivery Route			1							
Site Drainage and Fencing			2	2						
Ready Mix Concrete for turbine Foundations				75	75	75				

Activity	Weeks 1-4	Weeks 4-8	Weeks 8-12	Weeks 12-16	Weeks 16-20	Weeks 20-24	Weeks 24-28	Weeks 28-32	Weeks 32-36	Weeks 36-40
Steel Reinforcement for Turbine Foundations			3	3						
Foundation Bolts			1	1						
Substation Building Materials		1	1	1	1					
Electrical Switchgear					1	1				
Electrical Cables		1	1	1	1	1				
Grid Connection Works					12	12	12			
Wind Turbine Components					3	3	3			
Crane					5			5		
Reinstatement of L6132 verges, 5.16km (Site Entrance to N68)								10	10	10
Reinstatement and Demobilisation								5	5	5
Total	45	32	39	113	98	92	15	20	15	15

Weeks 1 to 8 will involve deliveries of materials for Site access works, site access tracks, Temporary Construction Compound, site offices, site security, and drainage. This period will include deliveries of fencing materials for Site boundaries and compounds, temporary fencing to protect trees, hedges and ecological buffer zones where necessary, road construction materials for access tracks and Site entrance, and delivery of temporary site office units. It is anticipated that a maximum of 55 HGV vehicles (110 HGV movements) will visit the Site on a daily basis during the period of weeks 1 to 8.

Weeks 8 to 20 will involve deliveries of materials for site access works, Turbine Hardstand, Turbine Foundations, site access tracks, Electrical Substation building and cable / ducting works, turbine component delivery and Grid Connection works. This period will include deliveries of fencing materials for site boundaries, road construction materials for access tracks, site entrances and Turbine Hardstands, ready mix concrete and steel reinforcement for Turbine Foundations. It is anticipated that a maximum of 38 HGV vehicles (76 HGV movements) will visit the Site on a daily basis during the period of weeks 8 to 20 with an additional 75 HGV vehicles (150 HGV movements) delivering concrete for Turbine Foundations on two / three separate days during the eight-week period between weeks 12 to 20. During concrete deliveries for Turbine Foundations a total of 113 HGV vehicles (226 HGV movements) per day will visit the Site.

Weeks 20 to 40 will involve HGV movements for works associated with Turbine Foundation construction, turbine delivery, turbine erection, turbine commissioning, electrical works, road reinstatement Site landscaping and the removal of temporary works materials such as offices and fencing from Site. It is anticipated that a maximum of 17 HGV vehicles (34 HGV movements) will visit the Site on a daily basis during the period of weeks 20 to 40 with an additional 75 HGV vehicles (150 HGV movements) delivering concrete for Turbine Foundations on one / two separate days during the four-week period between weeks 20 to 24. During concrete deliveries for Turbine Foundations a total of 92 HGV vehicles (184 HGV movements) will visit the Site.

The expected HGV volumes are based on earthworks calculations, peat depths and traffic profiles generated by similar sized wind farms and will be subject to amendment based on local conditions and contractor working practices which are projected to be not significant.

Based on the indicative timetable outlined above the peak times for HGV deliveries per day will be months 1 to 6 when site access roads, Turbine Hardstands and Turbine Foundations will be constructed.

Increased volumes of traffic will be generated by the proposed Development during the construction period. Peak traffic generated by the Development will correspond to the construction of Turbine Foundations and will occur during four days within the 10-month construction period when the Development will generate a maximum of 113 HGV trips (226 HGV movements) and 40 LGV (80 traffic movements) at the L6132 site entrance during each of the four days. Outside these times, construction traffic will typically consist of 28 HGV trips (56 HGV movements) and 40 LGV (80 traffic movements) at the L6132 site entrance. Development traffic will be distributed throughout the day with morning, afternoon and evening peaks. The distribution of daily development traffic is shown in **Table 16.15** during the construction of Turbine Foundations.

Table 16.15: Development Traffic Profile

Time	Arrivals		Departures	
	HGV	LGV	HGV	LGV
06.00 – 07.00		20		
07.00 – 08.00	10	15	10	
08.00 – 09.00	10	5	10	2
09.00 – 10.00	10		10	

Time	Arrivals		Departures	
	HGV	LGV	HGV	LGV
10.00 – 11.00	10		10	
11.00 – 12.00	10		10	
12.00 – 13.00	10		10	
13.00 – 14.00	5	5	5	5
14.00 – 15.00	10		10	
15.00 – 16.00	10		10	
16.00 – 17.00	10		10	
17.00 – 18.00	5	2	5	5
18.00 – 19.00	3		3	15
19.00 – 20.00				20

16.5.2 Works on the Grid Connection

The construction of the grid connection will be carried out under a number of phased operations which will involve traffic management. The first phase of the works will involve the excavation of a 0.6m wide cable trench, construction of 2m wide x 6m long joint bays, installation of cable ducting, backfilling of trench and temporary reinstatement of road surfacing. The second phase of the works will involve installing the electrical cable in the ducting. During the cable installation traffic management will be required at the joint bays to allow cable pulling and jointing. The final phase of the works will involve permanent reinstatement of the road surfacing and surface dressing. The phased works will require traffic management to be removed and reinstalled a number of times over the course of the project. The works will be carried out under a road opening licence and Traffic Management Plan approved by Clare County council. A TMP has been prepared for the Ballykett wind farm development and is submitted with the Planning Application (see **Appendix 16.2**). These works have the potential for a slight, negative, temporary effect on residents, businesses and road users due to increased noise and vibration resulting from construction activities and increased journey times and delays due to temporary traffic management. However, these effects will be confined to a relatively short 12-week period during the construction phase, prior to the delivery of turbine components and hence are not predicted to have a significant effect. The trenches and joint bays will be reinstated in accordance with the "Guidelines for Managing Openings in Public Roads", 2017 and to requirements of Clare County Council, as may be set out in the road opening license.

16.5.3 Works on the Turbine Delivery Route

Works will be required at a number of locations along the Turbine Delivery Route from Foynes Port to the Site as described in Section 16.4.3. The works from Foynes Port to the L6132 junction will include the temporary removal or relocation of street furniture and no works that will impose environmental effects. The TDR works along the L6132 will be carried out under a road opening licence and traffic management plan approved by Clare County council. A TMP has been prepared for the Ballykett wind farm development and is submitted with this application (see Appendix 16.2). These works may have a slight, negative, temporary effect on residents, businesses and road users due to increased noise and vibration resulting from construction activities and increased journey times and delays due to temporary traffic management. However, these effects will be confined to a very short period during the construction phase, prior to the delivery of turbine components and hence are not predicted to have a significant effect. Once works have been completed, the works will be reinstated in accordance with the requirements and specification of Clare County Council or to its pre-existing condition.

