FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED FAHY BEG WIND FARM, CO. CLARE

VOLUME 1 – NON-TECHNICAL SUMMARY

Prepared for: RWE Renewables Ireland Limited

RWE

Date: January 2023

Core House, Pouladuff Road, Cork
T12 D773, Ireland

T: +353 21 496 4133 E: info@ftco.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

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1. Introduction

1.1 Site Description

Fehily Timoney & Company (FT) has prepared this environmental impact assessment report (EIAR) on behalf of RWE Renewables Ireland . RWE Renewables Ireland Ltd. intends to apply to Clare County Council for planning permission to construct the proposed Fahy Beg Wind Farm, near Bridgetown, County Clare. The proposed project consists of the following main elements:

- Fahy Beg Wind Farm;
- Turbine Delivery Route;
- Grid Connection Route;

The proposed development is located in the jurisdiction of Clare County Council, approximately 7km south west of Killaloe and approximately 14km north east of Limerick City. The most proximate settlements are the village of Bridgetown, approximately 1.5km to the south east of the site and O'Briensbridge, approximately 3.5km south east of the site. The proposed Fahy Beg Wind Farm development includes lands contained within the following townlands: Fahy More North, Ballymoloney, Ballykavin, Ballyquin More, Woodpark and Leitrim. The location of the proposed development is illustrated in Figure 1-1.

1.2 Development Description

The proposed Fahy Beg Wind Farm will consist of up to 8 no. wind turbine generators, 1 no. meteorological mast, construction of new site tracks, the upgrade of existing agricultural tracks and 1 no. substation compound along with ancillary civil and electrical infrastructure.

The proposed development will have an estimated Maximum Export Capacity (MEC) ranging from 31.2 – 38.4 Megawatts (MW). The exact Export Capacity will be dependent on the output power of the turbine model available at procurement stage which is subject to technological advancements. The proposed turbines will have the following specifications:

- Three bladed, horizontal axis type turbine;
- Tip height ranging from 169m to 176.5m;
- Rotor diameter ranging from 131m to 138m;
- Hub height ranging from 102.5 to 110m

While it is proposed to apply for the above-mentioned limited range of turbine dimensions, if the Council is of a mind to permit the development based on fixed dimensions only for the turbines, we request that the following five fixed dimensions for turbines are consented:

- Tip height of 171.5m, hub height of 106m, blade length of 65.5m;
- Tip height of 169m, hub height of 102.5m, blade length of 66.5m;
- Tip height of 176.5m hub height of 110m, blade length of 66.5m;
- Tip height of 173m hub height of 105m, blade length of 68m;
- Tip height of 176.5m hub height of 107.5m, blade length of 69m.

The EIAR assesses the potential environmental effects of the full range and consequently the options listed above.

The associated grid connection cable will connect the on-site substation to the existing Ardnacrusha Substation located in Co. Clare. This will consist of 38kV cables and will be approximately 10.6 km in length including 10.3 km to be constructed primarily within the existing public road corridor.

Large components associated with the proposed Fahy Beg Wind Farm construction will be transported to the wind farm site via the identified Turbine Delivery Route. It is proposed that turbine deliveries shall approach the site from the North via Foynes Port, the N69, M7, N18, R494, R463, R466 and surrounding local road network. Temporary accommodation works will be required at selected locations along the Turbine Delivery Route to facilitate the delivery of large components to the site. The accommodation works associated with the Turbine Delivery Route are assessed in this report but do not all form part of the proposed development for which permission is sought.

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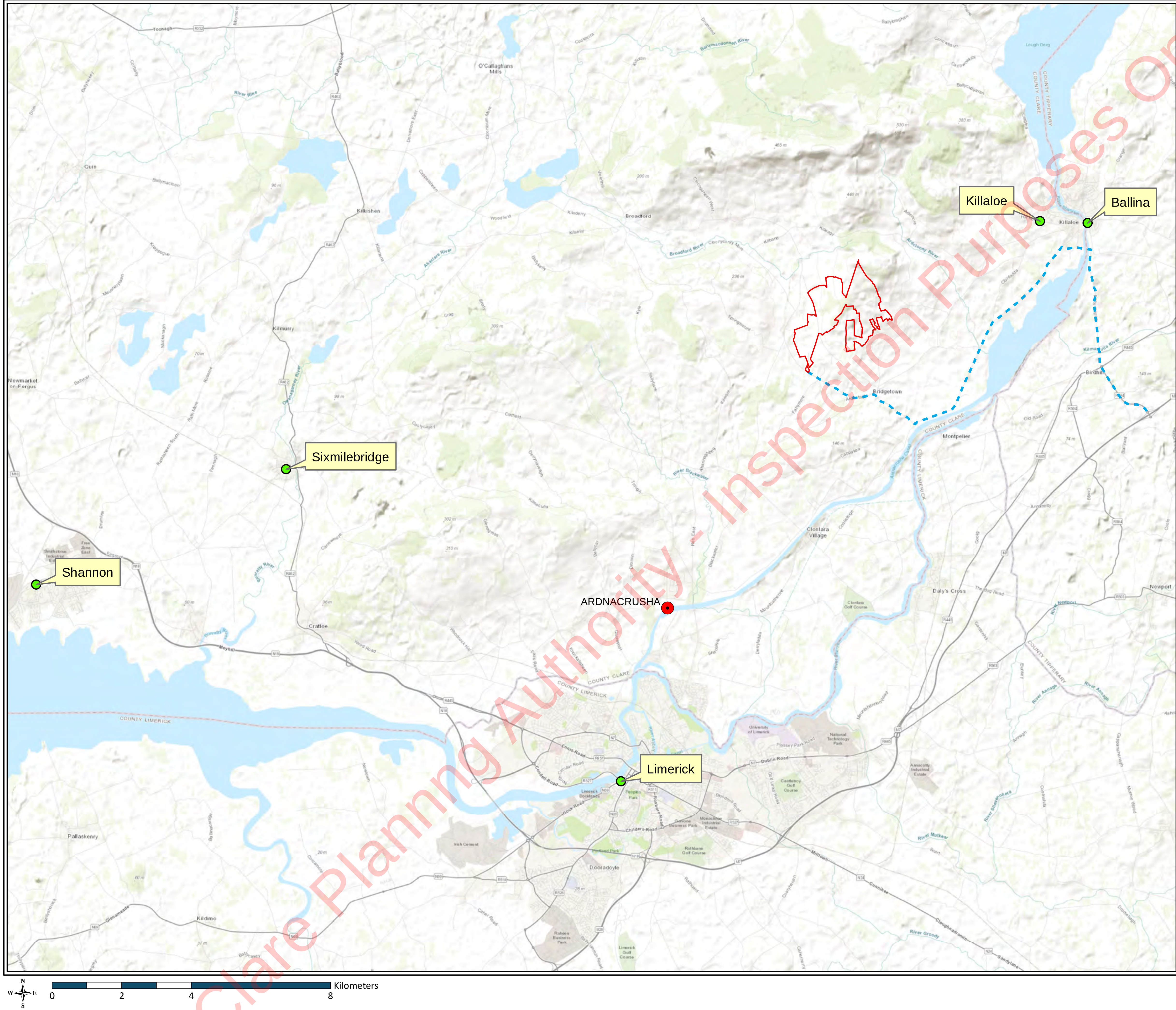
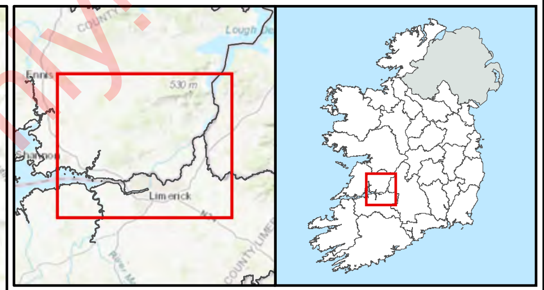
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community Creative and Commons Attribution 4.0 International (CC BY 4.0) licence https://creativecommons.org/licenses/by/4.0/, ESB 2017; If Applicable: Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001219 © Government of Ireland





Legend

- Ardnacrusha Substation (110kV)
- Wind Farm Site
- Turbine Delivery Route

TITLE: General Site Overview	
PROJECT: Fahy Beg Wind Farm, Co. Clare	
FIGURE NO: 1.1	
CLIENT: RWE Renewables Ireland Ltd.	
SCALE: 1:105000	**REVISION:** 0
DATE: 06/01/2023	**PAGE SIZE:** A3

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1.3 EIAR Structure

The EIAR has been prepared in line with EPA guidance document *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (2022). The format of this EIAR is designed to ensure that standard methods are used to describe all sections of the EIAR.

Using this structure there is a separate chapter for each topic, e.g. air quality and climate, biodiversity, hydrology. The description of the existing environment, the proposed development and the potential impacts, mitigation measures and residual impacts are grouped in the chapter. The grouped format makes it easy to investigate topics of interest and facilitates cross-reference to specialist studies.

The EIAR consists of the following chapters:

- Chapter 1 - Introduction
- Chapter 2 - Need for the Development and Alternatives Considered
- Chapter 3 - Description of the Proposed Development
- Chapter 4 - Policy
- Chapter 5 - EIA Scoping, Consultation and Key Issues
- Chapter 6 - Air Quality and Climate
- Chapter 7 - Noise and Vibration
- Chapter 8 - Biodiversity
- Chapter 9 - Land, Soils & Geology
- Chapter 10 - Hydrology and Water Quality
- Chapter 11 – Population, Human Health & Materiel Assets
- Chapter 12 – Shadow Flicker
- Chapter 13 - Traffic & Transportation
- Chapter 14 - Archaeology, Architectural and Cultural Heritage
- Chapter 15 - Landscape & Visual
- Chapter 16 - Telecommunications and Aviation
- Chapter 17 - Interactions of the Foregoing.

The EIAR is structured as follows:

Volume 1 – Non-Technical Summary
Volume 2 – Main EIAR
Volume 3 – Appendices to the Main EIAR
Volume 4 – Landscape and Visual Maps and Photomontages

Also included are:

- A separate Natura Impact Statement (NIS) has also been submitted with the application.

- The application is also supported by Planning Drawings and a Construction Environmental Management Plan

1.4 Permission Period

A ten-year consent is being requested for this development. That is, planning consent for the construction of the development would remain valid for ten years following the grant of permission. The applicant requests a grant of permission on the basis of a 35-year operational period from the date of commissioning of the wind farm.

1.5 Difficulties Encountered

There were no difficulties encountered during the preparation of this EIAR.

2. Site Selection And Alternatives Considered

2.1 The Need for the Proposed Development

The proposed Fahy Beg Wind Farm is necessary to produce renewable energy for the Irish national grid in order to transition Ireland to a low carbon economy. The proposed wind farm will play a role in providing renewable electricity in Ireland, where in November 2021, the Irish Government published a Climate Action Plan (CAP) which sets out an objective to more than double Ireland's onshore wind energy capacity to 8.2GW by 2030 in order to meet new renewable energy targets and reduce emissions (Climate Action Plan, 2021).

At a strategic level, the need for the Fahy Beg Project is supported by International, European, and National environmental and energy commitments and policies. In Chapter 4 of this EIAR, a detailed analysis of these commitments and policies is outlined. This is in the context of substantial and continuing failure by Ireland in meeting climate targets to date.

The Climate Action Plan (2021) provides a framework for delivering the Government's target of a 51% reduction (relative to 2018) in greenhouse gas (GHG) emissions by 2030. CAP21 follows the Climate Act 2021, which commits Ireland to a legally binding target of net zero greenhouse gas emissions no later than 2050, and a reduction of 51% by 2030, with the CAP 2021 stating:

> '*This plan sets a roadmap for taking decisive action to halve our emissions by 2030 and reach net zero no later than 2050, as we committed to in the Programme for Government. The science is indisputable and the effects of climate change are already clear. Extreme weather events are becoming more frequent with devastating consequences. Climate change is here and is already impacting our world, with risks to global security including food supplies. Ireland is also at risk of more frequent storms and flooding. We know we must act, and by acting now we can build a cleaner greener economy and society, which creates opportunities for us all. Implementation of the Climate Action Plan will create jobs, new economic opportunities and protect people and the planet. By delivering on this plan, we will secure the future for our children and grandchildren. It's our chance to make the right choice*'.

It is estimated that the proposed wind farm will have an estimated Export Capacity (MEC) ranging from 31.2 MW to 38.4 MW, depending on final turbine technology installed. Using a rated capacity of 38.4MW, the proposed wind farm has the potential to produce approximately 117,743 MWh (megawatt hours) of electricity per year, which will result in the net displacement of approximately 50,861 tonnes of CO2 per annum, as detailed in Chapter 6: Air and Climate.

2.2 Alternatives Considered

The alternatives considered have particular regard to the environmental considerations which influenced the selection of alternatives and details the evolution of the proposed project through alternatives considered, indicating the main reasons for selecting the chosen option taking into account the effects of the proposed project on the receiving environment and considering the comparison of environmental effects of each alternative.

The alternatives considered have been described in line with the EPA guidance document *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (2022).

Do-Nothing Scenario

Under the "Do-Nothing" scenario, the Fahy Beg Wind Farm project would not go ahead, the development of a renewable energy project is not pursued, and the site remains in use as agriculture and forestry. In the "Do-Nothing" scenario, the prospect of creating sustainable energy through County Clare's wind energy resource would be lost at this site. The nation's ability to produce sustainable energy and reduce greenhouse gas emissions to meet EU targets and National targets, as set out above, would be stifled. This may result in the nation incurring significant financial penalties from the EU if targets are not achieved. The "Do-Nothing" scenario may result in continued global warming and impact upon the intention to "pursue efforts" to limit warming as agreed to in the Paris Agreement (2015). Issues in securing a reliable supply of energy may arise due to Ireland's over-reliance on imported fossil fuels and plans to cease the burning of coal at Moneypoint and peat burning at Bord na Móna's powerplants by 2023. Under the "Do-Nothing" scenario, the socio-economic benefits associated with the proposed development will be lost and the local community will not benefit economically from the community benefit fund associated with the project which could be used to improve physical and social infrastructure in the area of the wind farm site.

