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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

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

VOLUME 2 – MAIN EIAR

CHAPTER 3 – DESCRIPTION OF THE PROPOSED PROJECT

Prepared for: RWE Renewables Ireland Ltd.

RWE

Date: **November 2022**

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3. DESCRIPTION OF PROPOSED PROJECT

3.1 Introduction

This chapter of the EIAR describes the existing site and the main components of the proposed project and provides details on the construction, operation and decommissioning of the wind farm in compliance with the EIA Directive.

A detailed summary of the proposed project assessed in the EIAR is contained in Section 3.3.

The proposed project assessed in this EIAR is comprised of the following key elements:

- The wind farm site **(referred to in this EIAR as** 'the Site');
- The grid connection (**referred to in this EIAR** as the 'GCR');
- The turbine delivery route **(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 GCR passes through the townlands of Leitrim, Fahy More South, Ballybrack, Aharinaghmore, Tooreen (Ed Cloghera), Aharinaghbeg, Knockdonagh, Roo East, Blackwater, Rosmadda West, Parkroe, Lackyle (Ed. Ballyglass) and Castlebank.

The TDR passes through the townlands of Ardataggle, Ardcloony, Cloonfadda, Coolnadornoy, Fahy Beg, Fahy More South, Fahy More North, Garrynatineel, Gortybrigane, Killestry, Kilmaglasderry, Knockadromin, Lackenavea (Dunalley), Lackenavea (Egremont), Leitrim, Moys, O'Briensbridge, Roolagh, Ross, and Shantraud and incorporates the proposed Killaloe town bypass which is currently under construction.

An overview of the proposed project is shown in
Figure 3-1, The general layouts of the proposed wind farm site, grid connection and turbine delivery route are presented in Figure 3-2: Wind Farm Site layout, Figure 3-3 and Figure 3-4.

Path: R:\Map Production\2020\P20-003\Workspace\EIAR\P20-003_GIS_Fig3-1_ProjectOverview_A3.mxd

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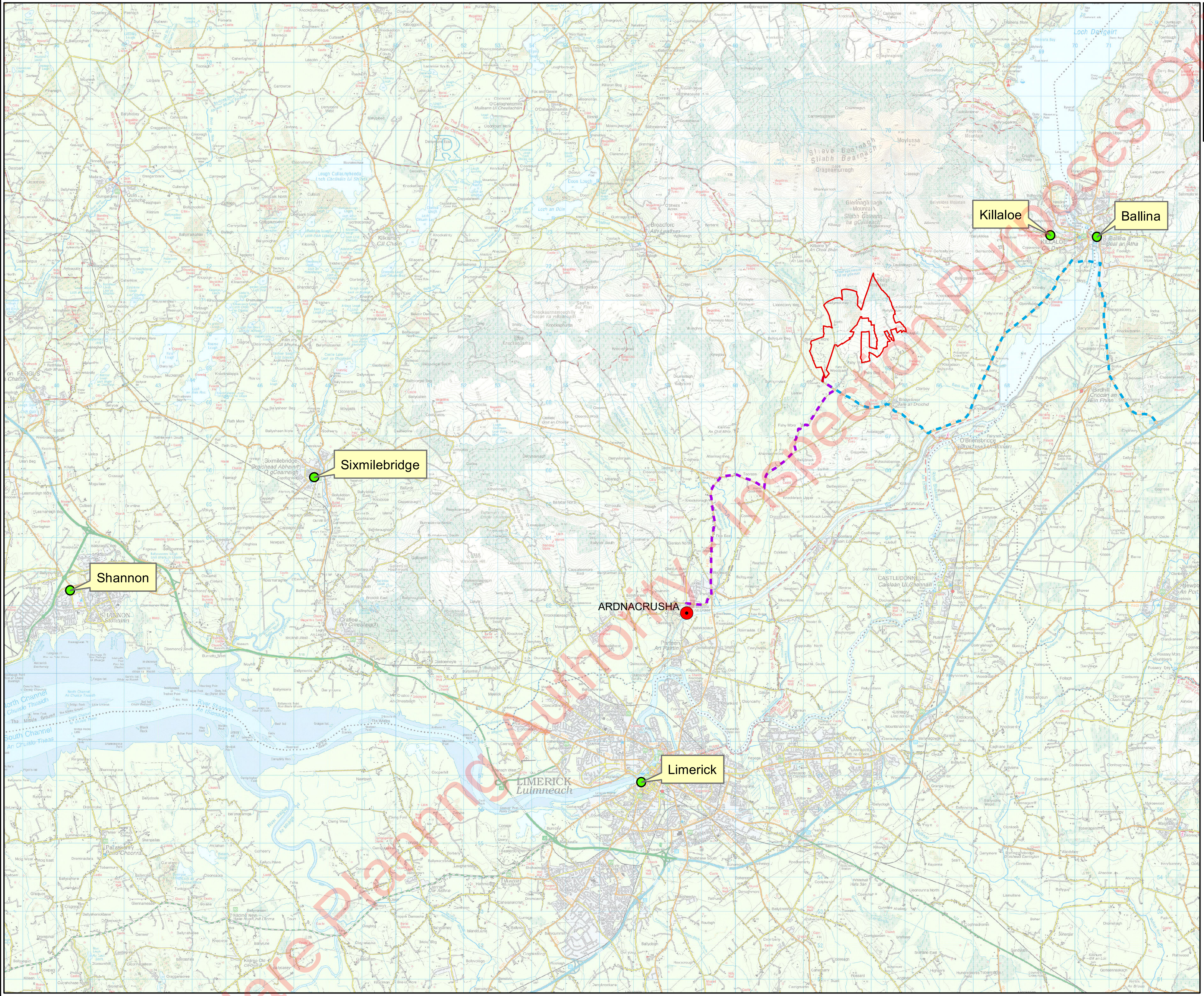

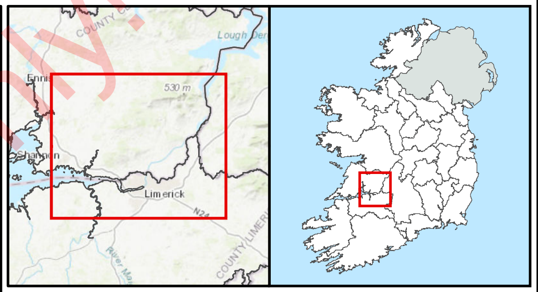

Legend

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

Kilometers: 0, 2, 4, 8

TITLE:	Site Location and Project Overview
PROJECT:	Fahy Beg Wind Farm, Co. Clare
FIGURE NO:	3.1
CLIENT:	Innogy Renewables Ireland Ltd.
SCALE:	1:110000
REVISION:	0
DATE:	27/05/2022
PAGE SIZE:	A3

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Path: R:\Map Production\2020\P20-003\Workspace\EIAR\P20-003_GIS_Fig3-2_SiteLayout_A3.mxd