16.5.4 Light Vehicles/Vans and Construction Personnel

The number of staff on the Site will vary according to the phase of the construction works being undertaken on Site. Staff numbers on Site are expected to reach approximately 40 during Turbine Foundation construction. It is expected that the majority of workers will arrive onsite in mini-buses and crew vehicles which are used to transport teams of workers from the various contractors. Vehicle sharing will be actively encouraged to reduce vehicular movements. A number of additional unscheduled visits may be required throughout the construction period for Site inspections, Site meetings, and unforeseen circumstances.

It is expected that a maximum of 35-40 vehicles will visit the Site on a daily basis during the peak construction period (Turbine Foundation construction). Parking for staff will be provided at the Temporary Construction Compound on the wind farm Site and at designated locations within the work zone during Turbine Delivery Route works on the public road network. No parking will be allowed for construction workers on the public road network in any other circumstance.

16.5.5 Air Quality

Good air quality is essential for the health and quality of life of residents in the vicinity of the wind farm Site and along the turbine delivery and construction traffic haul route. Transport accounts for a significant proportion of pollutants in the atmosphere namely, CO_2 emissions, nitrogen dioxide (NO_2) and particulate matter (PM_{10}). NO_2 emissions can also be harmful to

vegetation and ecosystems in the vicinity of the wind farm Site, Turbine Delivery Route and construction traffic haul route. The increase in traffic movements on the regional and national road network will average approximately 160 (two way) trips per day over a short-term period and therefore the effect of the Development on air quality will be imperceptible. Construction HGV's, LGV's and private vehicles are subject to government HCV, LCV and NCT emissions tests.

16.5.6 Noise and Vibration

There is likely to be some noise and vibration from increased HGV movements along the turbine delivery route and construction traffic haul route to the wind farm Site which may cause disturbance to residents living along this road. Due to the relatively low number of trips generated per day in relation to existing traffic volumes on the national and regional road network, the restrictions on working hours and the short-term nature of the construction phase, the effects are not predicted to be significant. Construction HGV's, LGV's and private vehicles are subject to government HCV, LCV and NCT noise and suspension tests.

16.5.7 Pedestrians and Vulnerable Road Users

Pedestrian and other vulnerable road users may be affected by the works at the wind farm site entrance, enabling works on the Turbine Delivery Route, construction traffic haul route modifications, grid connection works and vehicle movements during delivery of turbine components. The construction of the wind farm site entrance and modifications to the public road network at various locations along the Turbine Delivery Route will be carried out under a road opening licence and traffic management plan which will accommodate pedestrians at the works locations. Pedestrian facilities may be altered for short periods during the transportation of turbine components. During these periods alternative arrangements will be put in place for pedestrians. The effect on pedestrian safety is therefore considered not to be significant and short term.

16.5.8 Driver Delay

Projected traffic volumes for future years on the N68, R483 and L6132 are shown in **Table 16.16** and compared against the impact of peak construction traffic associated with the wind farm Development.

Table 16.16: Future Traffic Flows – With / Without Development (Concrete Pour)

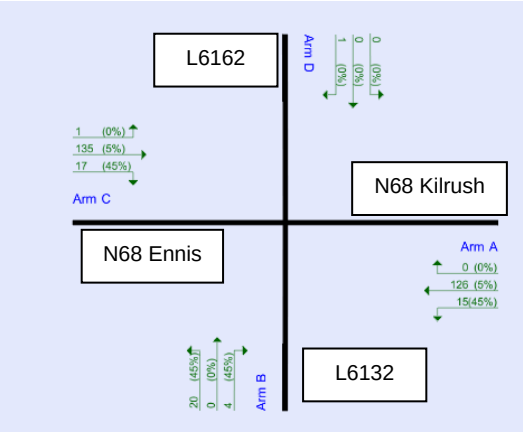
Year	N68			R483			L6132		
	AADT	HGV's Per Hour	%HGV	AADT	HGV's Per Hour	%HGV	AADT	HGV's Per Hour	%HGV
2023–No Development Traffic	2,870	15	5.0%	1,370	1	1.0%	170	1	<1.0%
2023–With Development Traffic	3,062	35	11.0%	1,599	21	12.0%	384	21	45.00%
2024–No Development Traffic	2,890	16	5.00%	1,385	1	1.0%	175	1	<1.0%
2024–With Development Traffic	3,082	36	11.0%	1,515	21	12.0%	390	21	45.00%
2025–No Development Traffic	2,930	17	5.00%	1,400	2	1.0%	180	1	<1.0%
2025–With Development Traffic	3,122	37	11.0%	1,630	22	12.0%	395	21	45.00%
2026–No Development Traffic	2,960	18	5.00%	1,415	2	1.0%	185	1	<1.0%
2026–With Development Traffic	3,152	38	11.0%	1645	22	12.0%	400	21	45.00%

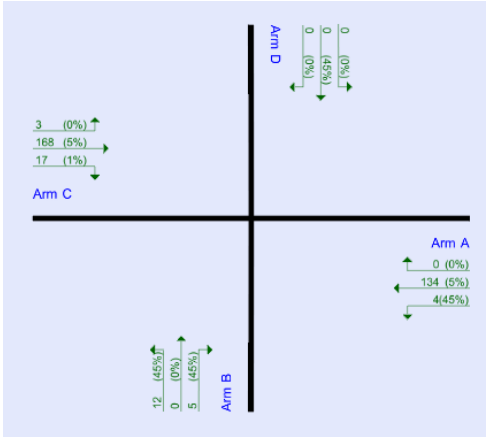
There is potential for driver delay on the public road network due to HGV turning movements and traffic management associated with Site access construction, road widening, Grid Connection and enabling works for the Turbine Delivery Route. Traffic analysis carried out for the development shows that delays of approximately 30 seconds can be expected at temporary traffic lights on the on the N68 if required during modifications to the junction for abnormal load vehicles. Delays of approximately 30 seconds can be expected at temporary traffic lights on the R483 during Grid Connection works which will cross the R483 at Tullabrack Cross. Traffic analysis for the N68 / L6132 junction and the R483 / L6132 junction show that the junctions will operate within capacity and will not cause any significant delays for motorists with the additional traffic generated during the wind farm construction period. A summary of the traffic analysis during the construction period is shown in **Table 16.17.**

Table 16.17: Traffic Analysis

N68 / L6132 / L6162 Junction – 2026 Traffic Analysis and Turning Movements with Construction Traffic