Alternatives Considered

The site selection process considered the following criteria: Wind Speeds available; Planning Policy, Landscape Designations, Proximity to existing grid connection points; Airport proximity; Existing electrical generation, grid upgrades and electrical loads in the area; Environmental designations and sensitivities; Existing planned and permitted projects; Tourism amenity; Cultural Heritage sites, Topography; Access route availability; Water bodies; Land use and number of landowners. A number of sites were considered for a wind energy development, however, the Fahy Beg site was found to be optimal for a wind energy development, considering the criteria above.

Alternative layouts for the proposed project considered the following criteria: Set back from houses; Set back from designated sites; Set back from other constraints such as watercourses, public roads and power lines; Suitable wind speeds; Landscape and visual sensitivity; Ecology; Ornithology; Soils and Geology; Hydrology; Noise; and Cultural Heritage. Five separate design iterations were produced in the development of the proposed project, which considered different numbers of turbines and a range of different turbine heights.

Four different substations were considered for a potential connection to the national grid. Following an assessment, the Ardnacrusha 110kV Substation was selected as the optimal connection point due to less environmental sensitivities. Three alternative grid routes were considered between the proposed wind farm site and the Ardnacrusha Substation. The least environmentally sensitive option was chosen.

The alternatives considered throughout the development process of the proposed Fahy Beg Wind farm aimed to minimise the potential impact on the receiving environment while providing significant renewable electricity production to the national grid.

3. Description of Proposed Project

3.1 Proposed Project

The proposed project assessed in the EIAR is comprised of the following key elements and is illustrated in Figure 1-1:

- The wind farm site (also referred to in this EIAR as 'the Site');
- The grid connection;
- The turbine delivery route (also referred to in this EIAR as 'the TDR');

The Site includes the wind turbines, internal access tracks, hard standings, permanent meteorological mast, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm as well as measures designed to protect and enhance existing habitats. The Site includes lands in the townlands of Fahy Beg, Fahy More North, Ballymoloney, Ballyknavin (Ed O'Briensbridge), Ballyquin More, Woodpark, and Leitrim.

The associated grid connection will consist entirely of underground cable and will connect the on-site substation to the existing 110kV substation at Ardnacrusha, Co. Clare. The Grid Connection Route is illustrated in Figure 3-3, below.

The Turbine Delivery Route passes through Foynes Port, County Limerick, the N69, N18, M7, R494, R463 and R466 to the proposed site entrance. The turbine delivery route is illustrated in Figure 3-4, below.

In summary, the proposed project will consist of the following:

- Construction of 8 no. wind turbines with a blade tip height range from 169 m to 176.5 m, a hub height range from 102.5 m to 110 m and a rotor diameter range from 131 m to 138 m;
- Construction of turbine foundations and crane pad hardstanding areas;
- Construction of new site tracks and associated drainage infrastructure;
- Upgrading of existing tracks and associated drainage infrastructure where necessary;
- Use of up to 2 no. existing quarry and agricultural field accesses including upgrades to same as necessary;
- Creation of 1no. new construction access between quarry lands and wind farm entrance.
- All associated drainage and sediment control;
- Installation of new watercourse or drain crossings;
- Re-use or upgrading of existing internal watercourse and drain crossings;
- Construction of 1 no. onsite 38kV electrical substation to ESB Networks (ESBN) specifications and associated compound including:
    - Welfare facilities;
    - Electrical infrastructure;
    - Parking;
    - Wastewater holding tank;
    - Rainwater harvesting tank;

  - Security fencing;
  - All associated infrastructure, services and site works including landscaping;

- Temporary accommodation works associated with the Turbine Delivery Route to facilitate the delivery of turbine components;
- 1no. Temporary construction site compound and associated ancillary infrastructure including parking;
- Tree felling to facilitate construction and operation of the proposed development;
- Installation of medium voltage electrical and communication cabling underground between the proposed turbines and the proposed on-site substation and associated ancillary works;
- Installation of medium voltage (up to 38kV) and communication cabling underground between the proposed on-site substation and the existing Ardnacrusha substation and associated ancillary works. The proposed grid connection cable works will include 7 no. existing watercourse and drain crossings and the installation of up to 14 no. pre-cast joint bays;
- Erection of 1 no. permanent meteorological mast to a height of 100m above ground level;
- Temporary accommodation works along TDR.

3.2 Wind Turbines

The proposed turbines will have a tip height ranging from 169m to 176.5m , a hub height ranging from 102.5m to 110m and a rotor diameter ranging from 131m to 138m. The wind turbines that will be installed on site will be conventional three bladed, tubular tower model with horizontal axis. The rotor blades are bolted to the central hub, which is connected to a generator located in the nacelle. The nacelle holds the following turbine components:

- Generator;
- Electrical components;
- Control unit.

A glass fibre reinforcing polyester hood covers the nacelle. Earthing and isolation protect all components from lightning strikes.

3.3 Turbine Transport

Large components associated with the wind farm construction will be transported to site via the identified Turbine Delivery Route. The proposed access route to site is as follows:

- Loads will depart Foynes Port and turn left onto the N69 travelling east;
- Join the eastbound N18 at Junction 2, Limerick and continue east onto the M7;
- Depart the M7 at Junction 27 and continue north on the R494 towards Killaloe;
- Turn left onto the proposed bypass and utilise the new Shannon River crossing before turning left onto the R463 travelling southbound;
- Continue south on the R463 before turning right onto the R466;
- Loads will continue north on the R466 to the proposed site entrance.

3.4 Construction

The construction sequence is expected to take between 12 – 18 months. There are a number of items which will be conducted in parallel, but the basis of the construction programme will involve site establishment, site access road and drainage construction, hardstanding construction and substation works. The grid connection works are likely to be done in parallel with the site works and the turbine installation works and will be completed before the commissioning, reinstatement and landscaping phases are completed. However it is also possible that the grid route could commence prior to the on-site infrastructure or subsequent to the construction of the on-site infrastructure. Carrying out the grid connection works in parallel with the site works represents the worst-case scenario as all works will be carried out at the same time.

The drainage system for the existing tracks and roads will largely be retained. All track widening will be undertaken using clean uncrushable stone with a minimum of fines. This will involve tree felling and hedge trimming and the upgrade of existing roadside ditches to allow widening.

For cable trenches located in public roads, the contractor will excavate cable trenches and then lay high density polyethylene (HDPE) ducting in the trench in a surround of cement bound material. A rope will be inserted into the ducts to facilitate cable-pulling later.

A similar construction methodology will apply for cable trenches laid within site access tracks. In this case the cable-ducts will generally be laid when the track is being constructed and will follow the edge of the site access tracks. The trenches within these locations will generally be backfilled using the excavated material.

3.5 Operation, Maintenance and Decommissioning/Reinstatement

The expected physical lifetime of the turbine is approximately 35 years, and permission is sought for a 35-year operation period commencing from full operational commissioning of the wind farm.

During the operation of the project some maintenance work may be required for the turbines and underground cabling. It will require maintenance and operations crews to tend to the site periodically throughout the lifetime of the project. It is unlikely that works will be required along the grid connection route during the operational phase unless maintenance is required. It is unlikely that the turbine delivery route will be used during the operational phase unless replacement or maintenance of turbine components is required.

On decommissioning, cranes will disassemble the above ground turbine components which will be removed off site for recycling. All the major component parts are bolted together, so this is a relatively straightforward process. The foundations will be covered over and allowed to re-vegetate naturally. Leaving the turbine foundations in situ is considered a more environmentally sensible option as to remove the reinforced concrete associated with each turbine would result in environmental nuisances such as noise and vibration and dust. It is proposed that the internal site access tracks will be left in place.

Grid connection infrastructure including substation and ancillary electrical equipment shall form part of the national grid and will be left in situ.

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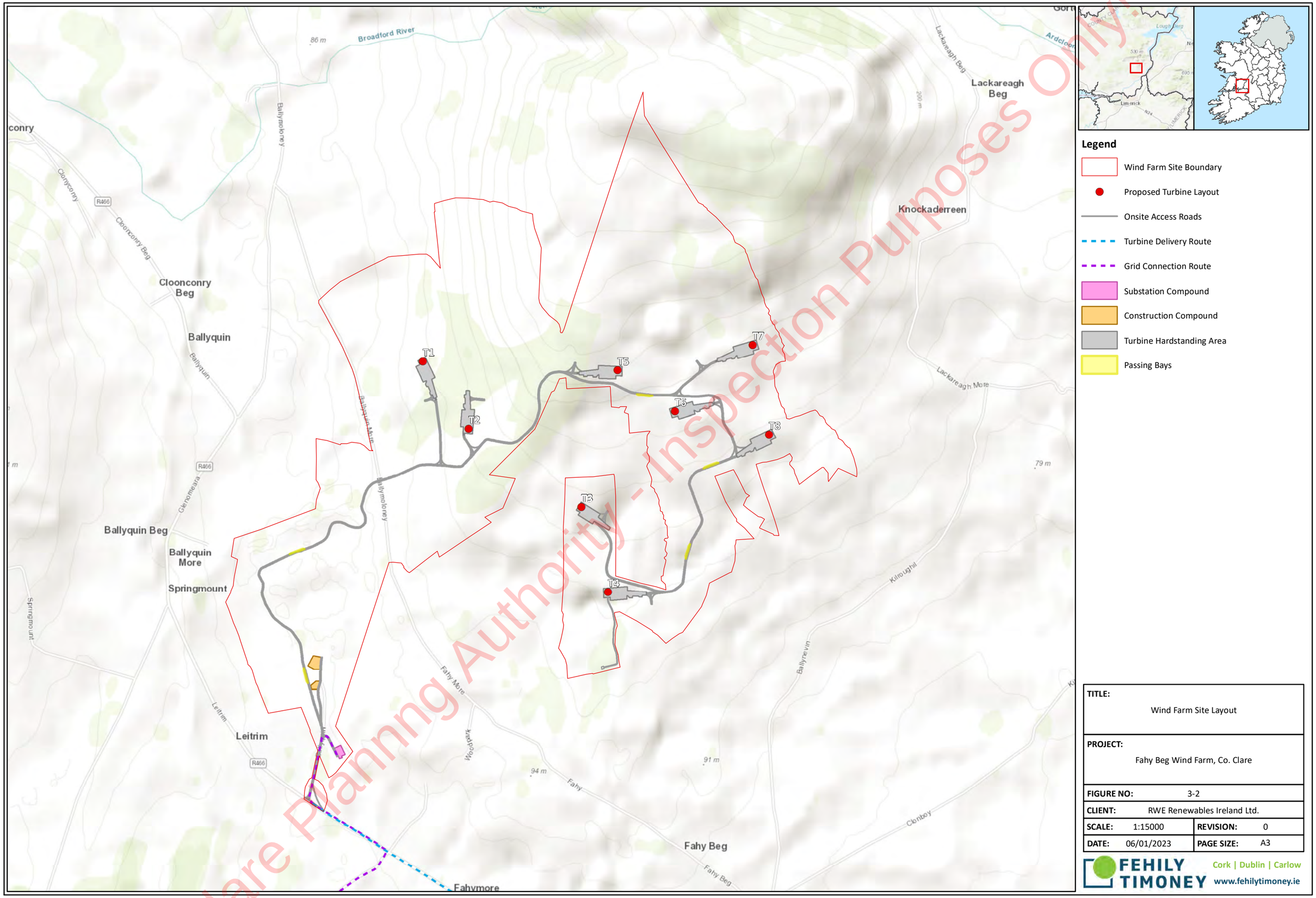

Legend

- Wind Farm Site Boundary
- Proposed Turbine Layout
- Onsite Access Roads
- Turbine Delivery Route
- Grid Connection Route
- Substation Compound
- Construction Compound
- Turbine Hardstanding Area
- Passing Bays

N W E S

0 200 400 800 Meters

TITLE:	Wind Farm Site Layout		
PROJECT:	Fahy Beg Wind Farm, Co. Clare		
FIGURE NO:	3-2		
CLIENT:	RWE Renewables Ireland Ltd.		
SCALE:	1:15000	**REVISION:**	0
DATE:	06/01/2023	**PAGE SIZE:**	A3