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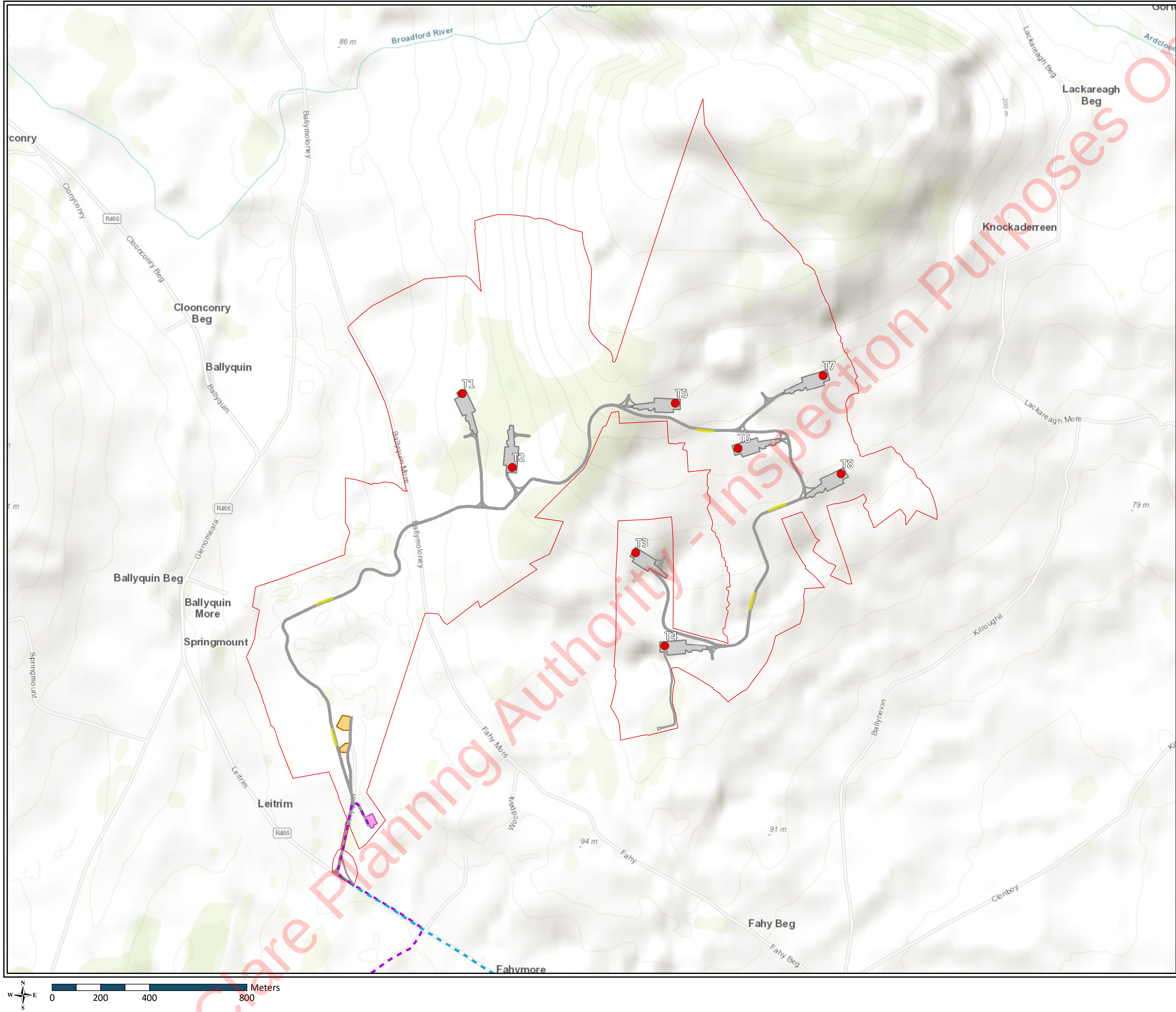

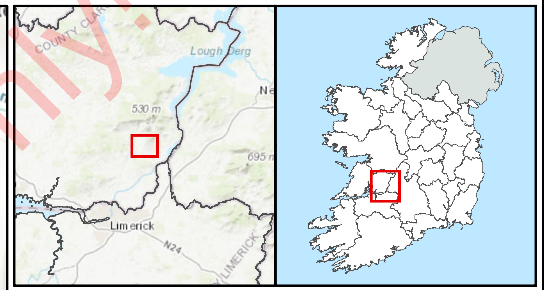

Legend

- 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

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: 22/11/2022	**PAGE SIZE:** A3

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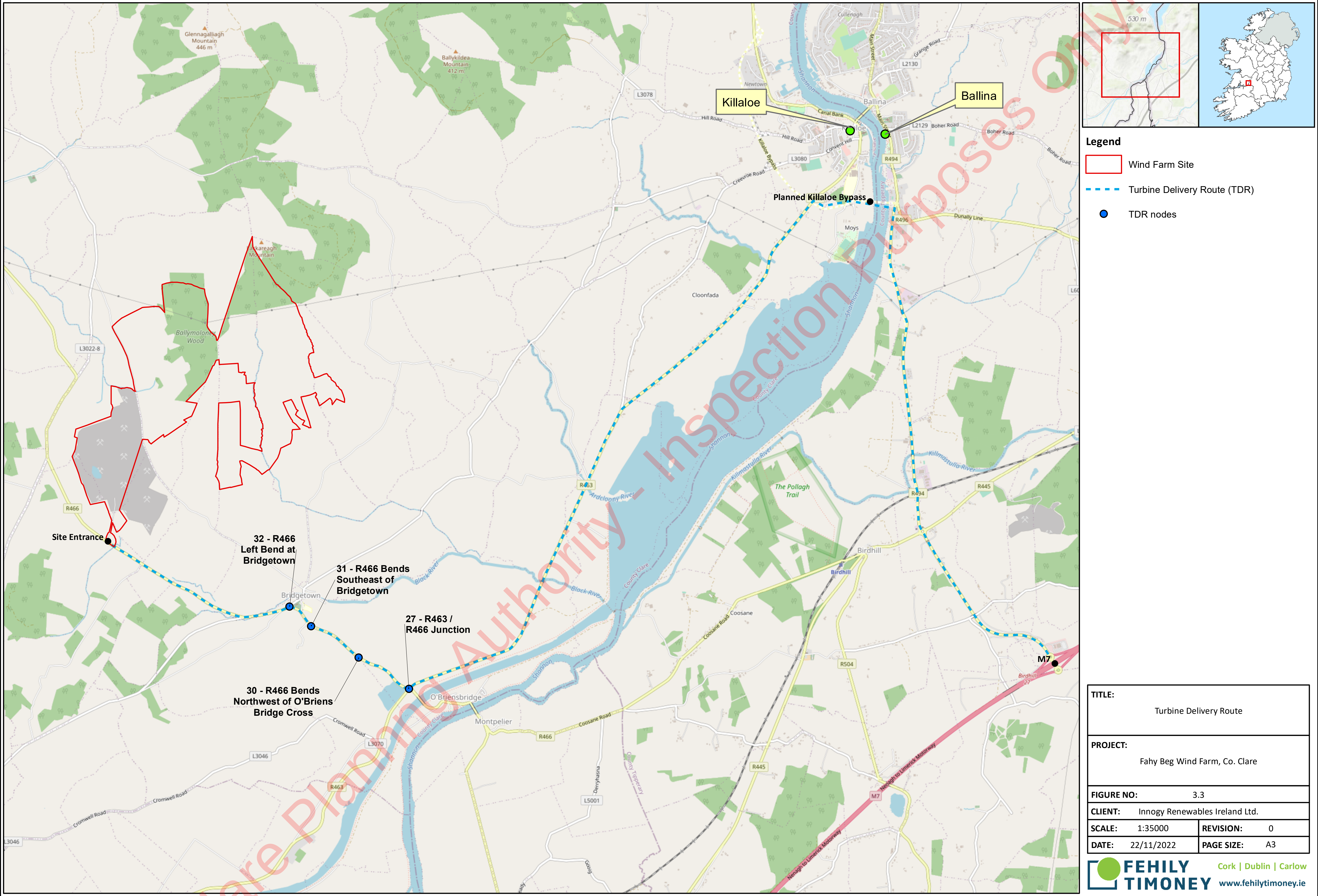