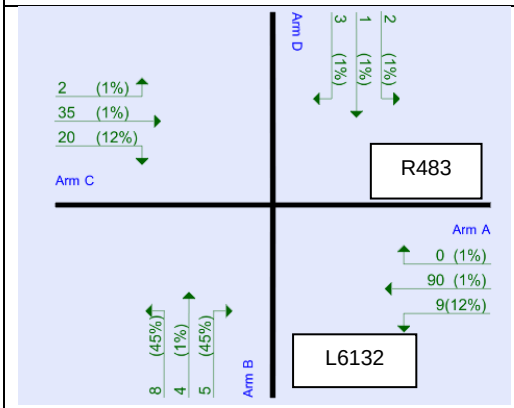
	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
2026 Construction Traffic - N68 / L6132 / L6162 Junction																		
Stream B-ACD	D1	0.1	0.7	10.53	0.05	B	1.28	A	478 % [Stream B-ACD]	D2	0.1	0.7	10.95	0.04	B	0.88	A	435 % [Stream B-ACD]
Stream A-BCD		0.0	~1	0.00	0.00	A					0.0	~1	0.00	0.00	A			
Stream D-ABC		0.0	~1	0.00	0.00	A					0.0	~1	0.00	0.00	A			
Stream C-ABD		0.1	0.6	7.38	0.03	A					0.0	0.5	5.34	0.03	A			

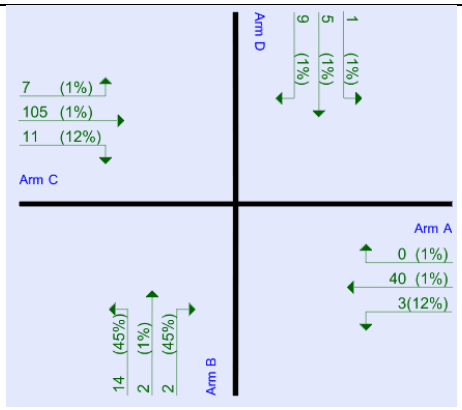




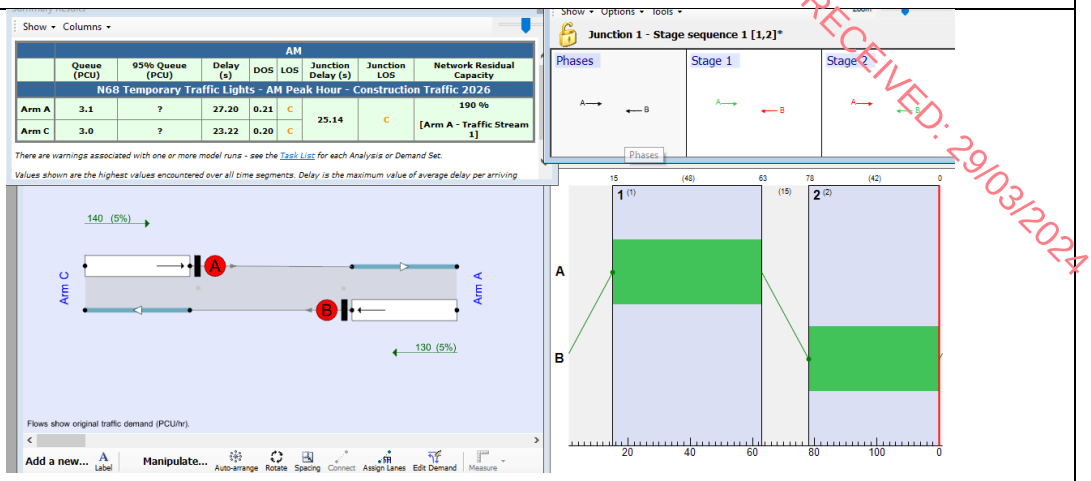
N68 / L6132 / L6162 Junction – 2026 Traffic Analysis and Turning Movements with Construction Traffic

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	De-lay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
2026 Construction Traffic - R483 / L6132 Tullabrack Cross																		
Stream B-ACD	D1	0.1	0.6	10.48	0.04	B	2.05	A	626 % [Stream B-ACD]	**D2**	**0.1**	**0.7**	**9.82**	**0.04**	**A**	**1.96**	**A**	**579 % [Stream D-ABC]**
Stream A-BCD		0.0	~1	0.00	0.00	A					**0.0**	**~1**	**0.00**	**0.00**	**A**			
Stream D-ABC		0.0	0.5	8.03	0.01	A					**0.0**	**0.5**	**9.04**	**0.04**	**A**			
Stream C-ABD		0.0	0.5	6.64	0.04	A					**0.0**	**0.5**	**5.99**	**0.02**	**A**			

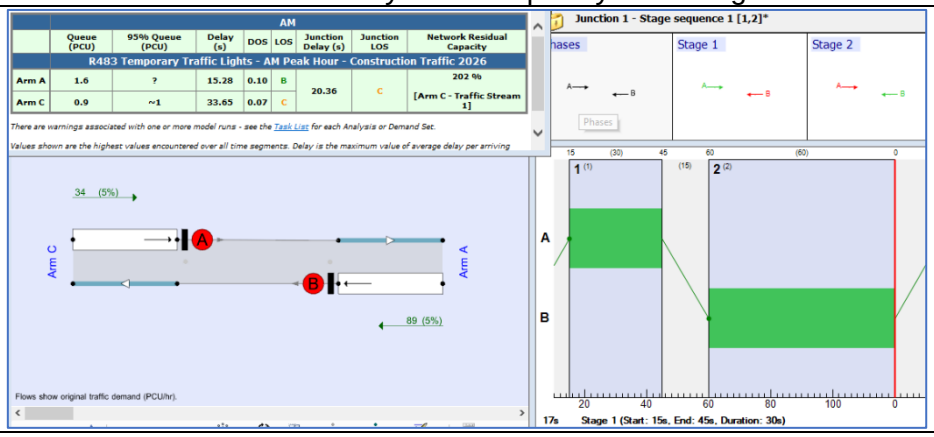




N68 – 2026 Construction Traffic Analysis – Temporary Traffic Lights



R483 – 2026 Construction Traffic Analysis – Temporary Traffic Lights



Delays are expected on the Turbine Delivery Route during the delivery of turbine components due to the abnormal load vehicles. Abnormal load deliveries will be carried out with an abnormal load permit and timed to take place outside of peak times, possibly at night, and therefore the potential effects are not considered to be significant. The abnormal load convoys will be accompanied by escorts who will provide traffic management for abnormal load convoys with prior agreement of the local Gardai Siochana and the Roads Departments in the respective Council areas through which the Turbine Delivery Route is routed.

16.5.9 Severance

Severance is caused when a community is perceived to be physically divided by traffic. The turbine delivery and construction haul route to the wind farm Site will use the existing national and regional road network to access the Site, therefore, potential effects are not predicted to be significant.

The proposed road works will have little or no effect on accessibility (apart from the construction of these road works when traffic management measures may cause driver delay). However, any widening works at Tullabrack junction will promote a slight positive improvement in accessibility.