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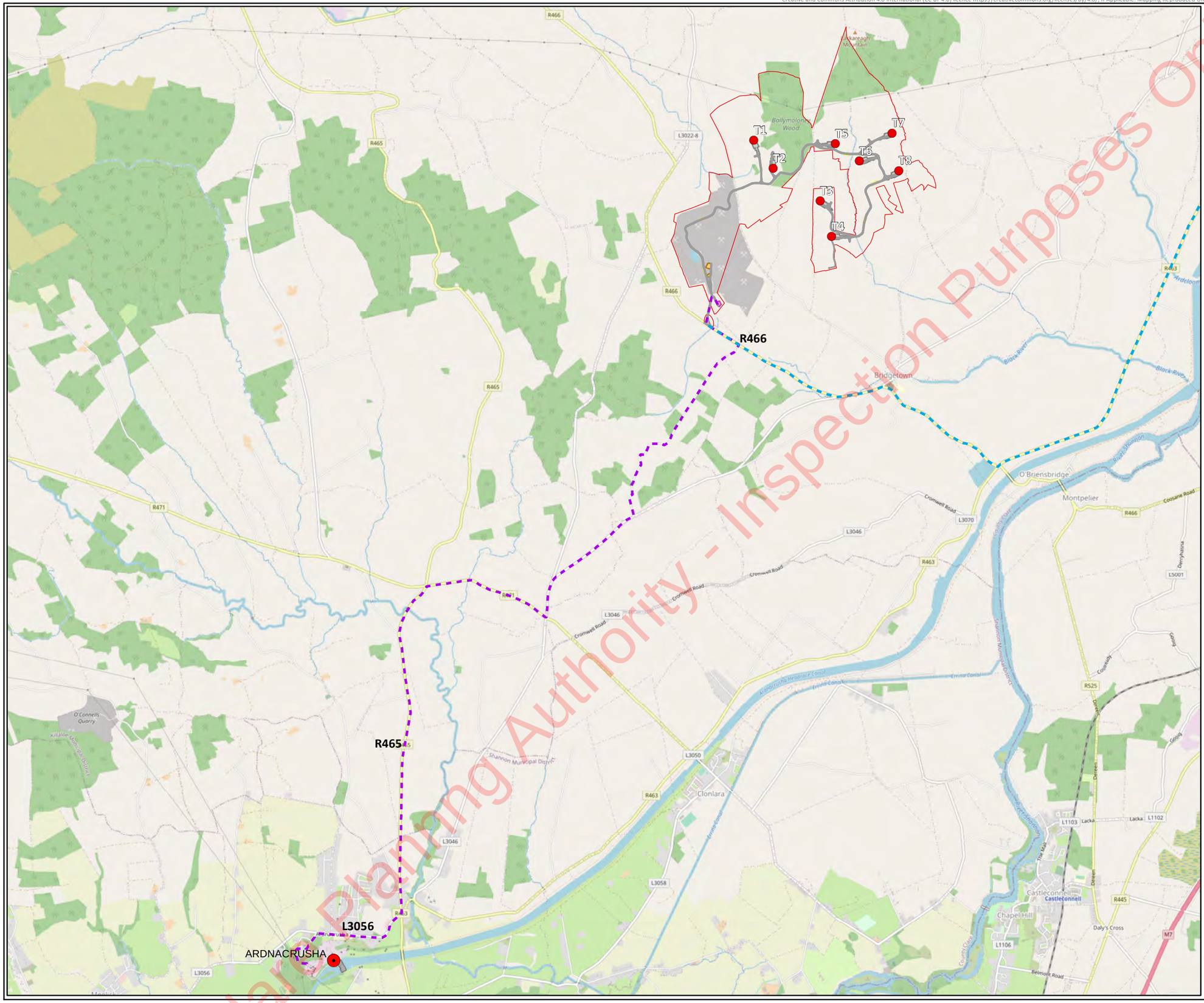

Legend

- Wind Farm Site Boundary
- Passing Bays
- Turbine Hardstanding Area
- Construction Compound
- Substation Compound
- Ardnacrusha Substation (110kV)
- Proposed Turbine Layout
- Met Mast Access Track
- Turbine Delivery Route
- Grid Connection Route
- Onsite Access Roads

N W E S

0 0.5 1 2 Kilometers

TITLE:	Grid Connection		
PROJECT:	Fahy Beg Wind Farm, Co. Clare		
FIGURE NO:	3-3		
CLIENT:	RWE Renewables Ireland Ltd.		
SCALE:	1:40000	**REVISION:**	0
DATE:	06/01/2023	**PAGE SIZE:**	A3

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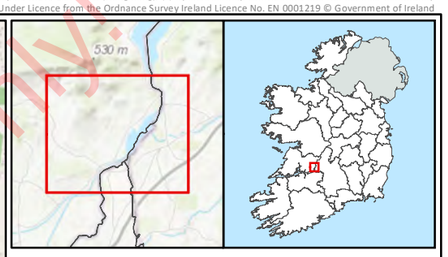

Legend

- Wind Farm Site Boundary
- Turbine Delivery Route
- TDR Nodes

TITLE:	Turbine Delivery Route
PROJECT:	Fahy Beg Wind Farm, Co. Clare
FIGURE NO:	3-4
CLIENT:	RWE Renewables Ireland Ltd.
SCALE:	1:35000
REVISION:	0
DATE:	06/01/2023
PAGE SIZE:	A3

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N W E S

0 0.5 1 2 Kilometers

4. POLICY AND LEGISLATION

4.1 EU Directives and Policies

The section details the latest policies and targets with a view to 2030 and beyond. The various directives and policies of the EU set a clear mandate for each member state to transition to sustainable, renewable energy and reduce greenhouse gas emissions.

Relevant international policies in relation to renewable energy and the need to prevent climate change include the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

EU Directives and Policies include:

- European Union Targets for 2020 and the Irish Context
- 2030 Climate and Energy Framework
- A Roadmap for Moving to a Competitive Low Carbon Economy in 2050
- Clean Energy for all Europeans Package (2019)
- Recast Renewable Energy Directive (RED2)
- European Green Deal (December 2019).
- European Climate Law (July 2021)

Relevant National Policies:

- Climate Action and Low Carbon Development Act 2015
- Climate Action and Low Carbon Development (Amendment) Act 2021
- Climate Action Plan (2021).
- EU Governance Regulation and Ireland's National Energy and Climate Plan (NECP)
- Project Ireland 2040: The National Planning Framework
- Project Ireland 2040: National Development Plan 2021 – 2030
- Ireland's Greenhouse Gas Emission Projections, 2018 – 2040
- National Policy Conclusion.

Regional and Local plans have also been considered including the Southern Regional Spatial & Economic Strategy, the Clare County Development Plan 2017-2023 and the upcoming Draft Clare County Development Plan 2023-2029, which sets out the wind energy strategy for the county. The immediate site area of the proposed Fahy Beg Wind Farm is located within an area described as a 'settled' landscape, that allows for enterprise in which renewable energy is envisioned as a use within, and therefore, can be considered compatible with the existing land use on the site.

The proposed development contributes to the nation's target increase of renewable energy from 30% to 70% by 2030 and supports the doubling of onshore wind energy in Ireland by 2030 as set out in the Climate Action Plan.

4.2 Irish Energy & Environment Policies

The development of the proposed Fahy Beg Wind Farm is in support of national policy. The project supports the enhancement of the competitiveness of rural areas and facilitates the development and diversification of the rural economy by supporting the energy sector and increasing the share of renewables in Ireland's energy mix.

The proposed development contributes to the nation's target increase of renewable energy from 30% to 70% by 2030 and supports the doubling of onshore wind energy in Ireland by 2030 as set out in the Climate Action Plan.

The project supports national targets of climate change mitigation and reduction in greenhouse gas emissions where significant focus has been set out in the recent Climate Action and Low Carbon Development (Amendment) Act 2021. The ambitious new programme for government is prioritising carbon neutrality and renewable energy generation. In light of this, it is important for the nation to rely on proven technologies such as on shore wind in order to meet the near-term objectives, as well as long-term objectives.

The proposed project promotes the generation of renewable energy at appropriate locations and supports the achievement of a low carbon economy by 2050. It is therefore considered that the proposed Fahy Beg Wind Farm is in line with national policy and supports the achievement of national energy and sustainability targets.

4.3 Clare County Development Plan

It is a specific planning policy requirement under Section 28 of the Planning & Development Act 2000 (as amended) that in making Development Plans a planning authority has regard to national policy on renewable energy as contained in the aforementioned policy documents. A County Development Plan is required to indicate how the implementation of the Development Plan will contribute to realising overall national targets on renewable energy and climate change mitigation. This applies in particular to wind energy production and the potential wind energy resource.

The Clare County Development Plan (CDP) 2017-2023 sets out the strategic framework for land use planning in the county.

Chapter 8 of the CDP sets out the energy strategy for the County with an aim to:

> *'' To reduce County Clare's dependence on imported fuels and to provide alternative energy sources by harnessing the County's potential for renewable energy sources''.*

The Clare County Development Plan 2017-2023 is currently under review. The draft County Development Plan 2022-2028 was published in April of 2021. The plan is subject to public consultation, prior to its expected adoption in 2023.

5. EIA SCOPING & CONSULTATION

5.1 Purpose of EIA scoping

The purpose of the EIA scoping process is to identify the key points and issues which are likely to be important during the environmental impact assessment (EIA) of a project and to eliminate those that are not. The scoping process identifies sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors which are likely to be affected. It defines the appropriate level of detail for the information to be provided in the EIAR. In essence, the primary focus of scoping is to define the most appropriate assessment of significant effects related to the proposed development.

A scoping request was sent to relevant parties in March 2021. The scoping process proved beneficial to the identification of potential issues in relation to the proposed Fahy Beg Wind Farm, and identified a range of observations which have been taken into consideration in the preparation of the respective chapters of the EIAR.

Pre-planning consultation was held with Clare County Council to determine the key points and potential impacts of the proposed development and to inform the assessment methodology. Further detailed correspondence was received from Clare County Council during the scoping exercise which informed various aspects of the EIAR assessment.

Observations and issues that arose during the scoping and consultation process have informed the design, assessment and mitigation measures proposed as part of this project.

Community consultation events were also organized, with community engagement conducted by members of the development team who acted as the Community Liaison Officers (CLOs), who also created a project website to provide information and advertise consultation dates. The consultations raised awareness of the project in the local community, created engagement with individuals in the area, allowed distribution of project information and updates, and invited feedback from the public. Whilst restricted by the COVID-19 guidelines, these public engagements included Information Service with a dedicated phone line and email address, three different letters to Residents, Project Brochure, Appointment Drop In Clinic, Door to Door Community Engagement between April 2021 and July 2022.

The main issues which arose during the public consultation process included issues around the positioning of turbines, the communication methods to local residents, the location of the turbines, shadow flicker from the turbines, turbine noise levels, impact on property prices, the sustainability of the turbine material, the lifespan and aftermath of the turbines, the value of turbine material, the availability of all planning process related correspondence, environmental studies, flood risks from the turbine/risks to the groundwater, the impact of the proposal on the nearby Ballymoloney Wood, the community benefit fund, construction noise/traffic disruption, RWE renewables investment in Fahy Beg, the cost of Fahy Beg, community shared ownership, investment in windfarms, broadband reception and felled forestry.

Observations and issues that arose during the scoping and consultation process have informed the design, assessment and mitigation measures proposed as part of this project as set out throughout this EIAR.

6. AIR QUALITY AND CLIMATE

This section describes the existing air and climate environment of the proposed Fahy Beg Wind Farm project as a whole. It examines the various elements of the construction, operational and decommissioning phases of the proposed project. Mitigation measures and the residual impacts after the proposed mitigation measures have been implemented are also described. A cumulative impacts assessment is also carried out.

If the proposed wind farm does not proceed, local air quality and the microclimate will remain unchanged. On a national scale, there will be an increase in greenhouse gas emissions if increasing future electricity needs are not met by alternative renewable sources which has the potential to contribute to air pollution and climate change. The opportunity to contribute to Ireland's commitments under the Kyoto Protocol and to meet national targets as set out in the Climate Action Plan (2021) would also be lost.

The principal sources of potential air emissions during the construction of the proposed project will be from the wind farm, grid connection route and turbine delivery route; from dust arising from earthworks, tree felling activities, trench excavation along cable routes, construction of the new access tracks, the temporary storage of excavated materials, the construction of the proposed substation, the movement of construction vehicles, loading and unloading of aggregates/materials and the movement of material around the site.

Dust emissions arise when particulate matter becomes airborne making it available to be carried downwind from the source.

Construction vehicles and plant emissions have the potential to increase concentrations of air pollutants in the receiving environment.

Plant and machinery such as generators, excavators etc. will be required at various stages of the construction works. These will be relatively small units which will be operated on an intermittent basis. Although there will be an emission from these units, given their scale and the length of operation time, the impacts of emissions from these units will be imperceptible.

Once the proposed wind farm and grid connection are constructed there will be no significant direct emissions to atmosphere.

Maintenance vehicles will access the proposed wind farm site during the operational period, however, due to the low traffic movements involved, the impact will be imperceptible. The operational phase of the wind farm will result in positive impacts on air quality due to the displacement of fossil fuels as an energy source.

During the decommissioning phase, there will be truck movements associated with removing the wind turbines from the wind farm resulting in vehicular emissions and also dust. However, the number of truck movements would be significantly less than the construction phase and would potentially result in a slight temporary impact.

During the decommissioning phase, the proposed grid connection infrastructure including substation and grid connection and ancillary electrical equipment will form part of the national grid and shall be left in situ. The internal ducts of the proposed project, and all internal access roads, turbine hardstanding's will be left in situ, resulting in no additional truck movements and no impact from emissions from machinery along the grid connection route.

For the construction phase, a Construction Environmental Management Plan (CEMP) has been prepared, which prescribes measures to mitigate potential impacts on air quality during the construction phase of the proposed wind farm.

Over the lifetime of the proposed wind farm, the operation of the wind farm will have positive impacts on air quality, as such, mitigation measures are considered unnecessary for the operational phase.

Mitigation measures for the removal of wind turbines from the proposed project site will be similar as per the construction phase with respect to dust control and minimisation.

7. Noise and Vibration

The proposed Fahy Beg Wind Farm is located within a rural environment, in an area comprising mostly of agricultural activities and residential areas. Noise will be generated by the proposed temporary works, comprising construction activities at the wind farm site, grid connection works and along the turbine delivery route. Noise will be generated during the operational phase by the rotation of the wind turbine blades and the turbine generator operation, as they generate electricity. Noise will also be generated during the decommissioning phase of the proposed development. These potential effects during decommissioning will be similar to those of the construction phase. Noise sensitive locations were identified in proximity to the proposed wind farm site, as illustrated in Figure 7-1.