0 0.5 1 2 Kilometers

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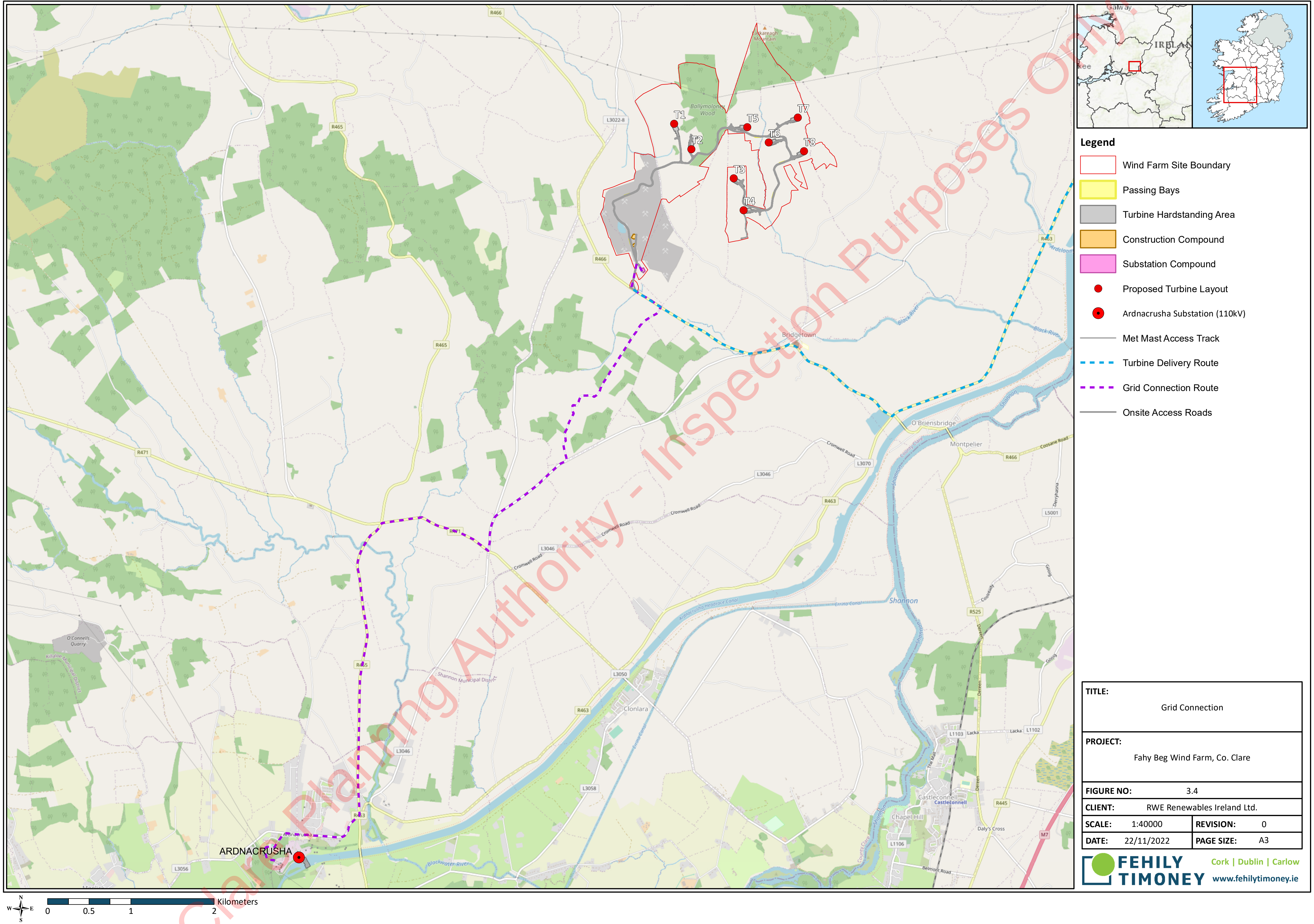

TITLE:	Grid Connection
PROJECT:	Fahy Beg Wind Farm, Co. Clare
FIGURE NO:	3.4
CLIENT:	RWE Renewables Ireland Ltd.
SCALE: 1:40000	REVISION: 0
DATE: 22/11/2022	PAGE SIZE: A3

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3.2 Existing Environment

3.2.1 Wind Farm Site

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.

Existing Hydrological Environment

The site is split between two river catchments. The eastern side of the site area is located in the Lower River Shannon catchment and the western side is located in the Shannon Estuary North catchment. The eastern part of the site is located in the Shannon (lower) sub-catchment and the western part is located in the Owenogarney sub-catchment.

There are two streams running through the site from north to south. These streams are the Black (O'Briensbridge) stream and the Fahy (Clare) stream. Both streams flow in a south-easterly direction and flow into the River Shannon which is designated as a Special Area of Conservation (Lower River Shannon SAC – Site Code: 002165).

The Broadford Stream is located to the west of the site and is hydrologically connected to the Doon Lough Natural Heritage Area.

The site is not located within a flood zone. No historical flooding data is recorded on the site. However, considering the poorly-drained and peaty topsoil located in the north-eastern and north-western extent of the site also low porosity of the bedrock aquifer below, there is a risk of pluvial flooding that is not listed on the Flood Info map viewer.

Existing Habitats

The footprint of the proposed wind farm site supports extensive areas of conifer woodland (WD4) and improved agricultural grassland (GA1). The proposed wind farm site will be accessed via the western boundary of an existing quarry site, the footprint of which supports scrub (WS1), young broadleaved woodland (WD1), other artificial lakes and ponds (FL8) and areas of recolonising bare ground and spoil and bare ground (ED2). The proposed access road turns east, crossing a local road and then entering the footprint of the proposed wind farm site. Immediately east of the local access road, the lands comprise low-lying improved agricultural grassland (GA1) bound by treelines (WL2) and hedgerows (WL1), with localised areas of rushy wet grassland (GS4). Continuing east, the topography of the proposed wind farm site continues to increase rapidly toward an extensive area of beech dominated mixed broadleaved woodland (WD1), which is bound to the north and east by conifer woodland (WD4). The southernmost areas of the proposed wind farm site layout support improved (GA1) and semi-improved agricultural grassland habitats, in addition to localised areas of wet grassland (GS4) habitats. The distribution and occurrence of these habitats are influenced by recent and ongoing maintenance, particularly drainage maintenance. The eastern southernmost sections of the proposed wind farm site are drained by tributaries of the Bridgetown (Clare)_010 river while the western half of the proposed wind farm site layout is drained by the Broadford_010 river.