16.5.10 Mud and Debris on the Local Road Network

HGVs leaving the Site have the potential to transport mud, stones or other debris from the Site to the public road network on wheels of the vehicles. This could cause nuisance to local road users or damage to vehicles from loose debris. This effect can be predicted to be direct, negative, minor and short-term in nature confined to the construction and Initial Decommissioning phases only.

16.5.11 Operational Phase – Traffic

During the operational phase of the Development, the wind farm will normally be unmanned. Operational and remote monitoring activities will be carried out on an ongoing basis via telephone and computer links. However, regular visits to the Site will be necessary for maintenance and routine inspections. A car or van will normally be required for these routine inspections. Under normal circumstances, the operation of the wind farm would require 1-2 visits to the Site per week by trained personnel and/or accompanied visitors. Parking will be provided outside the new on site substation and at turbine entrances. In the case of a major fault e.g., breakdown of a turbine component, larger machinery, including possibly mobile cranes, will require access to the Site.

There will be a low volume of traffic generated during the operational phase of the Development. The effect of traffic associated with the operation of the Development on the existing public road network will be imperceptible due to the type of traffic and the low volume of traffic generated during operation.

16.5.12 Traffic Impact During Wind Farm Decommissioning Phase

During Decommissioning, it is envisaged that the total volume of HGV traffic will be relatively small compared to the construction period. Turbine Foundations, Electrical Substation building, Site access tracks and Turbine Hardstands will remain in-situ, with the turbine Foundation and hardstand surface area landscaped and allowed to revegetate. This means only the turbines, building materials and electrical equipment will be removed from Site for recycling/reconditioning or disposal in a licenced facility. The Decommissioning phase is expected to last approximately 16 weeks and the effect of wind farm Decommissioning is predicted to have an imperceptible effect on traffic.

16.5.13 Need for a Road Safety Audit

A Road Safety Audit is required for all National Road Schemes. TII Publication GE-STY-01024, Dec. 2017 sets out two categories of scheme:

- Road Scheme – A scheme which results in new road construction or permanent change to the existing road or roadside layout.
- Development Scheme – A Scheme which results in a change to the road or roadside layout that is indicated and/or executed for commercial or private development.

The Development will use the N68 National Road but, apart from a localised section of widening at the junction with the L6132 local road, does not propose any modifications to the National Road. None of the modifications in TII Publication GE-STY-01024, (Dec. 2017) Appendix A – Scheme Type and Audit Stage of GE-STY-01024 are proposed.

Accordingly, a Road Safety Audit is not required.

16.6 MITIGATION MEASURES

The potential effects of the Development have been identified as being short-term in nature and associated with the construction and Decommissioning stages. Effects during operation have been assessed as being imperceptible and hence mitigation measures are not needed during that phase of the Development. However, it is still important that any effect is minimised as far as possible. Therefore, the following mitigation measures are recommended:

- Prior to delivery of abnormal loads i.e., turbine components, the Developer or their representatives, will consult with An Garda Síochána and Clare County Council to discuss the requirement for a Garda escort. The Developer will also outline the intended timescale for deliveries and efforts can be made to avoid peak times such as school drop off times, church services, peak traffic times where it is considered this may lead to unnecessary disruption, and abnormal loads may travel at night and outside the normal construction times as may be required by An Garda Síochána. Local residents at sensitive locations along the affected route will be notified of the timescale for abnormal load deliveries.
- Wheel cleaning equipment will be used on the site access track near the public road junction to prevent any mud and/or stones being transferred from Site to the public road network. All drivers will be required to see that their vehicle is free from dirt and stones prior to departure from the construction Site.
- In addition, any dust generating activities will be minimised where practical during windy conditions, and drivers will adopt driving practices to minimise the creation of dust.

Where conditions exist for dust to become friable, techniques such as damping down of the potentially affected areas may be employed.

- To reduce dust emissions, vehicle containers/loads will be covered during both entrance and egress to the Site where required.
- A survey of the Turbine Delivery Route will be undertaken prior to construction to identify if any overhead lines will need to be lifted along the route to allow abnormal loads such as tower sections and nacelles to be delivered.
- Turbine component deliveries will be timed to avoid peak times and in particular, times when pupils will be dropped off and picked up from the various schools on the Turbine Delivery Route.
- During the wind farm construction and Decommissioning phases, road works signs in accordance with the requirements of Chapter 8 of the traffic Signs Manual will be erected at the wind farm Site entrance on the N68 and at all locations on the Turbine Delivery Route which are being modified to facilitate turbine delivery.
- Access to the construction Site will be controlled by on Site personnel and all visitors will be asked to sign in and out of the Site by security/Site personnel on entering and exiting the Site. All Site visitors will undergo a Site induction covering Health and Safety issues at the contractor's Temporary Construction Compound and will be required to wear appropriate Personal Protective Equipment (PPE) while onsite.
- Road closures and traffic diversions will only be used on the public road network during Grid Connection works at locations where existing road widths do not permit alternative traffic management measures.

16.7 CUMULATIVE EFFECTS

The Clare County Council website was accessed to check for large capital projects. Current TII projects in County Clare include:

- Killaloe Bypass/Shannon Bridge Crossing/R494 Upgrade
- N67/N85 Inner Relief Road, Ennistymon (Blake's Corner)
- Limerick Northern Distribution Road
- N19 Shannon Airport Access Road Improvement Scheme

These are all in excess of 25km from the Ballykett Wind Farm and will not have any cumulative effect on Ballykett Wind Farm or its haul routes.

Table 2.1 of **Chapter 2: Project Description** (Section 2.3.2) sets out the existing and proposed wind farms within 20km of the Site.

Apart from two wind farms viz. Shronowen and Moanmore South, all other wind farms listed in Table 2.1 are operational. Shronowen Wind Farm, located in Co. Kerry was granted permission by An Bord Pleanála on 27/09/2022 Case Reference PA08.309156. From a review of the EIAR attached to that application it is evident that the construction of Shronowen Wind Farm will not use any of the haul routes proposed for Ballykett Wind Farm.

The proposed Moanmore South Wind Farm (3-turbine site) is some 3.27km west of Ballykett Wind Farm. It is likely to be serviced via the N68 and the Doonbeg Road. There is potential for cumulative impact during deliveries of concrete or stone or during turbine deliveries. During the placing of concrete for a foundation, the number of HGV loads (75 per day) will be similar for both wind farms.

The Clare County Council Planning portal was accessed to check planning permissions granted within a 10km radius of the wind farm and other major development or proposed developments (larger than a one-off house) are summarised in Table 2.2 of Section 2.3.3 of Chapter 2.

Much of the non-wind planning permissions relate to (see **Table 2.2**):

- Livestock slatted units;
- Solar Farm;
- Ballroom;
- Wastewater Project;
- 400kV Electrical Line Upgrade Works;
- Graveyard Extension;
- Pitch and Putt Course;
- Conversion of building to apartments; and
- External Refrigeration Unit.