7.1 Potential Impacts

Baseline noise monitoring was undertaken at nine receptor locations surrounding the proposed Fahybeg Wind Farm to establish the existing background noise levels in the vicinity of the proposed development. These are some of the closest locations to the proposed development as well as representing different noise environments in the vicinity of the proposed development. Noise monitoring locations are illustrated in Figure 7-2.

7.1.1 Construction Phase

Noise predictions were undertaken to determine the likely impact during the construction works due to activities such as site traffic, preparation of access roads, hardstands, drainage and wind turbine foundations and the instillation of the turbines, construction of the substation and grid connection works. The noise predictions have been carried out using British Standard, BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites.

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed with the Local Authority otherwise. For example, during turbine erection, an extension to the working day may be required, i.e. 05:00 to 21:00, but this would be necessary only on a relatively small number of occasions. If turbine deliveries are required at night, it will be ensured that vehicles on local roads do not wait outside residential properties with their engines idling, and that the local residents will be informed of any activities likely to occur outside of normal working hours.

Construction activities at the wind farm site are predicted to be below noise limits at nearby residential dwellings. These impacts are expected to be slight impact and temporary in duration. There is potential for elevated noise levels due to the grid connection works resulting in a temporary significant impact. However, these works will be for a short duration at a particular property (i.e. typically less than 3 days at any particular receptor) and where the works are to occur over an extended period at a given location, a temporary barrier or screen will be used to reduce noise level below the noise limit and reduce any potential impact resulting in a moderate short-term residual impact.

7.1.2 Operational Phase

Noise predictions have been carried out using International Standard ISO 9613, *Acoustics – Attenuation of Sound during Propagation Outdoors*.
The prediction methodology predicts noise based on the worst-case downwind condition, that is – for wind blowing from the proposed turbines towards the nearby houses. When the wind is blowing in the opposite direction noise levels will be significantly lower.

The predicted noise levels comply with the proposed daytime and night-time limits at all noise sensitive locations taking into consideration the upper and lower operational noise scenarios for the range of turbine hub heights based on the turbine arrangement options described in Section 1.2. Therefore no mitigation measures are required. For some receptors, a new source of noise will be introduced into the soundscape and it is expected that there will be a long-term, slight to moderate significance of impact. Dwellings closest to the project will experience a long-term, moderate significance of impact.

7.1.3 Decommissioning Phase

Decommissioning activities will be undertaken during daytime hours, and noise, which will be of a lesser impact than for construction, will be controlled through the relevant mitigation measures proposed for the construction phase. Significant impacts from noise are not expected during decommissioning.

7.2 Mitigation Measures

7.2.1 Construction Phase

The noise impact for construction works traffic will be mitigated by restricting movements along access routes to the standard working hours and exclude working on Sundays, unless specifically agreed otherwise with the local authority. The decommissioning works, which will be of a lower impact than construction works, will be carried out in accordance with the policies and guidance required at the time of the works, and restricted to normal working hours, 07:00 - 19:00 hours Monday to Friday and 07:00 - 13:00 on Saturdays in accordance with best practice.

Consultation with the local community is important in minimising the impacts and therefore construction will be undertaken in consultation with the local authority as well as the residents being informed of construction activities through the Community Liaison Officer.

During the Grid Connection works phase, where the works are required over an extended period at a given location, a temporary barrier or screen will be used to reduce noise levels below the noise limit where required. The noise impact will also be minimised by limiting the number of plant items operating simultaneously where reasonably practicable.

7.2.2 Operational Phase

No noise mitigation is required to meet the operational noise criteria, based on the proposed site noise limits.

7.2.3 Decommissioning Phase

During the decommissioning phase the noise impact for construction works traffic will be mitigated by restricting movements along access routes to the standard working hours and exclude working on Sundays, unless specifically agreed otherwise with the local authority.

The decommissioning works, which will be of a lower impact than construction works, will be carried out in accordance with the mitigation measures proposed for the construction phase, and restricted to normal working hours, 07:00 - 19:00 hours Monday to Friday and 07:00 - 13:00 on Saturdays in accordance with best practice.

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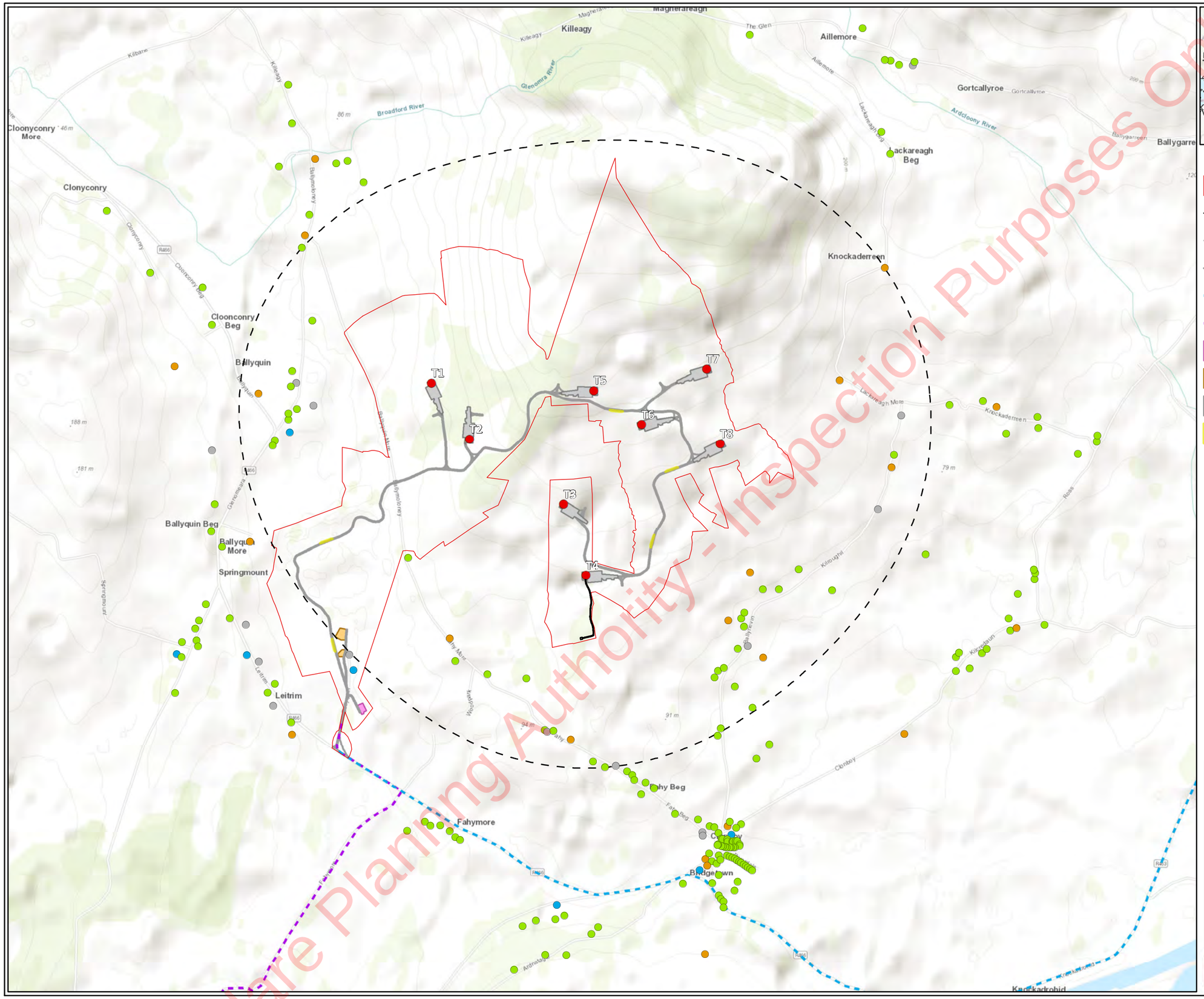

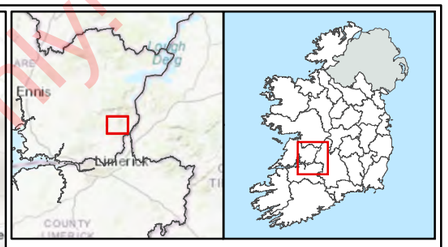

Legend

- Wind Farm Site Boundary
- Permanent Met Mast
- 35db LA90 Study Area
- Onsite Access Roads
- Turbine Delivery Route
- Grid Connection Route
- Substation Compound
- Construction Compound
- Turbine Hardstanding Area
- Passing Bays
- Proposed Turbine Layout

Receivers

Building Use

- Residential
- Commercial
- Residential and Commercial
- Unknown

TITLE:	Noise Sensitive Locations within the Study Area		
PROJECT:	Fahy Beg Wind Farm, Co. Clare		
FIGURE NO:	7.1		
CLIENT:	RWE Renewables Ireland Ltd.		
SCALE:	1:20000	**REVISION:**	0
DATE:	01/09/2022	**PAGE SIZE:**	A3

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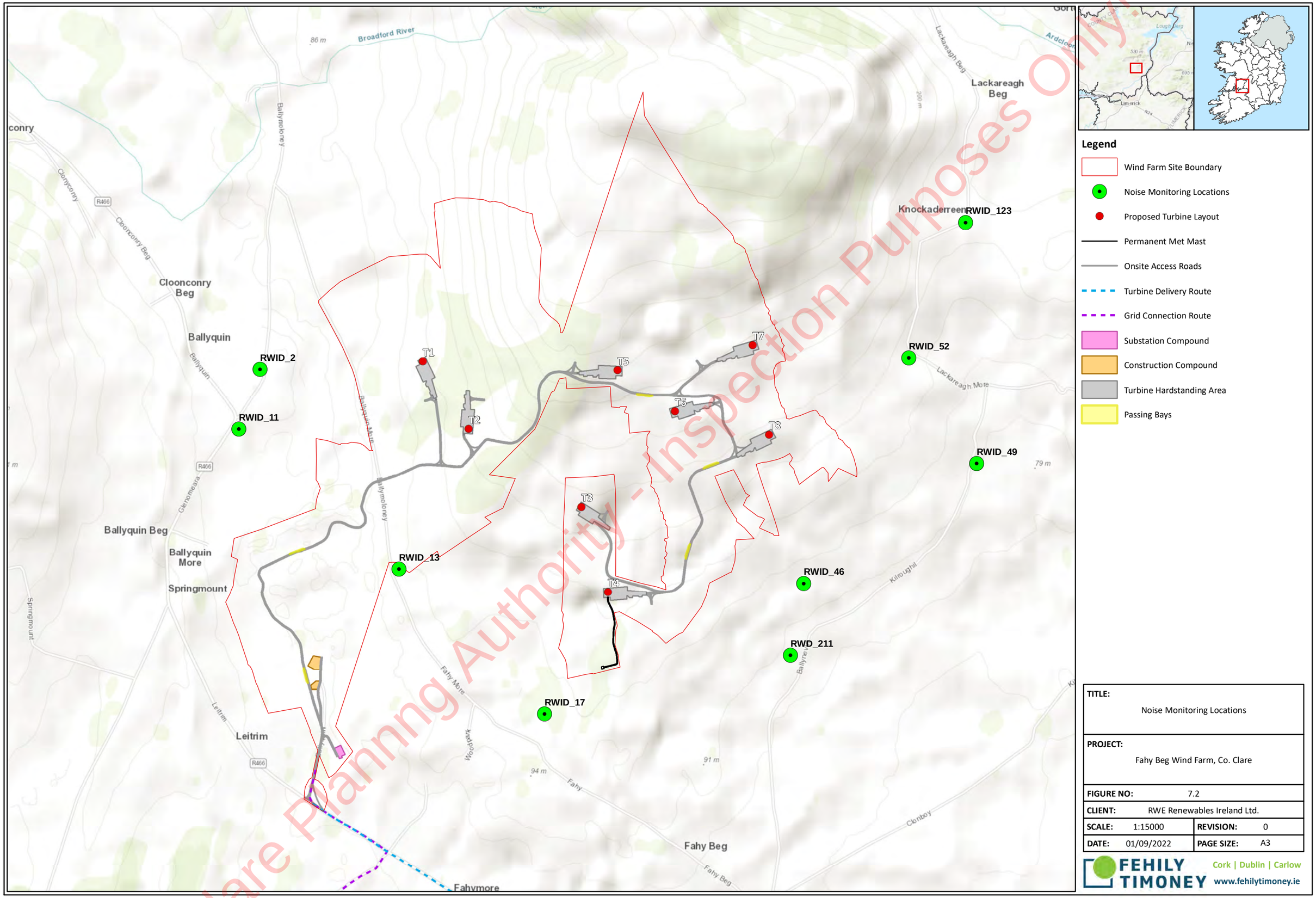

Legend

- Wind Farm Site Boundary
- Noise Monitoring Locations
- Proposed Turbine Layout
- Permanent Met Mast
- Onsite Access Roads
- Turbine Delivery Route
- Grid Connection Route
- Substation Compound
- Construction Compound
- Turbine Hardstanding Area
- Passing Bays

N W E S

0 200 400 800 Meters

TITLE:	Noise Monitoring Locations		
PROJECT:	Fahy Beg Wind Farm, Co. Clare		
FIGURE NO:	7.2		
CLIENT:	RWE Renewables Ireland Ltd.		
SCALE:	1:15000	**REVISION:**	0
DATE:	01/09/2022	**PAGE SIZE:**	A3

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8. BIODIVERSITY

The ecological appraisal for the project was undertaken by Fehily Timoney and Company (FT). Comprehensive ecological surveys were undertaken at the proposed wind farm site as well as the proposed underground grid connection route and turbine delivery route (including watercourse crossings).