Existing Archaeological Features

There are seven recorded archaeological sites located within the boundary of the proposed development site while there are a further eighteen examples located within a surrounding 1km study area. None of these recorded archaeological sites are National Monuments in state ownership or guardianship but all are protected under the National Monuments Acts 1930-2014.

The recorded archaeological sites within the proposed development boundary include five enclosures, two of which are now located within the quarry property in the western end of the site (CL044-073---- and CL044-074----), two examples are within pasture fields adjacent to the north and south boundaries of the site (CL044-062---- and CL044-077----) and one is within a clearing in a forestry plantation in the east end of the site (CL044-067----). The recorded location of a children's burial ground (CL045-052001-) with an associated bullaun stone (CL045-052002-), are within a field located adjacent to the eastern boundary of the site.

The recorded archaeological sites within the surrounding 1km area comprise thirteen enclosures, one fulacht fiadh, one unclassified cairn, one holy well, one standing stone and the former site of a levelled 16th/17th century house.

The current County Clare Record of Protected Structures (RPS) and the National Inventory of Architectural Heritage (NIAH) do not list any buildings/structures within the proposed development boundary. There is one Protected Structure within the surrounding 1km study area. This comprises Glemora House (RPS 427) which is a derelict, single storey house constructed in the early 20th century and is located 0.56km outside the west end of the proposed development boundary.

Existing Soils and Geology

The geology of the site can be summarised as consisting of till derived from Lower Palaeozoic sandstones and shales overlying the Old Red Sandstone formation across the majority of the site and the Broadford Formation across the northwest of the site. There are several locations with bedrock outcrop or sub-crop across the north of the site. An east-west striking fault transects the north of the site.

The soils within the region and the majority of the site are well-drained acidic soils with an exception being the poorly drained soils with some peaty topsoil in the north-western section of the site. Groundwater vulnerability is high to extreme within this region and along the western-most stream within the site. The Lough Graney and Tulla Newmarket on Fergus Groundwater Bodies reside within the site. Both are dominated by fracture flow and have low porosity and storability. Groundwater within the Old Red Sandstone formation may be isolated in regions with deep static water levels.

Existing Wind Farm Developments

Figure 3-7 illustrates existing wind farms within 20km of the site. The nearest operational wind farm to the site is Kockastanna Wind Farm located approximately 24km south east of Fahy Beg.

Other nearby wind farms in the vicinity include Templederry Wind Farm located approximately 25km east of Fahy Beg as shown in Figure 3-7.

Future Energy Ireland's permitted Carrownagowan Wind Farm project (Ref. ABP-303105-18) is located on the northern slopes of Slieve Bernagh mountain, approximately 4 km northeast of the village of Broadford, 7km north-west of Killaloe and 2.5 km south of the village of Bodyke, at its closest point.

This project comprises 19 no. turbines with a maximum tip height of 169m. Carrownagowan Wind Farm is located approximately 7km north west of Fahy Beg.

On-Site Wind Resource

The layout of the proposed wind farm has been designed to minimise the potential environmental impacts of the wind farm, while at the same time maximising the energy yields of the wind resource passing over the site. Available wind speed is a key factor in determining the economic viability of potential wind energy locations. The 2013 Sustainable Energy Authority of Ireland (SEAI) Wind Speed Atlas identifies the site as having an average wind speed of between 7.3 and 8.5 m/s at 100 m above ground level. Wind speed monitoring from the site has recorded average wind speeds of 7.4 m/s.

3.2.1.1 Biodiversity Enhancement and Management Plan (BEMP)

Lands associated with the proposed BEMP are all contained within the proposed wind farm site boundary. A detailed description of the existing environment at each of the proposed BEMP land sites is provided in Appendix 3-4.

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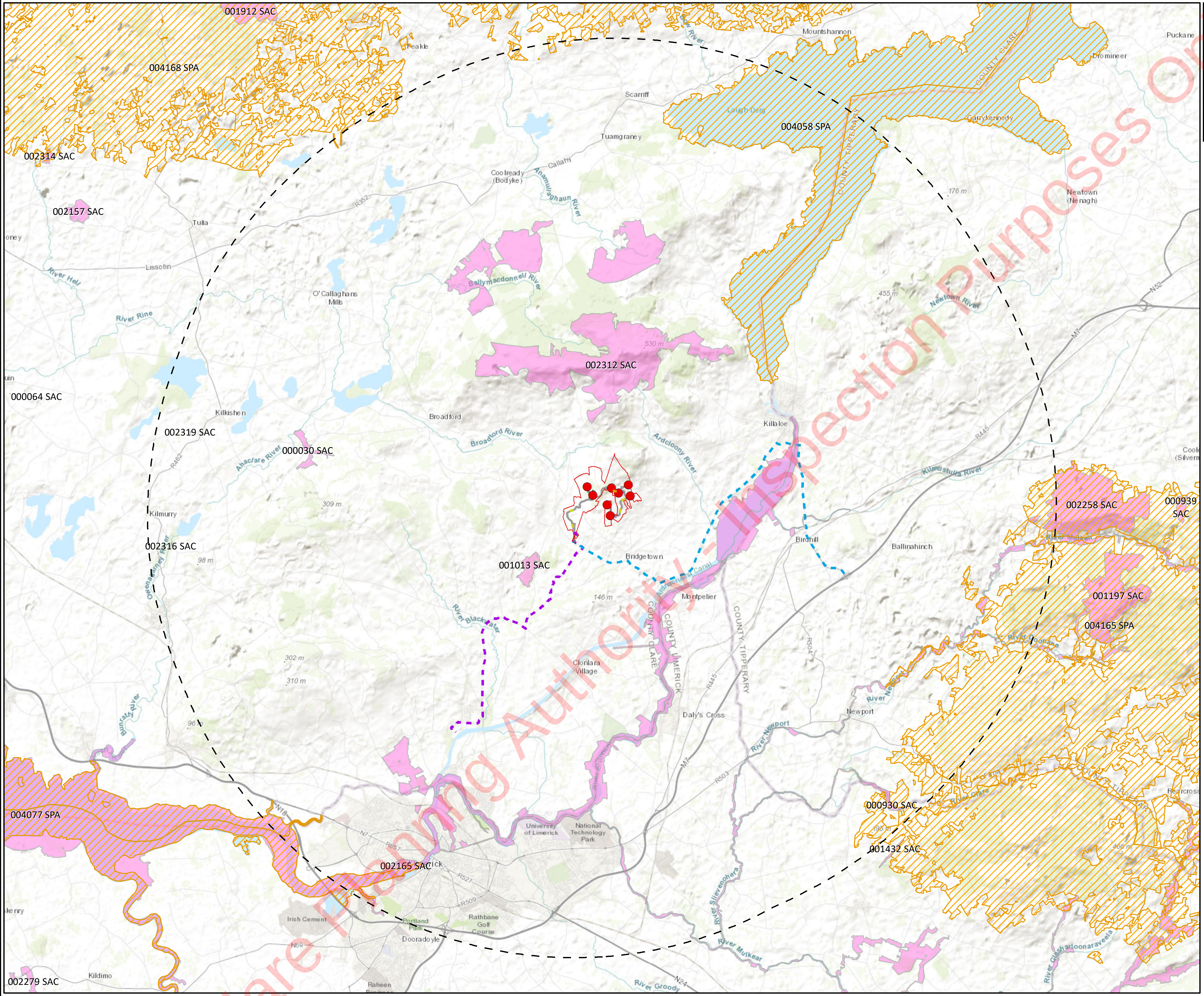