In terms of their scale, it is considered that the construction of the agricultural buildings would only have a negligible to minor localised impact on traffic should their construction be concurrent with the Project as none are located close to the Ballykett wind farm Development (all are 6.9 – 7.2km distant). They will also be serviced by N68 and R483 which have capacity to handle any increase in traffic volumes associated with the developments.

Kilrush Sewerage Scheme (Planning Ref. 21203 & 19643) is currently under construction[3] and will be complete prior to the commencement of construction of Ballykett Wind Farm.

The construction of the ballroom at Trump International Golf Links Hotel at Doonbeg (8.5km northwest of Ballykett Wind Farm) (Planning Ref. 18930) has not commenced. The geographical location of the project is such that potential cumulative impact could occur should both the ballroom site and the Ballykett Wind Farm be supplied with stone or concrete from Glenmore Quarry when traffic could increase on the section of road between the quarry and the junction with the R423 at Creagh Cross.

The construction of two water storage tanks one of 2,000m^3 capacity and one of 1,000m^3 capacity (Planning Ref. 17809) within the power station site at Moneypoint has been completed.

Upgrade work on the 400kV line (Planning Ref. 101011) have been completed.

The refrigeration plant order (Planning Ref. 20506) is to be constructed at Aldi, Ennis Road, Kilrush and Planning Permission will expire on 17th October 2025. It will have dimensions of 13m x 5m x 2.8m high and will be adjacent to the existing supermarket building. The works are small in scale and will not have any cumulative impact with Ballykett Wind Farm.

The pitch and putt course (Planning Ref. 19380) is a localised development (2.255ha site) at Kilrush and will largely use existing soil without the need to transport any significant quantities. However, there will be a requirement to import stone for 22 car parking spaces as well as building materials for a reception hut of 19.35m^2. These could require up to 20 deliveries of stone and building materials. The site is accessed from Wilson Road which links the N68 and R473. As the Grant of Planning Permission will expire on 11th October 2024, it is likely that the work will be complete in advance of construction of Ballykett Wind Farm which would start construction in 2026.

The proposed solar farm (Planning Ref. 18679) is to be located immediately west of Tullabrack Wind Farm. The section of Local Road between Tullabrack Cross (R483) and Tullabrack 110kV substation (c.1.22km long) will be used for the grid connection to Ballykett Wind Farm. This will also form part of the haul route/access route to the solar farm.

[3] www.water.ie/projects/local-projects/kilrush-sewerage-scheme

Construction has not yet commenced, and the Grant of Planning Permission will expire on 17th November 2023 unless extended which would involve the completion of substantial works (likely to be site roads) during 2023. From a review of Appendix 5 of the documents submitted as part of the Planning Application Ref. 18679, some 125 loads (stone/gravel) will be delivered for site roads. It is possible that construction of the balance of the solar farm could occur at the same time as the Ballykett Wind Farm. From Section 5.65 to 5.67 of Appendix 5 of the documents submitted as part of Planning Application Ref. 18679, the balance of loads is 179 which would be delivered over a 4-month period peaking at 15HGV deliveries (30HGV movements) per day. Some 10-15 staff vehicles (20-30 vehicle movements) will arrive on site at peak construction periods (see Section 5.71 of Appendix 5 to Planning Application Ref. 18679). Thus, there is the potential for up to 60 vehicle movements per day and for cumulative impacts to occur.

There could also be cumulative effects should blades need to be replaced in an operational wind farm (e.g., Tullabrack) during the construction phase. However, in the unlikely event of such a scenario the replacement blades would have a 3-4 month lead time and deliveries can be co-ordinated. It would not lead to significant effects.

Taking the above potential cumulative impacts into account, the following mitigation measures are proposed:

- Construction activity on concurrent projects will be scheduled such that large concrete pours will not be scheduled on the same day i.e., placing of concrete for a turbine foundation at Ballykett Wind Farm will not be scheduled on the same date as for Moanmore South Wind Farm or the ballroom at Doonbeg.
- Delivery of turbine components will be scheduled such that deliveries to Ballykett Wind Farm will be on different dates than deliveries to Moanmore South Wind Farm.
- Construction of the grid connection between Ballykett Wind Farm and Tullabrack 110kV substation will be co-ordinated such that no work will be carried out on the grid connection during the 4-months when solar PV panels, inverter etc. are being delivered to site.
- Traffic Management Measures during the construction of the grid connection between Ballykett Wind Farm and Tullabrack 110kV substation will be such as to allow access to Tullabrack 110kV substation, Tullabrack Wind Farm and Moanmore South Solar Farm.

16.7.1 Operational Phase

The level of maintenance traffic is normally 1-2 visits per week per wind farm with 5-6 visits per week for a month per year during servicing.

For the operational period of the solar farm, some 5-10 light goods vehicles are expected each year (Section 5.77 of Appendix 5 to Documents submitted for Planning Application Ref. 18672).

Traffic during the operation periods of Ballykett Wind Farm as well as the neighbouring sites viz. Tullabrack Wind Farm, Moanmore South Solar Farm and Moanmore South Wind Farm will be low and in the range of 0 – 10 trips per day. The effect is rated as being insignificant.

16.7.2 Decommissioning

The wind farms and the solar farm have operational periods (generally 25-35 years following commissioning) prescribed by their planning permissions and application documents. No two wind air solar farms will be connected at the same time by ESB/EirGrid due to issues of electrical safety. Therefore, the operational life of the various wind farms will expire on different dates. The decommissioning periods are relatively short (4-6 months). Accordingly, only slight impacts over those assessed in **Section 16.5.12** are predicted. It is unlikely that any significant cumulative impacts will arise.

16.8 RESIDUAL EFFECTS OF THE DEVELOPMENT

16.8.1 HGV Deliveries

On the Turbine Delivery Route, there is likely to be a slight, negative, short-term residual effect on the road network with an increase in abnormal load traffic volumes on the roads and enabling works at locations along the delivery route. In terms of the construction Haul Route, the Development is likely to have a minor residual effect on the local road network given increased traffic volumes on the road network are unavoidable. However, with the mitigation outlined, these effects will be minimised and will not be significant.

16.8.2 Operational Phase Residual Effects

There will be no residual effects during the operational phase as only occasional light vehicles are envisaged to visit the Site during operation for routine checking and maintenance as outlined in **Section 16.5.11**.

16.8.3 Decommissioning Phase Residual effects

On the Turbine Delivery Route, there is likely to be a slight, negative, short-term residual effect on the road network with an increase in traffic volumes. Turbine components will be reduced in size and transported to a licenced recycling facility. Effects during the Decommissioning phase have been assessed to be small compared to the construction phase. Turbine hardstands and Site access roads will be left in place and revegetated rather than removed from Site and the effect of the decommissioning phase can be assessed as being imperceptible.