Designated sites

The Site does not overlap with any designated nature conservation site but is linked hydrologically to the Lower River Shannon SAC (002165) and River Shannon and River Fergus Estuaries SPA (004077). Other European sites in the potential zone of influence of the proposed development are: Lough Derg (Shannon) SPA (004058), Danes Hole, Poulnalecka SAC (000030), Slievefelim to Slivermines Mountains SPA (004165), Slieve Aughty Mountains SPA (004168) and Curraghchase Woods Sac (000174). A total of one NHA and eight pNHAs are present within the potential ZoI of the proposed project (wind farm, grid connection & TDR).

Habitats

Habitats present within and adjacent to the site are dominated by the following: Mixed broadleaved woodland WD1, conifer plantation WD4, improved agricultural grassland GA1 and wet grassland GS4. A small percentage (2%, or 0.4 Ha) of county importance long-established mixed broadleaved woodland within the habitat survey study area will be lost. Loss of wooded habitats will be dominated by lower value conifer plantation (up to 17% of total in study area). Loss of higher value local importance natural mature/semi-mature wooded habitats will be up to 7 %. Approximately 7% of wet grassland in the study area will be lost. Wet grassland with links to the Annex I habitat *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] is present in the study area but is outside the development footprint and will not be affected by the proposed project.

The dominant habitat along the GCR is buildings and artificial surfaces BL3 represented by road surfaces, bounded by dry meadows and grassy verges GS2. Other habitats adjacent to the GCR include hedgerows WL1 and treelines WL2. Dry meadows and grassy verges may be subject to temporary loss/disturbance, while hedgerows and treelines may be subject to disturbance in the event limited trimming for access is required.

Tree felling, hedgerow trimming, and tree trimming will affect limited areas of hedgerow, treeline and mixed broadleaved woodland at a number of TDR nodes (points along the turbine delivery route where accommodation works are required to allow the passage of large turbine components).

The habitats at along the GCR and at TDR Nodes are subject to disturbance due to their proximity to roads and dwellings.

Botanical species

No rare or protected flora species were recorded during surveys of the windfarm site, GCR or TDR.

Invasive Alien Plants

A total of two invasive species controlled under Schedule III of S.I. No. 477/2011 European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 were found at the wind farm site: Japanese knotweed (*Fallopia japonica*)[1] and Himalayan knotweed (*Persicaria wallichii*). The infested areas are outside a 7m buffer around the proposed development footprint. No other invasive species are present within the proposed wind farm footprint.

Along the proposed GCR, two invasive species controlled under Schedule III of the habitats directive were recorded: Japanese knotweed and giant hogweed (*Heracleum mantegazzianum*). The Japanese knotweed is outside a 7m buffer around the GCR corridor; giant hogweed is present at two locations immediately adjacent to the GCR. A further 11 invasive/non-native species which are not legally restricted were recorded along the GCR. The most frequently recorded invasive species was snowberry (*Symphoricarpos albus*) (risk of low impact), which is abundant in hedgerows along sections of the route.

No schedule III listed invasive species were recorded at TDR nodes during current surveys; however, a historical record of Spanish bluebell outside the proposed works footprint at Node 8 has been included in the assessment.

Birds

Ornithology surveys were carried out in accordance with SNH (2017) guidance. These surveys were carried out from 2019 to 2021. Target bird species present within and in the environs of the site included: black-headed gull, buzzard, cormorant, greylag roose, hen harrier, kestrel, lesser black-backed gull, merlin, peregrine, sparrowhawk , swift, whimbrel and whooper swan.

The majority of target species flight activity in the study area was attributed to buzzard. There were 90 observations of this raptor species with 16,454 recorded flight seconds within the collision risk zone. Kestrel also had high activity levels with 82 observations and 4,680 seconds of recorded flight time within the collision risk zone. Both species were recorded breeding within the 2km turbine buffer. Kestrel is considered to have high sensitivity to windfarms and will be subject to potential effects in terms of habitat loss and collision risk. Merlin and hen harrier were recorded, though activity was very low with one and three observations respectively over two years of surveys. No roosting or breeding habitat of either species was found within the 2km turbine buffer and the site and surrounding areas do not provide important habitat for either species. Barn Owl breeding activity was recorded within the 2km turbine buffer. This species is not at high collision risk due to low flight heights, and there are no suitable nesting features in close proximity to the proposed works footprint. Curlew, lapwing, golden plover and snipe were also recorded within the 500m turbine buffer and 5km turbine buffer. The site itself is not of value to waders and waterbirds, and no waders have been recorded breeding on site.

Regarding impacts on bird species, it is considered that the main potential source of impacts on avifauna in general is the construction of the wind farm, particularly the construction of turbines and the associated road network. Kestrel and buzzard may also be subject to operational phase effects due to collision risk.

[1] Japanese Knotweed has an updated scientific name of *Reynoutria japonica*

Bats

Two years of bat surveys have been completed within the study area during the years 2020 and 2021, exceeding the requirements if SNH (2021) guidance. The first year of surveys improved the accuracy of Ecobat analysis of 2nd year surveys by providing baseline data for the site.

Bat surveys included roost assessments, summer and winter roost inspections, activity surveys and static detectors surveys. A total of six bat species, in addition to genus- level records of *Myotis* spp. have been recorded in the environs in and around the site.

Of county importance are populations of Lesser horseshoe bat (*Rhinolophus hipposideros),* Natterer's bat and Brown long-eared bat (*Plecotus auratus)* at the windfarm site.

The populations of Common pipistrelle (*Pipistrellus pipistrellus)*, Soprano pipistrelle (*Pipistrellus pygmaeus)* and Leisler's bat (*Nyctalus leisleri)*, are of regional importance. The population of Nathusius' pipistrelle at the wind farm site is of local importance.

The construction of the wind farm will lead to the loss of mature trees in an area of woodland classified as having moderate roosting potential overall, with potential for higher roosting potential features to occur. Vegetation clearance such as removal of scrub as well as hedgerows, treelines and sections of woodland will change current foraging and commuting routes of bats and has potential to cause long-term significant and reversible effects at the regional scale.

Four species present at the site are at high risk of turbine strike or barotrauma: Leisler's bat and the three pipistrelle species.

Mammals (other than bats)

A total of seven terrestrial mammals were identified within the windfarm site during surveys, while no mammals or mammal signs were observed during surveys of the GCR and TDR. These are badger, rabbit, fox, fallow deer, Irish hare, pine marten and greater white-toothed shrew, the latter of which is a medium impact invasive species. Other protected mammal species which have previously been recorded in the area but not observed during surveys which may also occur at or near the site are red squirrel, otter, red deer, Irish stoat, pygmy shrew, wood mouse and hedgehog.

Badger was seen foraging during daylight and latrines and scat were observed. A total of 6 setts are present within 150m of the proposed infrastructure and felling buffers. No setts are within the proposed works footprint. Three of the sets could be indirectly impacted by the wind farm development. One will require hard blocking and two will require a 50m buffer during the breeding season and/or hard blocking. No hard blocking will be carried out during the badger breeding season (December – June inclusive).

No otter or signs thereof were found onsite, and the small 1st order watercourses onsite are not of high value for otter. Otter signs were recorded near TDR node 20 (prints were observed downstream), and a potential otter couch was recorded c. 100m downstream of one GCR river crossing. No holts were recorded within 150m of the proposed project footprint.

Aquatic surveys

Aquatic surveys were carried out in September 2021 at 23 sites in the catchment areas in which the wind farm, the GCR and the TDR are located (Lower River Shannon and Shannon Estuary North catchments). A total of nine sites with potentially suitable habitat were re-visited to check for spawning brook lamprey in March 2022.

No sensitive aquatic receptors were found within the boundary of the wind farm site.

There are eight places where the GCR will require watercourse crossings. 4 no. ducts at minor watercourses will be installed above/under existing culverts, while horizontal directional drilling is proposed for 4 no. crossings over EPA-mapped watercourses (Glenlon South, Blackwater-Clare, Glenomra Wood Stream and Bridgetown - Clare).

A total of five survey locations (5, 8, 9, 10 and 16) (22% of total locations) did not support fish and/or lacked any fisheries habitat (i.e., non-perennial/seasonal channels). Where fish were present, brown trout (*Salmo trutta*) dominated across the survey area (recorded at eight sites). Salmon (*Salmo salar*) were also present (at two sites). Brook lamprey (*Lampetra planeri*) were recorded at five sites, while river lamprey (*Lampetra fluviatilis*) was recorded at one site. Other species including three-spined stickleback (*Gasterosteus aculeatus*), stone loach (*Barbatula barbatula*) and minnow (*Phoxinus phoxinus*) were also recorded. No freshwater pearl mussel or white-clawed crayfish were recorded during the aquatic surveys.

Aquatic vegetation representative of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] ('floating river vegetation') was recorded at site 11 on the Blackwater (Clare) (upstream of the Lower River Shannon SAC). No non-native species were found during aquatic surveys.

A total of nine sites were categorised as ≥Q4 'good status'; five sites were categorised as Q3-4 'moderate status', while four survey sites were Q3 'poor status'. The remainder of sites were unsuitable for assessment (small/perennial streams; recent dredging at site).

Marsh Fritillary

Areas of devil's bit scabious *(Succisa pratensis),* the larval food plant of marsh fritillary were found onsite; these areas, as well as areas of higher floristic diversity such as wet grassland were thoroughly searched during a targeted survey from the 19th to the 20th of September 2022. A total of four larval webs with caterpillars were found, and five potential larval webs without caterpillars were found during surveys. None of these were within the proposed works footprint. There was potentially suitable habitat for marsh fritillary within the works footprint, this however has been assessed as sub-optimal due to height and density of the vegetation containing *S. pratensis*. It is considered that marsh fritillary could potentially be affected by wind farm construction if larvae are present within the proposed footprint.

Mitigation

Detailed mitigation measures are provided within the main body of the EIAR to be put in place to protect downstream water quality, habitats, birds, terrestrial mammals, bats, and prevent spread of invasive species.

Mitigation for bats includes bat felling buffers of 50m from turbine blade tip, and the retention and translocation of potential roosting features from felled trees. During operation feathering of turbines as well as increasing cut in speed above manufacturers guidelines when temperatures are above 10-11 degrees Celsius at

turbine nacelle height will reduce bat fatalities. Vegetation free buffers will be maintained throughout the operational phase of the wind farm.

To mitigate impacts on birds, vegetation clearance will take place outside of the main bird breeding season. Where this is not possible a suitably qualified Ecologist will inspect vegetation to be cleared for nesting birds and put in places exclusion buffers where nests are found.

Mitigation for habitat loss, bats and birds includes the planting of new hedgerows with native species. New hedgerows with a rapid growth rate will be planted to divert bats away from buffers and maintain connectivity for commuting and foraging. These linear habitats are also utilised by barn owl and kestrel for hunting. Planting of wildflower strips away from the turbine locations will also benefit kestrel and barn owl.

Pre-construction mammal surveys will take place to re-confirm the findings of EIA surveys. A badger mitigation plan has been prepared. No sets will be hard blocked or disturbed during the badger breeding season. An ECoW will be present during any vegetation clearance and tree felling which is taking place during times when mammals have vulnerable young in trees or dens and will put in place buffers to protect mammals from works as required.
Mitigation for the aquatic environment focuses on preventing silt runoff via silt traps, set back distances of works from streams, and timing of earth works and vegetation clearance etc. Pollution by hydrocarbons is mitigated by fuel storage in bunded areas and machinery being stored at the site compound, while re-fuelling and maintenance will take place in designated areas set back from watercourses. Spill kits and drip trays will be available on site. Strict biosecurity measures will be put in place, where equipment or clothing of operatives comes in contact with water, to prevent the spread of invasive alien species or pathogens such as crayfish plague.

An Invasive Species Management Plan (ISMP) has been prepared, the implementation of which will prevent the spread of invasive alien plant species.

A pre-construction survey will take place to search the proposed works footprint and adjacent areas for marsh fritillary larval webs and larvae in August/September prior to construction. If larvae are present in the zone of influence, they will be translocated to suitable habitat outside the infrastructure footprint.

Residual impacts

Following mitigation to reduce possible impacts to important ecological features outlined above, the following conclusions were determined:

With the implementation of the mitigation measures detailed in Chapter 8 Biodiversity, Chapter 9 Land, Soils and Geology, Chapter 10 Hydrology and Water Quality and the CEMP, there will be no significant residual impacts from the wind farm site, turbine delivery route and grid connection on biodiversity.

There will be no habitat loss of higher value aquatic habitat and with mitigation measures in place there will be no deterioration of any watercourses.

9. LAND, SOILS AND GEOLOGY

9.1 Existing Environment

The existing environment underlying the proposed Fahy Beg Wind Farm consists of quaternary and bedrock geology, areas of geological heritage, areas of economic interest with respect to geological resources and potential for soil contamination.

The majority of turbine locations and associated infrastructure are underlain by Till derived from Lower Palaeozoic sandstones and shales.

Peat depths throughout the site were found to be sporadic and shallow in nature (0.1 to 0.2m thick) and described as highly organic Topsoil with a peaty appearance.

There are no known areas of soil contamination on the proposed development site or the grid connection route.

The site is located within three groundwater bodies namely the Lough Graney, Tulla-Newmarket-on-Fergus, and Broadford Gravels.

There are no Public Water Supplies or Public Supply Source Protection Areas within the proposed development site boundary. There are however 3 No. Source Protection Areas for public water supply schemes in the wider study area ranging between 16km and 19km from the wind farm site.

The GSI Online Minerals database shows no metallic occurrences within the site. A lead deposit has been recorded within the Broadford Gravels approximately 1.4km north of the site. The quarry Ballyquin Pit operated by Roadstone Ltd. is located within the site boundary. The main product from Ballyquin Pit is sand and gravel for concrete and earthworks use.