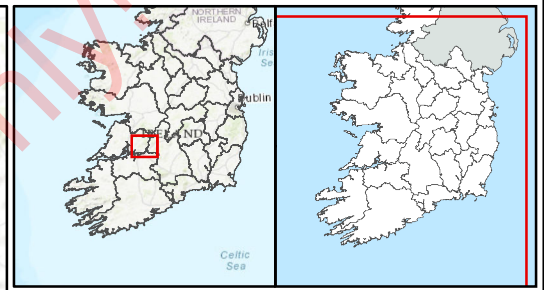

Legend

- 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
- 15km Buffer Zone
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)

TITLE: European Sites within ZOI	
PROJECT: Fahy Beg Wind Farm, Co. Clare	
FIGURE NO: 3-5	
CLIENT: RWE Renewables Ireland Ltd.	
SCALE: 1:135000	**REVISION:** 0
DATE: 16/11/2022	**PAGE SIZE:** A3

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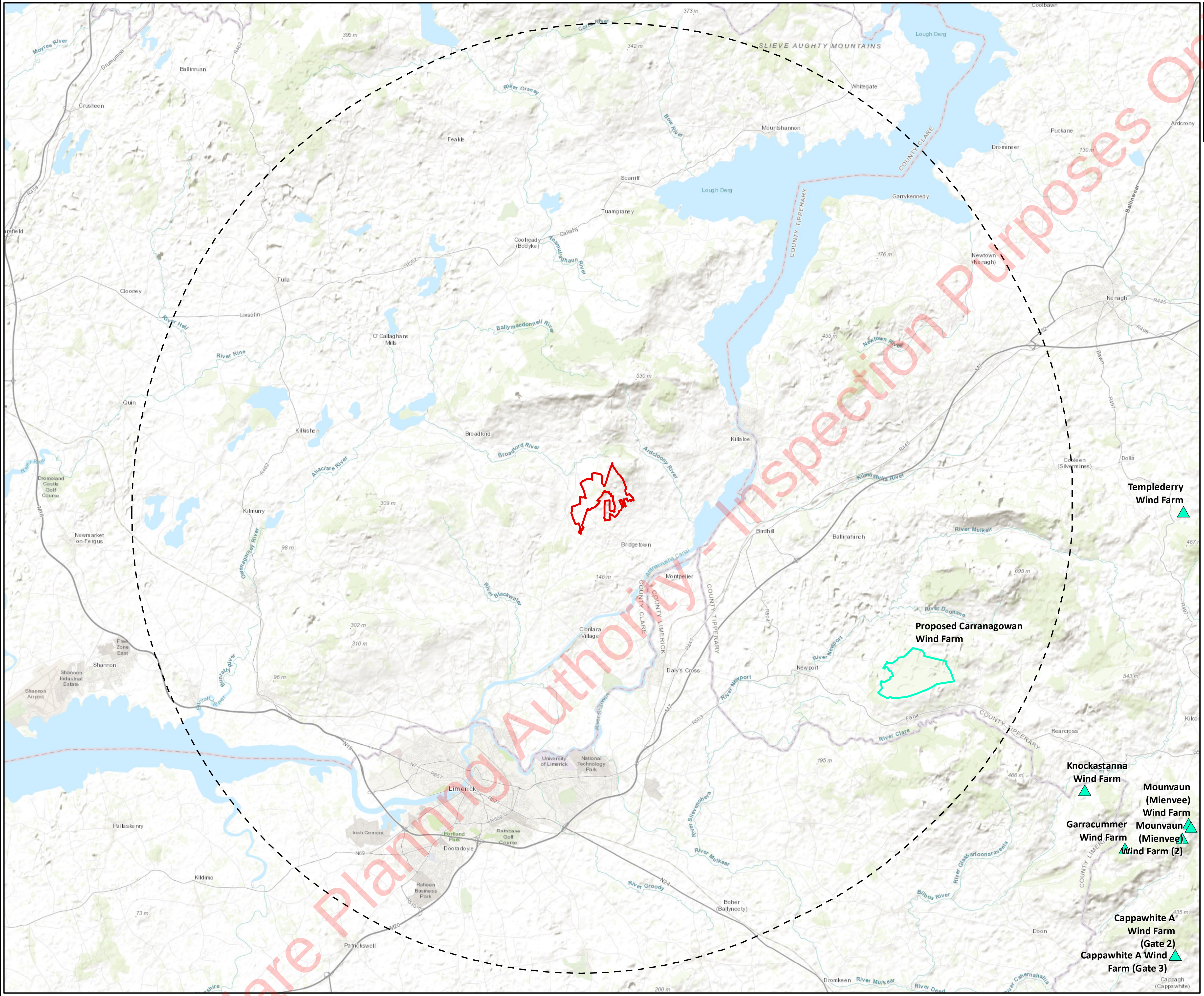
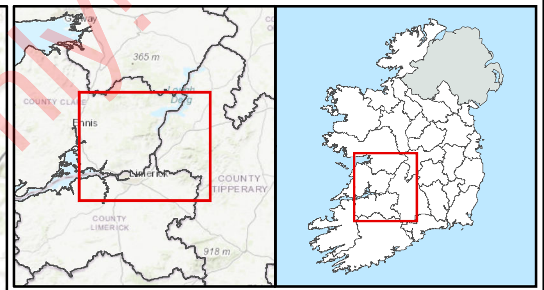
0 2.5 5 10 Kilometers





Legend

- Study Area
- 20km Buffer of Study Area
- Proposed Carranagowan Wind Farm
- SEAI Wind Farms (2018)

TITLE:	Existing Wind Farms in the Vicinity
PROJECT:	Fahy Beg Wind Farm, Co. Clare
FIGURE NO:	3.7
CLIENT:	Innogy Renewables Ireland Ltd.
SCALE: 1:170000	REVISION: 0
DATE: 16/11/2022	PAGE SIZE: A3

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0 2.5 5 10 Kilometers

3.2.2 Grid Connection Cable Route

The proposed grid connection route will be 38kV underground cable ca. 10.612 km in length, with 10.335 km to be constructed within the existing road corridor. The proposed grid connection arrangement is illustrated in Figure 3-4. The grid connection will be contained within the public road corridor throughout its length with the exception of start and finish points where the cables shall be terminated in the existing network substation and proposed onsite substation which is located within the wind farm site.