16.9 MONITORING

The public road network near the Site used to transport construction materials will be monitored during construction so that any damage caused by construction traffic associated with the Development can be identified and maintenance works carried out as soon as practicable to avoid issues for other road users and the local population of the area.

The appointed contractor will be responsible for seeing that HGV drivers travelling to and from the Site obey the designated speed limits, rules of the road and that they only use the designated Haul Route. This will be done through regular tool-box talks for drivers.

16.10 SUMMARY OF SIGNIFICANT EFFECTS

This section has assessed the significance of potential effects of the Project on traffic and transport. The Project has generally been assessed as having the potential to result in effects of a negative, slight/moderate, direct, short-term, high probability effect or lower during the construction and Decommissioning phase only. After mitigation, the residual effects have been assessed as imperceptible/slight, negative and short-term in nature. There will be a slight positive residual effect from verges having been widened at locations along the Turbine Delivery Route. This effect could be temporary or permanent depending on the preference of Clare County Council.

Potential cumulative effects were assessed as being slight, negative, short-term and low probability in nature. There was also a slight positive residual effect identified in terms of the works on the Turbine Delivery Route.

Given that only effects of significant effect or greater are considered "significant" in terms of national legislation as detailed in chapter one, the potential effects of the Project on traffic and transport are considered to be **not significant**.

16.11 STATEMENT OF SIGNIFICANCE

This assessment has identified no potentially significant effects, given the mitigation measures embedded in the design and recommended for the implementation of the Project.

17 INTERACTIONS OF THE FOREGOING AND A SUMMARY OF MITIGATION MEASURES

17.1 INTRODUCTION

The purpose of this Chapter is to identify significant interactions and interdependencies in the existing environment and set out the likely interactions of, and between effects predicted as a result of the Project. Impact interactions and inter-relationships have been considered throughout the EIA process. The foregoing topics in earlier chapters do not exist in isolation from each other and consequently, any impact on one element of the environment may also affect another.

The requirement for the identification of interactions between the various aspects of the environment as detailed throughout the EIAR is set out in Article 3(1) of the amended EIA Directive 2011/92/EU as amended by the Directive 2014/52/EU, which states:

> *The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors: a) population and human health; b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC; c) land, soil, water, air and climate; d) material assets, cultural heritage and the landscape and e) the interaction between the factors referred to in points (a) to (d)."*

The Environmental Protection Agency (EPA) has developed a sample matrix to show the key interactions and interrelationships between the environmental aspects of a Development (**Table 17.1**). The interactions between effects on different factors have been addressed throughout the EIAR (**Table 17.2**); the cumulative slight effect on a number of topics may result in a significant effect on another topic.

17.2 STATEMENT OF AUTHORITY

This chapter has been prepared by Jennings O'Donovan & Partners Limited. It was Prepared by Mr. David Kiely and Ms. Sarah Moore, with the assistance of Mr. Darren Timlin.

David Kiely has undertaken EISs/ EIARs for wind farms throughout Ireland. He has 39 years' experience in the civil engineering and environmental sector and has obtained a Bachelor of Engineering Degree in Civil Engineering and a Master of Science degree in Environmental Protection. David has overseen the development of over 50 wind farms from feasibility, planning and environmental assessment through to construction.

Sarah Moore is an Environmental Scientist in JOD with over 17 years of environmental consultancy experience. She has obtained a MSc in Environmental Engineering from Queens University, Belfast, and a BSc in Environmental Science from University of Limerick. Since joining JOD, Sarah has worked as a Project Environmental Scientist on a range of renewable energy, wastewater, structures and commercial projects. She has experience in the preparation of Appropriate Assessments, Ecological Impact Assessments, Environmental Impact Assessments and Geographic Information Systems.

Darren Timlin is a Graduate Environmental Scientist with a Bachelor (Hons.) Degree in Environmental Science from the Atlantic University of Sligo. Darren's key capabilities are in report writing, assisting senior consultants and Geographic Information Systems (GIS).

17.3 INTERACTIONS OF THE FOREGOING

17.3.1 Impact Interactions

Where any potential negative effects have been identified during the assessment process, these effects have been avoided by embedded design mitigation or at a minimum, reduced by the proposed mitigation measures. **Table 17.2** outlines interactions between environmental aspects. Technical assessments have assessed pathways, both direct and indirect that can magnify effects through the interaction or accumulation of effects. Effects have been cross-referenced between chapter topics. An outline of potential interactions between chapters/topics is presented in **Table 17.1**.

The assessment of the residual impacts and cumulative impacts of the environmental aspects and developments (Chapter 2 Project Description - Section 2.3.3) undertaken as part of this EIAR found there are no significant adverse residual impacts relating to Population and Human Health, Biodiversity, Aquatic Ecology, Soils and Geology, Hydrology and Hydrogeology, Landscape and Visual Amenity, Noise, Cultural Heritage, Traffic and Transport and Material Assets.

Table 17.1: Summary matrix of Interactions of Negative Impacts during Construction and Operational Phases (Source: Adapted from EIAR Guidelines, 2022)[1]

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

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

Interaction or inter-relationship

No interaction or inter-relationship

[1]. Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Available online at: https://www.epa.ie/publications/monitoring--assessment/assessment/guidelines-on-the-information-to-be-contained-in-environmental-impact-assessment.php [Accessed on 27/02/2024]

Table 17.2: Interactions & Inter-relationships between Environmental Aspects of the Project