The proposed development and proposed infrastructure locations are generally located within areas of 'Low' to 'Moderate High' susceptibility, with localised areas classified as 'High' (northernmost extent of the site). Elevations across the site range from 50m to 350m AOD. Slopes at the proposed turbine locations range from 4 to 12 degrees.

During construction potential impacts may include soil erosion, soil compaction and or ground water pollution.

Proposed tree felling will involve the use of heavy felling machinery and exposure of underlying soils to surface water runoff, which could result in soil erosion.

The proposed development will require construction phase earthworks associated with the excavation of turbine bases, removal of overburden deposits. It is proposed that all onsite materials excavated shall be retained on site and re-used where suitable as part of the construction phase to minimise the import materials requirements. Surplus Topsoil, Gravel deposits and Glacial Till recovered from excavations will be used for the reinstatement proposed around turbine bases, hardstands and the temporary construction compound.

There will be approximately 8.5km of internal access tracks associated with the proposed site. This will be a combination of existing track upgrade and construction of new tracks; approximately 7.1km of new track construction and approximately 1.4km of existing track upgrade. Hardstand areas will be provided at each turbine location.

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

Access track formation will consist of a minimum 500mm hardcore on a geotextile separator.

Grid connection works will involve the installation of ducting, joint bays, drainage and ancillary infrastructure and the subsequent running of cables along the existing road network. For cable trenches located in public roads, the contractor will excavate cable trenches and then lay high density polyethylene (HDPE) ducting in the trench in a surround of cement bound material (CBM). Back-filling and reinstatement in public roads will be to a specification to be agreed with the road authority.

A similar construction methodology will apply for cable trenches laid within site access tracks.

Horizontal Directional Drilling (HDD) will be employed at 4 no. locations along the GCR to cross existing watercourses as described in Section 3.1.2.1 of the Construction Environmental Management Plan (CEMP).

The process will involve setting up a small, tracked drilling rig on one side of the watercourse at least 10m back from the stream bank. A shallow starter pit will be excavated at the point of entry and shall be located at a sufficient distance from the watercourse to achieve a minimum 3m clearance depth below the bed of the watercourse.

The accommodation works associated with the Turbine Delivery Route will include the excavation of existing overburden deposits. The potential impact would be from the temporary exposure of the overburden to erosion via surface water ingress during the works.

Very few potential direct impacts are envisaged during the operational phase of the proposed project.

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

The primary mitigation measure employed has been the design of the wind farm in terms of locating the turbines, access roads, material storage areas and other site infrastructure within an area of agriculture and commercial forestry where the soils are extensively worked and drained. Extensive work has already been undertaken at the design stage to apply risk avoidance by design.

A Construction Environmental Management Plan (CEMP) has been prepared for the proposed development. The following mitigation measures are included for Land, Soils and Geology.

The development will be constructed in a phased manner as described in Section 3.4 to reduce the potential impacts of the development on the Land, Soils and Geology at the site. Phased construction reduces the amount of open, exposed excavations at any one time. Excavated overburden will be retained on-site and reused as far as possible.

Surplus overburden deposits excavated during the course of the works will be temporarily stored in a level area adjacent to the construction phase excavations prior to reuse.

Some temporary stockpiles (not exceeding 2m in height) of material will be necessary adjacent to the excavation areas prior to reinstatement, however no long-term stockpiles of material will remain after construction and no surplus/waste soil or rock will be removed from the proposed development site.

To mitigate against the compaction of soil at the site, prior to the commencement of any earthworks, the work corridor will be pegged, and machinery will stay within this corridor. Excavations will then be carried out from access tracks, where possible.

To mitigate against erosion of the exposed soil or rock, all excavations will be constructed and backfilled as quickly as possible.

Soil excavated from trenches along the proposed grid connection route will be taken to a licenced facility for disposal or recycling where required. If feasible, the upper layers of tarmac and asphalt will be excavated separately to the lower engineered fill layers. All temporary cuts/excavations will be carried out such that they are stable or adequately supported.

Gravel fill will be used to provide additional support to temporary cuts/excavations where appropriate. Unstable temporary cuts/excavations will not be left unsupported.

Interceptor drains will be installed prior to any construction works commencing. Temporary settlement ponds and silt management measures will be installed to mitigate against sediment run-off as required.

Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of construction vehicles will be carried out from these tanks or from delivery vehicles at designated refuelling areas.

With respect to slope stability, the works will be designed and supervised by a suitably qualified and experienced geotechnical engineer or engineering geologist, and hydrologist or drainage engineer. Drainage infrastructure will be put in place in advance of turbine excavations. Loading or stockpiling on the surface of soft ground will be avoided.

To monitor groundwater during the construction phase groundwater monitoring wells will be installed between areas of deeper excavations and sensitive groundwater receptors.

Mitigation measures applied during decommissioning activities will be similar to those applied during construction as relevant.

10. HYDROLOGY AND WATER QUALITY

10.1 Existing Environment

The proposed Fahy Beg wind farm is located within two catchments of the Irish River Network System. These are the Lower Shannon catchment (ID 25D) and Shannon Estuary North catchment (ID 27).

The wind farm site is drained by forestry and field drains which ultimately join the Black (O'Briensbridge) stream and the Fahy (Clare) stream which drain from within the wind farm site to the south-east and the Broadford stream which passes through the wind farm site is located to the west of the site, draining towards the north-west generally. There are no lakes or reservoirs within the wind farm site study area. According to the Preliminary Flood Risk Assessment maps, the proposed wind farm site is not at risk of fluvial flooding.

During the construction period, the project has the potential to lead to impacts on hydrology and water quality unless appropriate mitigations are applied. Inappropriate construction practices could also have the potential to impact the water quality and WFD status of existing waterbodies, which includes the Lower Shannon River which is part of the Lower River Shannon Special Area of Conservation (SAC) and the Doon Lough NHA, which are highly sensitive receptors that are hydrologically connected to the wind farm site.

Potential impacts on hydrology and water quality include impacts associated with the wind farm, grid connection and turbine delivery route (TDR).

Construction of new access tracks and upgrade of existing tracks, turbine hard-standing areas, the on-site substation and other new, hard surfaces have the potential to contribute to an increase in runoff. The effects of the increase in runoff have a negligible magnitude on receiving waters because estimated increases in runoff are low compared to the flows of receiving waters. The increased runoff will be mitigated with the proposed drainage system which is based on SuDS methodology.

During construction, there is the potential for sediment release into the receiving watercourses. Possible potential impacts on surface water quality during tree felling and construction activities include increased sediment in watercourses, increase in nutrients from tree felling, suspended solids and could affect aquatic fauna and habitats. Wet concrete could also affect receiving waters.

In the event of decommissioning, activities will take place in a similar fashion to the construction phase. Potential impacts will be similar to the construction phase but to a lesser degree. Any such potential impacts would be likely to be less than during the construction stage as the drainage swales would be fully mature and would provide additional filtration of runoff.

Mitigation includes the proposed drainage measures. Two distinct methods will be employed in the management of construction surface water runoff. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimizing any works in or around drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage water from works areas within the site that might carry silt or sediment, and to route them towards settlement ponds prior to controlled diffuse release over vegetated natural surfaces. There will be no direct discharge to existing surface waterbodies.

The proposed measures will prevent the release of sediment into the watercourses to which the proposed development site drains. The main mitigation measures are the use of settlement ponds, silt fencing, monitoring

of works by a suitably qualified person, silt traps, use of cross drains, swales, proper storage of fuels and oils and designated refuelling areas.

When operational, the development will have a negligible effect on surface water quality as there will be no further disturbance of soils post-construction. It is not envisaged that the maintenance period will involve any significant impacts on the hydrological regime of the area. The maintenance of the development will incorporate effective maintenance of the drainage system.

Following the implementation of mitigation measures, the significance of the residual risk to the receiving watercourses would be 'Not significant' during the construction, operation and decommissioning stage of the development.

Due to the mitigation measures proposed, the residual and cumulative impacts of the proposed development on hydrology and water quality are not significant.

11. POPULATION, HUMAN HEALTH AND MATERIAL ASSETS

11.1 Population

The general area of the proposed Fahy Beg Wind Farm is rural in nature, and dominated by agricultural enterprise, the Study Area has a low population density associated with sparse rural settlement. This is in contrast to the State-wide and County-wide population densities which show greater figures. Overall, the receiving area has a low population density (26.1 persons per square kilometre) due to its rural nature and low density 'one-off' house settlement pattern. There are approx. 173 no. residential dwellings within 1.55km of the turbine locations. Of these 173 dwellings, 28 no. are also registered as commercial. There are also approx. 20 permitted dwellings yet to be constructed within 1.55km of the proposed turbine locations.

The potential impacts on population and demographic trends arising from the proposed project during its construction phase relate to potential population increase or decrease. This will give rise to short-term/brief population growth at the wind farm site during working hours. This is associated with the direct employment of construction workers, trades people, labourers and specialised contractors. The construction phase of the wind farm site has potential to create between 39 and 44 jobs.

It is unlikely that permanent effects to population at the Wind Farm Site, Grid Connection Route or Turbine Delivery Route will occur, in terms of changes to population trends or population density as a result of the construction phase.

Once constructed, it is envisaged that there will be direct and indirect employment associated with the operational phase of the proposed project.

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

11.2 Socio-economics, Employment and Economic Activity

The wind farm site, grid connection area and turbine delivery route areas have a similar economic profile to that of County Clare, County Tipperary and the State.

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

It is estimated that between approximately 37.5 to 46 staff/contractors could be employed during the construction phase of the proposed project. Furthermore, local businesses in the nearby towns of Bridgetown, O'Briensbridge, Killaloe and Ardnacrusha will likely receive a slight indirect positive economic impact due to the influx of workers to the area who will require services such as shops and food places.

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

It is expected that the operational phase of the proposed development (wind farm site) could create between 9.4 and 15.4 long term jobs. It is likely that only a small proportion of these jobs are likely to be based in the Wind Farm Site.

A community benefit fund of approximately €173,000 to €208,000 per annum for the first 15 years of the project will be distributed in the local community. The provision of the Community Benefit Fund will have a significant long-term, positive effect on the socio-economic profile of the study area and wider area.

The decommissioning phase of the proposed project provides for the removal of turbines and associated infrastructure from the site. The potential effects associated with the decommissioning phase in relation to employment will be similar to that of the construction phase but at a reduced magnitude.

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

11.3 Land Use

The existing land-uses in proximity to the proposed Fahy Beg Wind Farm will remain broadly unchanged during the construction phase of the project, however, some land use in close proximity to the site will be temporarily disrupted during the construction phase as a result of construction activity.

Temporary effects on land use will arise as a result of the installation of the grid connection along the grid route which will be constructed within the public road corridor. Full road closures will be put in place to facilitate cabling works in combination with lane closures, partial road closures and stop/go systems. Turbine Delivery Route node upgrade activity has potential for slight, brief to temporary impacts to land use in proximity to each node.

It is anticipated that there will be minimal impact on existing land uses arising from the operational phase.

The potential effects associated with the decommissioning phase in relation to land use will be similar to those associated with construction phase but of a reduced magnitude.

11.4 Recreation, Amenity and Tourism

Top attractions in the Clare area in 2019, listed by Fáilte Ireland, include Lough Derg, Inis Cealtra (Holy Island), Burren, Cliffs of Moher the Wild Atlantic Way and Loop Head which are located approx. 6.2km, 14.5km, 53km, 62.6km, 97.1km, 63km and 97.1km respectively from the proposed wind farm site.

Overall, the most significant recreation activity/attractions in proximity to the Fahy Beg Wind Farm site is trail walking, mountain biking, equestrian activity and sports grounds.

There are no significant tourism attractions located in proximity to the proposed Fahy Beg Wind Farm site, grid route and TDR, and as such, the construction phase of the proposed development is not expected to impact on major tourism attractions, tourism numbers or tourism revenue.

From a review of literature it is indicated that the majority of tourists surveyed in Ireland and Scotland had a generally positive view on wind energy development in the landscape. The most proximate major tourist attraction to the Fahy Beg Wind Farm Site is Lough Derg, located ca. 6.2km from the proposed wind farm site.

Overall, it is expected that the operational phase of the proposed development will have a non-significant neutral impact on recreation and tourism in the area due to the distance of the proposed turbines from significant features.

The potential impacts associated with the decommissioning phase in relation to recreation, amenity and tourism will be similar to those associated with construction phase but will likely be of a reduced magnitude.

11.5 Human Health & Safety

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

Potential impacts on air quality has the potential to affect human health. This has been assessed in Chapter 6: Air and Climate Change.

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

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

Under normal conditions, operational wind turbines do not pose a threat to public safety or the safety of animals. There are no expected works to take place along the grid route or Turbine Delivery Route during the operational phase of the proposed development. If maintenance works are required in these areas or bulk equipment is required to be delivered, proper safety protocols will be put in place in line with the mitigation measures. Therefore, impact to human safety on public roads during the operation phase is unlikely, as a result of the proposed development.

In terms of noise, operational wind farm noise levels meet the derived night and daytime noise limits at all residential properties surrounding the proposed Fahy Beg Wind Farm. Based on the details of the proposed development, there will be no impact on residential properties at any distance from the proposed development in terms of magnetic field levels from power cables.

The proposed development has been examined with respect to potential impact from major accidents and natural disasters. This relates to:

- Flooding;
- Fire;
- Major incidents involving dangerous substances;

- Catastrophic events; and
- Landslides.

There is limited potential for significant natural disasters to occur at the Fahy Beg Wind Farm. Bulk storage of hydrocarbons, chemicals and wastes will not occur on the wind farm site. Emergency protocols will be in place should an accident occur at the proposed wind farm.