The grid connection is located within the Shannon[Lower]_SC_080 and Shannon[Lower]_SC_100 sub-catchments in its entirety.

See the 38kV Grid Connection Outline Construction Methodology prepared by TLI in Appendix 3.1 for further details.

3.2.3 Turbine Delivery Route

Large components associated with the wind farm construction will be transported to the Site via the identified turbine delivery route (TDR). The TDR includes the following roads:

- N69
- N18
- M7
- R494 (Planned Killaloe Bypass)
- R463
- R466

The study area and associated existing environment associated with the TDR shall be confined to the public road corridor associated with the above roads with the exception of locations where temporary accommodation works will be required to facilitate the delivery of oversized loads. For these locations, private lands have been identified and assessed in the EIAR. The TDR and location of temporary accommodation works are described in detail in Section 3.5 and presented in Figure 3-3. All of these works are located within County Clare.

3.2.4 Land Ownership

The lands associated with the proposed development are owned by a combination of private landowners.

The majority of the proposed GCR is contained within public roads with the exception of off-road watercourse crossings and at start and end points where the proposed 38kV grid connection cable connects into both the onsite and network substations.

Temporary accommodation works required to facilitate the delivery of large components to the site shall be contained within the public road corridor and private lands as identified on planning application drawings.

3.3 Proposed Project

As described in Section 3.1, the proposed project assessed in this EIAR is comprised of the following key elements:

- 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').

A detailed description of each element of the project is contained hereunder. Sections 3.3.1 and 3.3.2 below outline the elements of the project for which planning consent is being sought.

3.3.1 Summary of the Statutory Development Description for Consent

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;
- 2no. Temporary construction site compounds 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 8 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;

3.3.2 Additional Project Elements Assessed in the EIAR

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.

Each of 5 no. fixed dimensions within the proposed range have been fully assessed as part of the EIA and AA process.

3.3.3 Wind Farm Site

The proposed wind farm will consist of 8 no. wind turbine generators (WTG's), a meteorological mast, and 1 no. substation compound along with ancillary civil and electrical infrastructure.

3.3.3.1 Turbine Layout

The layout of the proposed wind farm has been designed to minimise the potential environmental effects of the wind farm while at the same time maximising the energy yield of the wind resource passing over the site. Figure 3-2 shows the proposed wind farm site layout. The layout reflects the outcome of an iterative design process. Further detail on the design philosophy, constraints and alternative layouts is provided in Chapter 2 of the EIAR: Need for the Development and Alternatives Considered.

Turbine location co-ordinates in Irish Transverse Mercator (ITM) are detailed in Table 3-1 below.

Table 3-1: Proposed Turbine Coordinates

Turbine ID	ITM Coordinates	
	X	Y
1	563041	670613
2	563247	670311
3	563916	670573
4	563753	669961
5	563873	669578
6	564173	670389
7	564524	670688
8	564597	670284

Fahy Beg Wind Farm has been designed in accordance with the current Section 28 Ministerial Guidelines (section 28 of the Planning and Development Act 2000, as amended), Wind Energy Guidelines 2006. We are aware that these guidelines are subject to targeted review. The layout and design of the wind farm has the ability to comply with the "Draft Revised Wind Energy Development Guidelines," published by the Department of Housing, Planning and Local Government (December 2019). If new Guidelines are adopted prior to a decision of permission by the authority, the applicant is happy to demonstrate compliance with same as appropriate.

Further to this the proposed layout sought to achieve an optimum separation distance between dwellings and the proposed turbines by providing a minimum separation distance of 720m between turbines and the closest dwellings. The Draft Revised Guidelines outlines a minimum 500m or 4 times tip height set back. Following completion of layout optimisation, a separation distance of 720m was achieved from the closest third-party dwelling to a turbine tower. There are 26 no. dwellings located within 1km of the wind turbines. One property is located within this distance however it is owned by an involved landowner who has agreed a reduced setback distance to the property with the Applicant.

3.3.3.2 Wind Farm Power Output

The proposed wind farm will have an estimated Export Capacity (MEC) ranging from 31.2 – 38.4 MW depending on final turbine technology installed. Turbines of the exact same make, model and dimensions can have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. The exact rating and design of the proposed turbine will be subject to a competitive procurement process that will only commence if the project receives consent. The above range has been fully assessed in the Air and Climate chapter with respect to emissions calculations.

A rated capacity of 31.2 MW used below (represents the worst case in terms of generation capacity) to calculate the power output of the proposed wind farm.

Assuming an installed capacity of 31.2 MW, the proposed wind farm has the potential to produce approximately 95,659 MWh (megawatt hours) of electricity per year, based on the following calculation:

A x B x C = Megawatt Hours of electricity produced per year where:

A = The number of hours in a year: 8,760 hours

B = The capacity factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc. A capacity factor of 35 % is applied here

C = Rated capacity of the wind farm: 31.2 MW

The electricity produced by the proposed wind farm would be sufficient to supply approximately 22,000 – 28,000 Irish households with electricity per year, based on the average Irish household using 4.2 MWh of electricity (this latest figure is available from the March 2017 Commission for Energy Regulation (CER) Review of Typical Consumption Figures Decision Paper[1]).

EirGrid in their All-Island Generation Capacity Statement (2017-2026) estimates a capacity factor of approximately 31% for onshore wind. The capacity factor applied for the proposed wind farm is greater than the EirGrid estimation as a result of improvements in turbine technology and the good wind flows at the site. The proposed turbine type allows for the use of fewer, taller turbines with an increased efficiency and in return greater economic benefit to the consumer.

3.3.3.3 Wind Turbines

Turbine General Description

Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics with only minor cosmetic differences differentiating one from another.

The wind turbines that will be installed on site will be conventional three-blade horizontal axis turbines, which will be designed to ensure the rotors of all turbines always rotate in the same direction.

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 reinforced polyester hood covers the nacelle. Earthing and isolation protect all components from lightning strikes.

The plans and particulars submitted with this application for consent are precise and provide specific dimensions for the turbine structures which incorporates a small range in dimensions. The turbine specifications will have a hub height ranging from 102.5 to 110m and a rotor diameter ranging from 131m to 138m with a tip height ranging from 169m to 176.5m. Each chapter of this EIAR has fully assessed the full spectrum of different scenarios within this range in turbine specification and the ultimate final turbine selection will fall within the parameters of this range.

[1] https://www.cru.ie/wp-content/uploads/2017/07/CER17042-Review-of-Typical-Consumption-Figures-Decision-Paper-1.pdf

The exact make and model of the turbine will be dictated by a competitive tender process, but it will not exceed the maximum or minimum size envelope set out above.

Detailed drawings, which accompany the planning application, show a turbine that may be used for the proposed project.

Turbine Blades

The blades of a modern turbine are made up of glass fibre reinforced polyester. They turn at between 5 and 15 revolutions per minute depending on wind speed and make of turbine.