Interaction	Description
Population and Human Health & Hydrology and Hydrogeology	Effects could be observed through flood risk polluting water supplies. **Chapter 9: Hydrology and Hydrogeology** considers these aspects. In accordance with recommended mitigation the potential effects associated with surface water and groundwater pollution will be avoided with no increased effects on Population and Human Health. From a cumulative effects perspective, no potential significant cumulative effects, in the form of a diminution of surface water or groundwater resources, have been identified, either from existing development in the area or from proposed future development in the study area.
Population and Human Health & Noise	The noise assessment inherently covers any interaction as the methodology used and limits applied are designed to protect health and amenity. No significant noise effects are expected to affect population and human health receptors as a result of the construction, operation and Decommissioning of the Project. A cumulative effects assessment also concludes that no significant effects on population and human health receptors will occur as a result of this Project proceeding in tandem with other existing or proposed development in the study area.
Population and Human Health & Landscape and Visual	The Construction phase of the Project will see a temporary introduction of machinery and the erection of four turbines into a natural but already modified landscape. **Chapter 11: Landscape and Visual Amenity** assessed the landscape effects, the visual effects and the cumulative effects of the Project. The interactions between the environmental aspects were carefully considered in the EIAR, particularly in the design of the turbine layout. Detailed zone of theoretical visibility maps (ZTVs), route screening analysis and photomontages were prepared to assess the level of impact. Based on the findings of the collective assessments, it is considered that the Project will not give rise to any significant effects, either singly or in combination with other projects. The findings of referenced scientific studies / surveys have been presented in the Population and Human Health Chapter. These findings would support the case for tourists having become accustomed to wind farms in the landscape. On the basis of the scenario where more onshore wind farms will be built in Ireland in the future in order to meet Irelands Climate Action Plan ambitions, the findings from these studies indicate that this will not impact the likelihood tourists will visit the area again.
Population and Human Health & Material Assets: 1. Shadow Flicker 2. Air Navigation 3. Telecommunications 4. Socio-economic	Shadow flicker could potentially effect residences in the absence of mitigation measures. The results from the shadow flicker assessment presented in Chapter 13: Shadow Flicker and EMI show the projected total hours of shadow flicker occurrences per year in the absence of mitigation. The shadow flicker assessment study identified no significant effects to local residences, given that predicted shadow flicker effect incidence is forecast to be less than prevailing European guidance for shadow flicker. Therefore, even without mitigation it is unlikely to cause a significant effect to local inhabited dwellings, which are greater than ten rotor diameters from the turbines (1,500m). The shadow flicker and EMI assessment chapter also discusses software that is installed in the proposed turbines to enable remote control/ stopping the turbines when shadow flicker is predicted. An analysis of potential for cumulative shadow flicker effect has also been carried out and found no significant effects are likely. The potential effects of the Project from shadow flicker are considered to be Not Significant. Operating windfarms have the potential to cause adverse effects on aviation. Rotating wind turbine blades may have an effect on certain aviation operations, particularly

Interaction	Description
	those involving radar. The turbine height can cause obstruction to aviation and the overall performance of communications, navigation and surveillance equipment. All structures over 150m in height are required to have lighting to warn aviation traffic. An aviation constraints analysis and pre-planning applications coping exercise with aviation stakeholders has been carried out in advance of the preparation of this planning application. In adherence to IAA Safety Regulations and ICAO Annex 15, aeronautical obstacle warning light schemes will be installed as requested by IAA, co-ordinates of ground and tip height elevations at each wind turbine location as constructed delivered, and the identification of the provision of the intention to commence crane operations provided within a minimum of 30 days prior to erection. No significant effects are predicted in terms of human beings and air navigation. During operation, wind turbines have the potential to interfere with electromagnetic signals passing above the ground due to the nature and size of the wind farm. During the Construction phase activity, signals may be passed below ground via existing infrastructure. Effects may include overground or underground communication cables, microwave links, telecommunication links, business radio and television reception. In the course of EIA scoping exercise and pre-planning application consultations RTÉ indicated that the Development would have no effect on their fixed linking. However, they asked for a Protocol agreement to be signed should the Development receive planning permission due to the risk of interference with broadcast services. The Applicant is willing to enter into a Protocol agreement with RTE should the Development receive planning permission. In the operational phase, all electrical components, equipment, apparatus and systems will be required by Irish and European law to comply with the EMC Directive 2014/30/EU as amended. Compliance with this Directive will mean that the electromagnetic emissions from these devices will not cause interference to other equipment. Turbine and substation control electronics will be typical of any circuits used by industry or a conventional generating station. There is no potential for interference with the links from other wind farms in combination with the Development. Based on the remote location of the Development and a distance of c.0.6km to the nearest inhabited residential dwelling (excluding derelict and financially involved houses), no effects are predicted on telecommunications or radio reception as a result of the Development. The Project will provide opportunities for local suppliers to be engaged in the Construction and Decommissioning phase. This will be a minor beneficial impact. The Developer will seek to secure positive benefits for the local/regional economy by encouraging the use of local labour, manufacture and suppliers where possible.
Population and Human Health & Cultural Heritage	Damaging a cultural asset could affect tourism; the potential for such an effect has been considered fully in **Chapter 14: Cultural Heritage** and it has been concluded not to be an issue.
Population and Human Health & Traffic and Transport	The Construction phase will give rise to traffic movements of abnormal loads and is likely to create some short-term inconvenience for road users. A Traffic Management Plan (TMP) will be implemented and minimise disruption insofar as possible. Suitable mitigation measures to reduce dust emissions have been outlined in **Chapter 16: Traffic and Transportation**, Section 16.6. It is not considered likely that there will be cumulative effects on population and human health resulting from the combined effects of construction traffic and delivery schedules to the Ballykett wind farm in combination with other projects in the area. Overall, population and human health effects are assessed to be of a short-term nature in respect to traffic and transport and the magnitude effect is considered to be low or **Not Significant**.

Interaction	Description
Population and Human Health & Air and Climate	Air quality and Climate effects during the Construction phase may result from dust emissions from construction activities on Site and associated vehicle exhaust emissions from construction traffic. These interactions have been considered as part of the EIAR, and no significant effects are expected; suitable mitigation measures have been outlined to further reduce potential effects. During the operational phase, the energy generated by the Project will offset energy and the associated emission of greenhouse gases from electricity-generating stations dependent on fossil fuels, thereby having a net positive effect on climate. In doing so, there will likely be reduced effects from climate change on human beings. The cumulative effect of the Project with other Irish renewable generation is considered to be a fundamental change in the climate effects of Ireland's energy supply, which is a **major, positive effect,** that is **Significant** (beneficial) under the EIA Regulations and will contribute to Ireland's binding emission reduction targets.
Biodiversity	All interactions for any habitat or species including those associated with Special Protection Areas (SPA) or Special Areas of Conservation (SAC) are considered in the Natura Impact Statement and not considered further here.
Biodiversity & Hydrology and Hydrogeology	Contamination of surface water and groundwater could occur from many elements of the Project including wastewater sanitation contamination, hydrocarbon contamination, entrainment of suspended solids during earth works, increased entrainment of contaminants and other effects arising due to localised stability issues, amongst other potential sources. Contamination of water quality could effect both flora and fauna including fisheries. Interceptor drains and silt fences will be installed to prevent silt laden runoff to protect the freshwater species. These interactions have been considered as part of the EIAR, with suitable mitigation measures provided to minimise potential effects. The implementation of mitigation recommendations outlined in **Chapter 9: hydrology and Hydrogeology** will avoid or reduce potential effects on Biodiversity receptors to a **low** or **negligible significance** level**.**
Biodiversity & Soils and Geology	Potential effects on biodiversity during the Construction phase could include disturbance to birds and mammals from loss / changes in habitat. Loss of peatland habitat will be mitigated where possible. Restoration will be undertaken in line with the Biodiversity Enhancement Management Plan (BEMP). The biodiversity assessment considers general disturbance to sensitive bird species, including that caused by the sources likely to occur during the Construction and Decommissioning of the Project. The implementation of mitigation recommendations outlined **in Chapter 8: Soils and Geology** will avoid or reduce potential effects to Biodiversity receptors to a **low** or **negligible significance** level.
Soils and Geology & Hydrology and Hydrogeology	The hydrogeological balance of the Site could be impacted by the amount of earth materials excavated. Adopting good practices, planning ahead and real time monitoring in more sensitive (>1m peat depth) areas will see that all excavations associated with the Project will have minimal effect. These interactions have been considered as part of the EIAR, with suitable mitigation measures provided to minimise potential effects. Application of the mitigation measures will reduce the risk of stability issues and effects on hydrology and hydrogeology arising at a localised scale. The implementation of mitigation recommendations outlined **in Chapter 8: Soils and Geology** will avoid or reduce potential effects to Hydrology and Hydrogeology receptors to a **negligible significance** level.
Soils and Geology	The unavoidable residual impacts on the soils and geology environment as a function of the Project is that there will be a change in ground conditions at the Site with the