The potential impacts associated with decommissioning phase in relation to human health will be similar to those associated with the construction phase.

11.6 Material Assets - Renewable, Non-Renewable Resources and Utility Infrastructure

The construction of the proposed Fahy Beg Wind Farm will impact on natural resources such as aggregates which will be sourced from batching plants, quarries and pits in proximity to the site.

The proposed development is intended to capture the renewable wind resource at the site. There will be no negative effects on the renewable wind resource of the receiving environment. Trees felled for development purposes will be replanted at another unplanted location as required by Irish Forest Service Guidelines.

The temporary removal of overhead utility infrastructure has the potential to cause a brief to temporary non-significant negative impact on nearby dwellings and commercial/industrial activities in proximity to Turbine Delivery Route nodes.

The proposed GCR will not impact on existing electrical infrastructure entering the existing Ardnacrusha substation.

During the construction phase of the proposed development, waste will be generated due to the various construction activities and materials required for the installation of infrastructure at the wind farm site, grid route and turbine delivery route. In line with the National Waste Management Guidelines for the circular economy and European Waste Management Hierarchy, the developer and appointed contractor will aim to prevent, reduce, reuse and recover as much of the waste generated on site as practicable and to ensure the appropriate transport and disposal of residual waste off site.

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

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

Significant volume of waste is not expected to be produced during the operation phase of the proposed development.

Decommissioning works will include removal of above ground structures including the turbines and met masts. Turbine foundations and access tracks will be left in situ. The proposed on-site substation building will be taken in charge by ESB which will have a long-term slight positive impact on electricity infrastructure provision in the

area. There will be no significant negative impacts on renewable and non-renewable resources during the decommissioning phase.

Existing services along the proposed grid connection cable route have been predicted through a desktop study and will be confirmed in the pre-construction surveys prior to construction. This will minimise the impact in terms of disruption or damage to existing utilities. It is not intended to divert existing services but instead, where possible, the cable will be laid above or below existing services. Communication with service providers will be maintained for the duration of the construction works where required.

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

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

12. SHADOW FLICKER

Under certain combinations of geographical position, wind direction, weather conditions, times of day and time of the year, the sun may pass behind the rotors of a wind turbine and cast a shadow over the windows of nearby buildings. When the blades rotate and the shadow passes a window, to a person within that room the shadow appears to 'flick' on and off; this effect is known as 'shadow flicker'.

A study area of 1380 m from each of the 8 wind turbines was selected for this assessment, which is ten times the maximum rotor diameter (138 m) that would be used within the proposed development. A total of 65 sensitive receptors have been identified within the adopted 1380 m shadow flicker study area.

The assessment has considered the whole range of proposed turbine dimensions, including minimum and maximum tip heights, hub heights and rotor diameters. Specifically, the following scenarios were modelled:

1. Scenario 01: Largest rotor on smallest hub height (138m rotor diameter, 102.5m hub height)
2. Scenario 02: Smallest rotor on the largest hub height (131m rotor diameter, 110m hub height)
3. Scenario 03: Largest rotor with maximum possible tip height (138m rotor diameter, with 107.5m hub height)

Assessing shadow flicker effects using the scenarios above covers the full range of potential shadow flicker impacts that may occur. Changes in hub height may have a relatively small impact on the predicted levels, however, having a smaller tower does not necessarily mean that the impacts will decrease at all properties (or vice versa). Rather it will result in changes to the time of day and time of year that flicker is predicted at a given property. Using the largest possible rotor diameter to determine the study area for all three scenarios ensures the maximum number of sensitive properties are accounted for.

The assessment has calculated all times that shadow flicker could theoretically occur for all sensitive receptors for a range of scenarios and these times will be input into the shadow flicker control module within each turbine so that, if conditions for shadow flicker do occur, the turbines will automatically come to a gradual stop. Accordingly, the proposed development will meet the draft Government guidelines and the proposed method of mitigation will be used to mitigate all shadow flicker effects resulting in zero shadow flicker, allowing for a short time for the rotor to come to a stop.

No cumulative shadow flicker effects were identified at nearby receptors.

Decommissioning Phase

Shadow flicker can only occur as a by-product of wind turbine operation; as such, there will be no shadow flicker effects during the decommissioning phase.

12.1 Mitigation Measures

Shadow flicker control modules, consisting of light sensors and specialised software, will be installed on the turbines as part of a system to prevent operation during periods when shadow flicker may occur to attain 'zero shadow flicker'. The calculated potential shadow flicker periods will be input into the turbine control software

and when the correct conditions are met i.e. the light intensity is sufficient and during a potential period of shadow flicker. When the threshold is exceeded, individual turbines will cease operation until the conditions for shadow flicker are no longer present. This method of mitigation will be used to fully mitigate all shadow flicker effects resulting in zero shadow flicker.

13. TRAFFIC AND TRANSPORT

The study area for the traffic and transportation study includes the main wind farm site along with the surrounding road network leading to and from the main wind farm site. The site entrance is also assessed. The roads associated with the grid connection are assessed as is the turbine delivery route.

The closest local road is located along the western boundary of the Ballyquinn quarry site. The proposed delivery route proposes the use of this local road to connect the quarry site to the main wind farm site. Local roads associated with the grid connection include the Fahymore local road for approximately 3.5km located between the R466 and R471. The grid connection utilises the L3046 for approximately 0.4km and the L3056 road for approximately 0.9km before turning left onto the Ardnacrusha access road for approximately 0.35km where it reaches the Ardnacrusha 110kV Substation.

The construction activities associated with the project will lead to additional construction related traffic on the existing public road network over the duration of the construction works. Without appropriate mitigation measures, the proposed works have the potential to lead to a negative impact on the existing road network.

The traffic impact associated with the grid connection cable works will fall into two main categories, the construction traffic related impacts and the road/lane closure related impacts. The use of heavy goods vehicles, light goods vehicles and the transport of materials will be involved with the grid connection. The grid connection construction works will require a combination of temporary road closures with traffic diversions and temporary lane closures along the proposed route.

All road works will be subject to a road opening licence, but it is anticipated that the cable installation along local roads will be advanced using a combination of rolling lane closures and temporary road closures where the existing road width is insufficient to accommodate an open lane for traffic to pass the works area.

The delivery of turbine components including blades, tower sections and nacelles is a specialist transport operation owing to the oversized loads involved. The largest possible blade and tower components for the range of turbine options described in Section 1 were considered and modelled using Autotrack vehicle modelling software to ensure that the potential environmental effects for the full range were fully assessed. Turbine component deliveries will be carried out during off-peak times and will be done using a convoy and a specialist heavy haulage company. Turbine deliveries will also be escorted by An Garda Siochána.

A small number of full-time wind farm personnel are expected to be present during the operational phase of the project.

Unforeseen or unplanned events such as emergency turbine repair works could potentially require the mobilisation of construction plant and personnel to site or grid route. The replacement of a large turbine component such as a blade will require a crane and the re-installation of some Turbine Delivery Route temporary accommodation works. In such an event the impacts associated with these works will be less than those associated with the construction stage.

The potential impacts associated with the decommissioning phase will be significantly less than the construction phase due to the considerably lower number of vehicle movements.

A number of measures will be employed during construction to reduce and minimise disruption to the public and road users. These measures include the following:

- A Traffic Management Plan to be implemented
- A Traffic Management Coordinator to be appointed
- Road pre-condition survey to be carried out
- Road reinstatement on completion of the works
- Site inductions – all workers will receive an induction
- 24-hour emergency contact
- Traffic management guidance – all temporary traffic management will be planned and executed in accordance with best practice
- Letter drops will be carried out to notify the public living nearby of upcoming traffic related measures
- Signage – clear signage relating to the development will be displayed
- Road sweeper – if necessary a road sweeper will be used
- Site entrance – the entrances will be secured when not in use and when necessary a flagman will be used.

The proposed project is likely to result in a slight to moderate short-term negative impact on the existing road network during the construction phase if adequate mitigation measures are not implemented.

Site entrances at the wind farm site shall be maintained continually to ensure conditions at these entrances do not deteriorate. Hedgerow maintenance will be required to ensure continued visibility at the entrances.

14. ARCHAEOLOGY, ARCHITECTURAL AND CULTURAL HERITAGE

A study area extending for 1km in all directions from the proposed locations of turbines, hardstands, access tracks, site compound, met mast and substation and 100m in all directions from the grid connection route and turbine delivery work areas was reviewed in order to assess the potential for direct impacts on known and potential elements of the cultural heritage resource. In addition, the wider landscape extending for 10km from the Site was also reviewed to assess the potential for indirect impacts on the settings or visual attributes (e.g., ritual alignments or intervisibility) of monuments with notable visual sensitivities, e.g., National Monuments in State Care (Ownership / Guardianship) and other extant recorded monuments with potential ritual visual alignments across the landscape.

There are no recorded archaeological sites, designated architectural heritage structures or Architectural Conservation Areas directly located on the public road that will form the grid route connection. There is one known archaeological site located within the 100m corridor centred on the public roads along the GCR.

In relation to potential direct impacts on archaeology from the proposed development, there are no recorded archaeological sites located on the footprint of any of the proposed construction areas within the Site and no potential unrecorded archaeological sites were identified within these areas during the desktop study and field inspections carried out as part of this assessment. The nearest recorded archaeological site to a proposed construction area within the Site is an enclosure which is located within a clearing in commercial plantation between T06 and T08.

Given the above factors, no direct impacts on the known archaeological resource are predicted during the construction phase.

The operational phase of the proposed development will result in no predicted direct impacts on the known archaeological, architectural and cultural heritage resources. 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 development areas.

No significant indirect visual impacts on cultural heritage receptors within the wider landscape were identified.

No direct impacts on known elements of the cultural heritage resource are predicted during the decommissioning phase as there are no recorded cultural heritage assets located within the footprint, or close environs, of the various elements of the wind farm that will be subject to decommissioning.

A suitably qualified archaeologist will be employed to oversee the construction phase of the proposed project.

The locations of all recorded archaeological sites within fields and forestry clearings within the Site will be cordoned off.

In relation to the monitoring of mitigation measures, there are a number of obligatory processes to be undertaken as part of archaeological licence applications to the National Monuments Service and these will allow for monitoring of the successful implementation of the archaeological mitigation measures. These will clearly outline the extent of all ground works and outline the onsite and consultation processes to be enacted in the event that any unrecorded archaeological sites or features are identified. A report will be compiled on all site investigations 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.

In conclusion, the mitigation measures will provide for either the avoidance of the unrecorded archaeological resource or the proper and adequate recording of this resource by systematic archaeological excavation. While the operation of the proposed wind farm will result in a number of indirect, slight, negative impacts on a number of cultural heritage receptors within the wider landscape these will be reversible during the decommissioning phase. No residual impacts on the architectural heritage and undesignated cultural heritage resources are predicted to arise following decommissioning of the wind farm. No residual impacts on the cultural heritage resource are predicted to arise from the grid connection route or turbine delivery route.

15. LANDSCAPE AND VISUAL

The study area is highly varied, with both dramatic upland areas and major waterways. The study area is divided in half by the Shannon corridor and the southern half of Lough Derg. There are two mountain ranges through the middle of the study area, with the Slieve Bearnagh Mountains on the west of the river corridor, and the Arra Mountains to the east. There are other, lesser upland areas to the south of the Slieve Bearnagh Mountains, Seefin, and Woodcock Hill. At the periphery of the study area, there is a second set of major upland areas, with the Slieve Aughty Mountains at the north-western edge of the study area, and the Silvermine Mountains, Keepers Hill, and Slieve Felim Mountains to the southeast of the study area. The river corridor and lough is framed by these upland areas and through the central/eastern study area, most waterways are connected to the Shannon. This differs to the wider western half of the study area, where the landform and drainage are a sweeping glacial valley of varied slopes. This valley opens to the west of the study area, into open, rolling landform interspersed with loughs. The nearest of these to the site is Doon Lough and Lough Gar. The major waterway through the west of the study area is the Owenogarney or Ratty River, which forms a chain of loughs around the western hills of Seefin and Woodcock Hill. Both of these areas and waterway networks drain to the south/southwest of the study area where the Shannon opens to the coast, forming a broad estuarine landscape.

The vegetation and land use are dominated by densely tree-lined agricultural fields. There are dispersed instances of more intensive land use, such as population centres, power generation and extractive industries. The largest built-up area is to the south of the study area consisting of Limerick City and surrounds. There is also a cluster of industrial sites and quarries across the centre of the study area, with the nearest located c. 750m to the southwest of the site.

A computer generated Zone of Theoretical Visibility (ZTV) map has been prepared to illustrate where the proposed turbines are potentially visible from. 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. The ZTV map is presented in Figure 15-1. Here we can see the areas within 20km of the proposed turbines where 7 to 8 turbines will be visible (blue areas), 5 to 6 turbines will be visible (purple areas), 3 to 4 turbines will be visible (orange colour) and 1 to 2 turbines will be visible (yellow colour). The bare ordinance survey mapping indicates areas where the proposed turbines will not be seen.

Photomontages of the proposed wind farm have been prepared. These are photographs taken from various locations in the vicinity of the proposed development with a computer generated model of the proposed wind farm included. This is used to study the landscape and visual impact of the proposed wind farm in detail. 19 different viewpoints have been selected. These photomontages are included in Volume 4 of the EIAR.