A turbine begins generating electricity at a wind speed of 3 to 4m/s depending on turbine type, with rated power generation at wind speeds of approximately 12 to 14m/s.

The turbines usually shut down at wind speeds greater than 25m/s, although some machines are designed to operate at up to 30m/s. The yaw mechanism turns the nacelle and blades into and out of the wind. A wind vane on the nacelle controls the yaw mechanism. Blades are pitched to match the wind conditions.

Turbine Tower and Foundation

The tower of the turbine is a conical steel tube, with multiple painted finish. It is generally delivered to site in four or five sections. The first section is bolted to the steel base, which is cast into the concrete foundation.

The upper sections of the tower are bolted to the lower ones in sequence. The base of the tower is approximately 5m in diameter, tapering to approximately 3m, where it is attached to the nacelle. The first floor of the tower is approximately 2-3m above ground level it is accessed by a galvanised steel staircase and a steel hatch door which will be kept locked except during maintenance.

The turbine will be anchored to the foundation as per the turbine manufacturer's guidelines which will be incorporated in the civil foundation design.

Following detailed site investigations, it has been determined that the wind turbine foundations at Fahy Beg will be standard shallow reinforced concrete foundations.

For this project, the turbine foundations will be circular in shape and will be 25m in diameter and 3.5m in depth.

The turbine foundations shall be constructed using standard reinforced concrete construction techniques. Detailed construction methodologies for turbine foundations are provided in the CEMP in Appendix 3.1.

In summary the works shall be carried out as follows:

- The extent of the excavation will be marked out.
- Around the perimeter of the foundation formation a shallow drain will be formed.
- The base of the foundations will be excavated to competent bearing strata.
- Excavated soil will be placed in the temporary storage areas adjacent to the turbines in accordance with the soil management plan contained within the CEMP in Appendix 3.1.

- A layer of concrete blinding will be laid approximately 75mm thick directly on top of the newly exposed formation.
- Formwork and reinforcement will be fixed in accordance with the designer's drawings & schedules.
- Ductwork will be installed as required for cables, and formwork erected around the steel cage.
- Concrete will be placed using a concrete pump and compacted using vibrating pokers to the levels and profile indicated on the construction drawings.
- Upon completion of the concreting works the foundation base will be covered from the elements.
- Steel shutters will be used to pour the upper plinth section.
- Once the concrete is set the earthing system is put in place and the foundation is backfilled with suitable material.
- The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the top-soil set-aside during the excavation.

Turbine foundations will be designed to Eurocode Standards[2]. Foundation loads will be provided by the wind turbine supplier, and factors of safety will be applied to these in accordance with European design standards.

Turbine Transformer

The turbine will have a transformer located within the tower. The turbine will generate electricity at approximately 660 volts, depending on the machine chosen. The turbine transformer will step up the voltage to up to 33kV to reduce the electrical loss on the cabling connector circuits that connect to the site substation.

Turbine Colour

The turbines have a multiple painted coating to protect against corrosion. They are coloured off-white or light grey to blend into the sky background. This minimises visual impact, as recommended by the following guidelines on wind energy development:

- "Wind Energy Development – Planning Guidelines" (2006), Department of the Environment, Heritage and Local Government;
- "The Influence of Colour on the Aesthetics of Wind Turbine Generators," ETSU W/14/00533/00/00
- PAN 45, The Scottish Office Environment Department;
- PPG22, Department of the Environment - Welsh Office;
- Technical Advice Note 8, Welsh Assembly, 2005.

Turbine Erection

Once the turbine components arrive on site they will be placed on the hardstand and lay down areas prior to assembly. The towers will be delivered in sections and each blade will be delivered in a separate delivery. Once there is a suitable weather window the turbine will be assembled.

[2] EN 1992-1-1: Eurocode 2: Design of concrete structures.

BS EN 61400-1:2005: Wind Turbines Design Requirements.

It is anticipated that each turbine will take approximately 3 to 4 days to erect (depending on the weather), requiring two cranes. Finally, the turbines will be commissioned and tested.

It is expected that the entire construction phase, including civil, electrical and grid works, and turbine assembly will take between approximately 12-18 months.

3.3.3.4 Wind Farm Site Access

Access to the site will be made through the existing Roadstone quarry to the southwest. The existing quarry entrance on the R466 will be utilized for construction purposes.

There will be two more entrances on the Fahymore local road. There will be an entrance on either side of the road to facilitate a crossing point between the quarry and the site. There will be a 5m concrete apron at both entrances of the crossing point. All large loads including turbine towers, turbine blades and trucks with materials will only be permitted to enter via the quarry. Only light goods vehicles (LGV) such as vans and jeeps will be allowed travel along the Fahymore local road and enter the site using that site entrance.

3.3.3.5 Wind Farm Internal Access Tracks

1.4 km of internal access tracks will be required to be upgraded as part of the project and 7.2 km of new internal access tracks will be required. Figure 3-2: Wind Farm Site layout illustrates the internal access tracks within the proposed wind farm site. The proposed internal site track layout will permit access for vehicles during the construction phase, for maintenance during the operational phase and for vehicles to decommission the turbines at the end of the life of the project.

All access tracks will be 5m wide along straight sections and wider at bends and turning areas as required as shown on accompanying planning application drawings in accordance with wind turbine manufacturer requirements for the wind turbines of this size. The tracks will be finished with a well graded aggregate. The drainage system will be installed adjacent to the internal access tracks. Existing drainage infrastructure will be maintained and upgraded where necessary. Existing drainage channels will be upgraded to the same standard as the proposed drainage infrastructure in accordance with the drainage design and Surface Water Management Plan (Appendix 10.2).

The stone required for the construction of the internal access roads will be sourced from licenced quarries in the vicinity of the project. The location of licensed quarries, waste facilities and haulage routes are identified in Chapter 9: Land, Soils, Geology and Hydrogeology and Chapter 13: Traffic and Transportation.

Existing forest track drainage is extensive throughout the wind farm site and shall be maintained wherever possible and upgraded as required to meet the requirements of the proposed wind farm drainage design. SuDS design approach shall ensure that existing drainage patterns shall be maintained throughout the wind farm site and this is discussed further below.

The drainage system for the existing tracks and roads will largely be retained. It is proposed to upgrade approximately 1.4 km of existing forestry and agricultural tracks which will involve widening by approximately 1m, with some additional widening a bends and turning areas.

All track widening will be undertaken using clean uncrushable stone with a minimum of fines. This will involve slight relocation of existing roadside ditches to allow widening.

Access track formation will consist of a minimum 500mm hardcore on geo-textile membrane. The proposed construction methodology for newly constructed tracks is as follows:

- The formation will be prepared to receive the geotextile membrane.
- Stone will be placed and compacted in layers to minimum 500mm depth.
- Drainage ditches will be formed, within the excavated width and along the sides of the track. Drainage infrastructure will be constructed in parallel with the access track construction.
- A layer of compacted Cl 804 material will be placed on top to provide a suitable running surface.
- Surplus excavated material will be placed along the side of sections of the tracks in suitable locations as identified in the soil management plan which is contained within the CEMP (Appendix 3.1) and where appropriate dressed to blend in with surrounding landscaping and partially obscure visibility of the track during operation.