Interaction	Description
& Landscape and Visual	replacement of natural materials such as peat, subsoil and bedrock by concrete, subgrade and surfacing materials. Stability issues and slope failure arising from vehicular movement could cause significant local or at worst-case scenario landslide effects. Where suitable mitigation measures are applied and proper precautions and planning are executed effectively, the risk of such potential effects can be significantly reduced or are considered avoidable. The details of these measures for ensuring ground stability and eliminating or reducing risk of slope failure to an acceptable level are outlined in Chapter 8 Soils and Geology and addressed in the CEMP (**Appendix 2.1**) No new effects are anticipated during the operational phase of the Project. The implementation of mitigation recommendations outlined **in Chapter 8: Soils and Geology** will incur an imperceptible effect in terms of Landscape and Visual receptors.
Soils and Geology & Cultural Heritage	The Construction phase pertaining to the Project will involve significant ground reduction and topsoil removal throughout the design layout footprint. There is a possibility of encountering archaeological finds/features in any previously undisturbed areas of the Site, during the Construction phase and increasing the area of disturbed soil. These interactions were considered in the EIAR, both in the design of turbine layout and in the design of mitigation measures. Monitoring, including a watching brief in undisturbed portions of the footprint will be carried out. All records will be preserved where found. The operational phase is considered to have no likely or significant direct effects on the cultural heritage resource.
Hydrology & Material Assets	Fisheries may be impacted by a disturbance or contamination of watercourses. Mitigation measures to protect watercourses are outlined in several chapters and include monitoring of Site water run-off during all phases of the Project. The implementation of mitigation recommendations outlined in **Chapter 9: hydrology and Hydrogeology** will avoid or reduce potential effects on Material Assets receptors to a **low significance** level**.**
Noise & Traffic and Transport	Traffic and Transport will create noise on Site and along the access road to the Site. Site contractors will be required to employ the best practicable means of reducing noise emissions from plant, machinery and activities, as advocated in BS 5228. The implementation of mitigation recommendations outlined in **Chapter 10: Noise** will avoid or reduce potential effects on Traffic and Transport receptors to a **low significance** level**.**
Landscape and Visual & Cultural heritage	Landscape and Visual impacts on cultural heritage assets has potential to affect the sense of place or the setting of a cultural heritage asset. In the case of this development no archaeological records exist within the Site of the wind farm. An appraisal of the overall effects of the Project is provided in **Chapter 14: Archaeology and Cultural Heritage** which has concluded no significant effects to cultural heritage assets are expected from the construction and operation of the wind farm subject to standard archaeological monitoring is carried out.
Landscape and Visual & Material Assets	The Irish Aviation Authority (IAA) has outlined criteria regarding tall structures and the procedure for agreeing installation of an aeronautical warning light scheme for the Project. This has been addressed in **Chapter 15: Material Assets** and is not considered further here.
Traffic and Transport & Air and Climate	Impacts on air quality during the construction and decommissioning phase may occur due to dust emissions from construction activities onsite and through increased traffic and associated exhaust emissions from construction traffic. These interactions have

Interaction	Description
	been considered as part of the EIAR, without significant effects being predicted and suitable mitigation measures provided to further reduce potential impacts. The implementation of mitigation recommendations outlined in Chapter 16: **Traffic and Transport** will avoid or reduce potential effects on Air and Climate receptors to a negligible significance level.
Traffic and Transport & Material Assets	During the Construction phase, increased traffic and works along local roads could impact local road users. could lead increased traffic on local roads. The interactions between these aspects were considered in the EIAR and mitigation has been embedded in the design and recommended for the implementation of the Project. This assessment has identified no potentially significant residual effects on access of local road users from Traffic & Transport, from the Project. The implementation of mitigation recommendations outlined in **Chapter 16: Traffic and Transport** will avoid or reduce potential effects on Material Assets to **slight negative to neutral significance** for the duration of the construction and operational lifespan of the Project.

17.4 SUMMARY OF MITIGATION MEASURES

This chapter summarises the potential effects from the proposed development that were considered in detail the foregoing EIAR Chapters. Chapters 5 to 16 of the EIAR outline the findings of the assessment of the predicted effects of the Project on a topic-by-topic basis. The significance of these effects has been assessed using criteria defined in the topic chapters. In the context of the EPA Guidelines (2022), the significance of effects ranges from imperceptible, to not significant, significant and profound.

17.4.1 Embedded Mitigation

Embedded mitigation includes design changes that were made in order to reduce or avoid adverse effects, as well as normal good practice measures. The application of the "mitigation by design" process has avoided most of potentially significant effects. **Appendix 17.1** summarises mitigation measures for all technical assessment chapters. Embedded mitigation is considered in the "Predicted Effect" column in **Table 1 and Table 2** of **Appendix 17.1** and is not treated as "Mitigation" for these purposes. These are outlined in the following locations in the EIAR and details are not repeated here:

- **Appendix 2.1:** Construction Environmental Management Plan (CEMP)
- **Appendix 6.6:** Biodiversity Enhancement and Management Plan (BEMP)

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

- Avoiding inconsistent turbine spacing, outliers and excessive turbine overlapping to minimise visual confusion and ensure a balanced/compact array of key views has allowed for a reduction in adverse effects from a landscape and visual effect perspective.

- Evaluating both the landscape and planning policy objectives set out in the County Clare Development Plan 2023 – 2029 has influenced an appropriate scale of turbine, taking account of the landscape context of the local area.
- Respecting and understanding the ground conditions and topography of the Site, including avoiding effects on active peat where possible and integrating a biodiversity enhancement management plan into the operation of the wind farm Development.
- Maximising the separation from residential dwellings to avoid or reduce visual, noise and shadow flicker effects on residential dwellings.
- Respecting other environmental constraints and associated buffer separations.

17.4.2 Specific Mitigation Measures

In addition to the mitigation proposed to address significant adverse effects (**Appendix 17.1**), some EIAR chapters have also proposed additional measures to further reduce effects that were assessed as 'Not Significant' before mitigation.