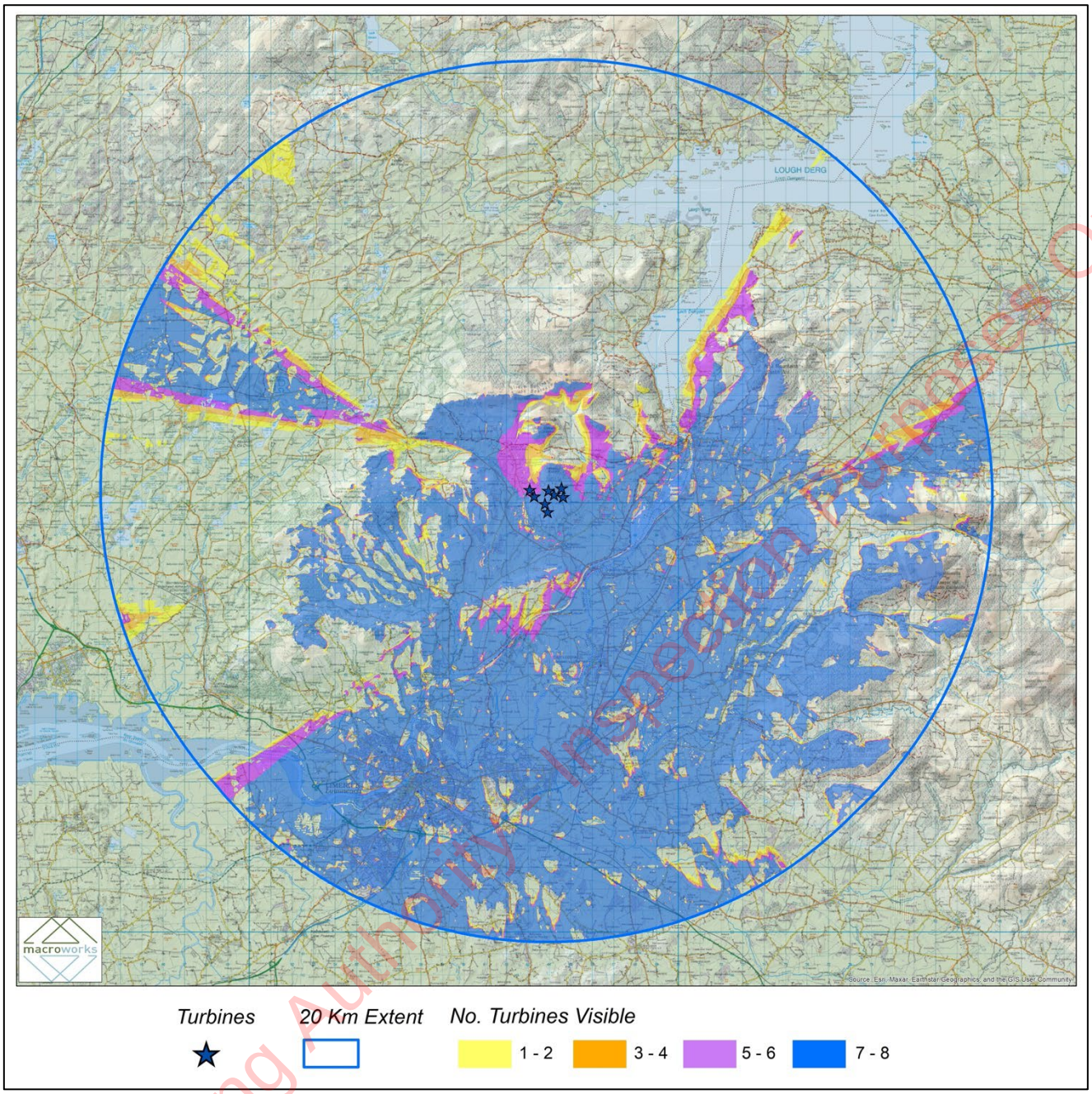

Figure 15-1: Zone of Theoretical Visibility Map

Given the highly visible nature of commercial wind energy developments it is not generally feasible to screen them from view using on-site measures, as would be the primary form of mitigation for many other types of development. Instead, landscape and visual mitigation for wind farms must be incorporated into the early stage site selection and design phases. In this instance, the main form of landscape and visual mitigation employed is the buffering of residential receptors.

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 significant impact on the character of the site than the operational phase, but it is a 'short-term' impact that will cease as soon as the proposed development is constructed and becomes operational (approximately 12-18 months from the commencement of construction).

There will be some long term/permanent construction stage effects on the physical landscape in the form of turbine foundations and hardstands, access tracks and a substation, but only the on-site substation and grid connection is likely to remain in perpetuity as part of the national grid network. It is likely that, with the exception of some residually useful access tracks, all other development features will be removed from the project site and it will be reinstated to agricultural or forestry use upon decommissioning. Thus, the construction stage landscape effects of the proposed development are largely reversible.

There will be some construction stage effects on landscape character generated by the intensity of construction activities (workers and heavy machinery), as well as areas of bare-ground and stockpiling of materials as identified in the Construction and Environmental Management Plan (CEMP). Such effects will be temporary/short term in duration and are, therefore, not considered to be significant.

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, 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 there are no other wind farms in the immediate vicinity, but they are a familiar feature of the wider study area, particularly within the Silvermines Mountains to the southeast.

In terms of scale and function, the proposed wind farm is well assimilated within the context of the central study area. This is due to the nature of the landform, landscape elements and land use patterns. These attributes prevent the height and extent of the proposed wind farm causing the type of scale conflict that can occur in other landscape areas. The central study area has a notable utilitarian, much-modified character and although the proposed development represents a stronger human presence and intensity / scale of built development than currently exists on the site, it will not detract significantly from its productive rural character, where the wind turbines are perceived as an additional supplementary layer of productivity above ground-based farming and forestry enterprises.

It is proposed to construct 8 no. turbines with a blade tip height range from 169 m to 176.5 m, a hub height range from 102.5 m to 110 m and a rotor diameter range from 131 m to 138 m.

In the context of the landscape and visual assessment, a specimen turbine that incorporates the highest potential blade tip height (176.5m) and largest potential rotor diameter (138m) will be used for the preparation of ZTV maps and Photomontages to aid the overall assessment. Thereafter, the potential range of turbine dimensions will be assessed using comparative photomontages of the specimen dimensions against the lowest hub height and largest rotor dimeter combination (102.5m / 138m) and then highest hub height and smallest rotor dimeter combination (110m / 131m). Comparative photomontages are prepared for three sample views selected from the main viewpoint set. This process ensures that the full range of potential turbine component dimensions is thoroughly assessed and has been used in a number of previous applications where it was considered to be a reasonable approach by the relevant Planning Authorities.

This development proposal represents a long term, but not permanent impact on the landscape and is reversible. The lifespan of the project is 35 years, after which time it will be dismantled and the landscape reinstated to prevailing conditions. Within 2-3 years of decommissioning, it is likely that there will be little evidence a wind farm ever existed on the site, albeit the proposed on-site substation and grid connection will remain in perpetuity as part of the national grid infrastructure, in addition to some residually useful access tracks.

The magnitude of the landscape impact is deemed to be **Medium** within the Central Study Area. Beyond 5km from the site, the residual magnitude of landscape impact is deemed to reduce to **Low** and **Negligible** at

increasing distances as the wind farm becomes a proportionately smaller component of the overall landscape fabric.

The decommissioning phase will have similar temporary impacts as the construction phase with the movement of large turbine components away from the site. This may potentially result in the minor loss of roadside and trackside vegetation that has grown during the operation phase of the project, but this can 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 surrounding land cover of the time. It is expected that the decommissioning phase would be completed within a period of approximately 6 months.

16. TELECOMMUNICATIONS AND AVIATION

The proposed development has been examined for the potential impact on telecommunications and aviation. This was completed through consultation with telecommunications providers and airport and aviation authorities. Telecommunication providers were asked to identify their infrastructure and links in the area in order to identify potential impacts to their services from the proposed wind turbines. Similarly, the airport and aviation authorities were asked to identify potential impact from the proposed turbines on infrastructure and airfields.

16.1 Potential Impacts

In the context of wind farm development, electromagnetic interference is the impact of a wind farm on existing telecommunication services resulting in an unacceptable negative impact. The rotating blades of a wind turbine can occasionally cause interference to electro-magnetically-propagated signals. Such interference could, in theory, affect all forms of electromagnetic communications including:

- Satellite communications
- RADAR
- Cellular radio communications
- Aircraft instrument landing systems
- Air traffic control
- Terrestrial telecommunication links
- Television broadcasts

This assessment considered all combinations of turbine arrangements within the range of dimensions described in Section 1. Aviation and telecommunications modelling was carried out based maximum turbine tip heights and rotor diameters from the range of options in order to determine the potential effects on telecommunications and aviation.

For the purposes of the telecommunications impact assessment, point-to-point and point-to-multipoint signals are considered, both are used extensively throughout Ireland. Point to point (or line of sight) is a wireless telecommunications transmission link between two nodes located at specified fixed points.

The term telecommunications link relates to the wireless transmission of data via radio frequencies between two fixed points. Telecommunications towers are generally used to transmit and receive signals over large distances. Radio frequency bands above 1 GHz are referred to as microwave radio links and are commonly used by telecommunications operators.

The proposed turbines have potential to interfere with these links if positioned in between their points.

The potential for electromagnetic interference from wind turbines occurs only during the operational phase of the project. There are no electromagnetic interference impacts associated with the construction phase of the proposed project on telecommunications and broadcasting in the area.

As the proposed grid connection will be constructed underground in the public roadway, there are no construction related impacts for electromagnetic interference and broadcasting interests in the area.

There is potential for aviation impacts during the late construction phase of a wind farm project and prior to the commissioning of the proposed project as the wind turbines are constructed and placed in situ. The turbines could be considered to be an obstacle to low flying craft.

As the proposed grid connection will be constructed underground within the public roadway, there are no construction related impacts on aviation interests associated with the Grid Connection Route.

During the operation phase, it is not expected that the proposed grid connection will have any operational related impacts on telecommunications and broadcasting interests in the area.

There is not expected to be any temporary impact to overhead lines during the operational phase of the proposed development. In the unlikely event that a turbine requires repair or replacement, a brief to temporary impact to overhead lines will occur during the delivery of turbine components.

As the proposed grid connection will be operating underground within the public roadway, there are no operational related impacts on aviation interests as a result of the operation of the Grid Connection Route.

There are no electromagnetic interference impacts associated with the construction or decommissioning phases of the proposed project, and therefore no mitigation required.

The proposed grid connection will be left in situ underground within the public roadway. There are no decommissioning related impacts on telecommunications and broadcasting interests in the area.

If overhead lines have to be temporarily disconnected at the time of decommissioning, the impacts will be no greater than those assessed at construction stage.

During the decommissioning phase, the turbines will be dismantled and removed from the site, thereby removing all potential obstacles to aviation interests. There will be no significant effects on aviation.

The proposed grid connection will be left in situ underground within the public roadway. There are no decommissioning related impacts on aviation associated with the Grid Connection Route.

In relation to Aviation, in line with standard practice for wind farm developments, the coordinates and elevations for turbines will be supplied to the Irish Aviation Authority (IAA) at the end of the construction phase. An aeronautical obstacle lighting scheme will be agreed with IAA in line with IAA's consultation response and applied to the proposed turbines.

17. INTERACTIONS OF THE FOREGOING

This Chapter considers the potential for interactions and inter-relationships between one aspect of the environment and another which can result in an impact being either positive or negative, as well as having varying significance. The chapter considers potential significant environmental effects that may occur in terms of the interaction and inter-relationships of Air Quality & Climate, Noise & Vibration, Biodiversity, Land, Soils & Geology, Hydrology & Water Quality, Population & Human Health, Material Assets, Shadow Flicker, Traffic & Transportation, Archaeology, Architectural & Cultural heritage, Landscape & Visual and Telecommunications & Aviation, as a result of the proposed project as described in Chapter 3 of this EIAR.

Table 17-1 herein provides a matrix detailing the key interactions and inter-relationships between the key environmental aspects of the proposed project, including the wind farm, grid connection route and turbine delivery route.

Each individual chapter of the EIAR has had regard to interactions between different potential impacts. For example, Hydrology & Water Quality has had regard to potential impacts on Biodiversity; and Land, Soils and Geology has had regard to potential impacts on both Biodiversity , Hydrology & Water Quality and Traffic & Transportation.

Table 17-1: Matrix of Interaction Between key Environmental Aspects

	Air Quality & Climate	Noise & Vibration	Biodiversity	Land, Soils & Geology	Hydrology & Water Quality	Population, Human Health & Material Assets	Shadow Flicker	Traffic & Transport	Archaeological, Architectural & Cultural Heritage	Landscape & Visual	Telecommunications & Aviation
Air Quality & Climate		■	■	■		■		■			
Noise & Vibration	■		■	■		■	■	■		■	
Biodiversity	■	■		■	■	■		■			
Land, Soils & Geology	■	■	■		■	■		■	■		
Hydrology & Water Quality			■	■		■		■	■		
Population, Human Health & Material Assets	■	■	■	■	■		■	■	■	■	
Shadow Flicker		■			■	■				■	
Traffic & Transport	■	■	■	■	■	■					
Archaeological, Architectural & Cultural Heritage				■	■	■				■	
Landscape & Visual		■				■	■		■		
Telecommunications & Aviation											

■ = interaction or inter-relationship □ = no interaction or inter-relationship

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

www.fehilytimoney.ie

CORK OFFICE
Core House
Pouladuff Road,
Cork, T12 D773,
Ireland
+353 21 496 4133

Dublin Office
J5 Plaza,
North Park Business Park,
North Road, Dublin 11, D11 PXT0,
Ireland
+353 1 658 3500

Carlow Office
Unit 6, Bagenalstown Industrial
Park, Royal Oak Road,
Muine Bheag,
Co. Carlow, R21 XW81,
Ireland
+353 59 972 3800