The proposed new internal access tracks will be founded on suitable substrate.

It is expected that floating roads will not be required for this site based on the results of assessments.

Further details on access track construction are provided in the CEMP in Appendix 3.1.

3.3.3.5.1 Wind farm Internal Access Track Watercourse Crossings

There will be ten watercourse crossings across larger watercourses within the wind farm site. It is proposed to install one single-span bridge and nine box culvert crossings. The proposed crossing designs have been designed in line with Inland Fisheries Ireland (IFI) requirements and consultation feedback. Details of proposed crossing structures are presented in 0500-Series planning application drawings. Watercourse crossings associated with wind farm access tracks are described in detail in Chapter 10.

Minor watercourse and drain crossings within the site will be crossed using piped culverts. Piped culverts will only be used over very short stretches i.e., at track crossings. Pipe culverts will be sized to take the 1 in 100-year flood flow with a 20% allowance for Climate Change. Concrete or HDPE pipes may be used depending on the size of the watercourse to be crossed. Water being conveyed underneath wind farm access tracks from drains or minor watercourses shall be done using 225mm and 450mm diameter pipes.

For a minor watercourse/drain crossing using a piped culvert, the following shall be employed:

- The access track construction will finish at least 10m from the nearside bank of the minor watercourse/drain.
- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in the Surface Water Management Plan (SWMP) in Appendix 10.2 and CEMP in Appendix 3.1.
- Pipe culvert installation will only take place during dry periods.
- The pipe is laid in one lift or in sections using a crane.
- Suitable bedding material in the form of clean round gravel between 10-100mm diameter, shall be laid in the base of the pipe in accordance with the recommendations set out in *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Watercourses from* Inland Fisheries Ireland.

- Rock armour headwalls will be constructed where necessary to protect pipe ends and the base of slope embankments on either side of the track.

In some cases where existing internal forest tracks need to be widened, it will be necessary to widen, replace or extend existing pipe drains. In such cases, the above measures shall also be employed.

Further details on hydrology and drainage are contained in Chapter 10 Hydrology and Water Quality, the Surface Water Management Plan (SWMP) which is contained in Appendix 10.2 and on accompanying planning application drawings.

3.3.3.6 Turbine Hardstandings

A turbine hardstanding area consists of a main crane pad hardstanding of 40m x 75m with a number of additional smaller hardstandings that act as set down and assembly areas, located as shown on the accompanying planning drawings. This area will accommodate a main crane and an assist crane during the assembly of the turbine, as well as during occasional maintenance periods during operation. It will also facilitate parking for operation and maintenance staff.

A turbine hardstanding area will be constructed at the base of each turbine to provide a solid area for the installation crane that will be used to erect the turbine and for the assembly of the turbine.

The stone required for the construction of the internal access roads will be sourced from licenced quarries in the vicinity of the project. The location of licensed quarries, waste facilities and haulage routes are identified in Chapter 9: Land, Soils, Geology and Hydrogeology and Chapter 13: Traffic and Transportation.

Hard standing formation will consist of a minimum 500mm hardcore on geo-textile membrane. The construction methodology for hard standings will be as follows:

- The formation will be prepared to receive the geotextile membrane.
- Stone will be placed and compacted in layers to minimum 500mm depth.
- A drainage ditch will be formed, within the excavated width and along the sides of the hard standing.
- Surplus topsoil will be placed along the side of the hard standing and dressed to blend in with surrounding landscaping.

3.3.3.7 On-Site Electricity Substation

An onsite electricity substation will be constructed within the proposed wind farm site as shown in Figure 3-2. This will provide a connection point between the wind farm and the proposed grid connection point at the existing Ardnacrusha substation.

The dimensions of the substation compounds will be up to 53.5 m x 33.2 m and will include a substation control building and electrical components necessary to export the electricity generated from the wind farm to the national grid. The substation compound will be surrounded by a ca. 2.5-metre-high steel palisade fence and internal fences will also be provided to segregate different areas within the main substation compound.

Lighting will be required on site, and this will be provided by lighting poles located around the substation and exterior wall mounted lights on the control buildings.

The control building located within the substation compound will measure up to 24 m by 10 m and up to 6m in height. The control building will include the Independent Power Production (IPP) and grid operator control rooms, an office space and welfare facilities for staff during the operational phase of the wind farm. Due to the nature of the project, there will be a small water requirement for occasional toilet flushing/hand washing with a rainwater harvesting tank adjacent to the control building.

A wastewater holding tank will be provided outside the substation compound fence line so that it can be maintained where required without requiring access to the substation compound. The wastewater holding tank will be a sealed storage tank with all wastewater tankered off site as required by an authorised waste collector to a wastewater treatment plant. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007, will be employed to transport wastewater away from the site. The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. Potable water shall be delivered to site and stored in a holding tank in the substation control building.

The substation compound will also contain external electrical and ancillary infrastructure in the form of the following:

- Cable sealing ends;
- Surge arrestors;
- Cable disconnectors;
- Post insulators;
- Circuit breakers;
- Current and voltage transformers;
- Steel gantry's and cable chairs;
- Power transformers;
- Power quality compensation equipment;
- Concrete plinths and bunds;
- External lighting;
- Lightening protection masts;
- Telecommunications masts;
- Security cameras;
- Palisade fencing and gates.

Lightning protection and telecommunications masts will represent the tallest structures in the compound and shall not exceed 18.1m in height.

The proposed substation compound is presented in accompanying planning application drawings.

3.3.3.8 On-Site Electrical Cabling

Electricity generated from wind turbines shall be collected at medium voltage (up to 33kV) by an internal circuit of buried cables which will follow on-site access tracks. This circuit shall be terminated at the proposed onsite substation.

Internal collector circuit cable routes are shown on the planning application drawings and will follow the alignment of the internal access tracks.

The electricity will be transmitted as a three-phase power supply so there will be three individual conductors (or individual cables) in each cable circuit. The three conductors will each be laid in separate ducts which will usually be laid in a trefoil formation but may also be laid in a flat formation where conditions require it such as where the ducts need to cross an existing structure or culvert in such cases, cable ducts shall be cast into the structures to allow the power cables to cross the watercourses under the access track.

The design and construction methods associated with the internal wind farm electrical cabling will be similar in nature to that of the 38kV grid connection cable works as described in Section 3.3.4.1.

The width of the internal cable trench with a trefoil formation will be 600mm, a flat formation will require a wider trench width (approximately 1200mm). The depth of cover to the ducts carrying the cables will be 900mm to the top of the upper ducts. The depth of trench for the cables will be 1200mm. The diameter of the ducting will be selected to suit the range of cross-sectional areas of electrical cables and is likely to fall between 100mm and 200mm diameter.

Internal cable trench section types associated with on-site electrical cabling are presented in the accompanying planning application drawings.

Further details on cable trench construction methodologies can be found in the CEMP in Appendix 3.1.

3.3.3.9 Temporary Site Compound

During the construction phase, it will be necessary to provide temporary facilities for construction personnel. The location of the temporary site compound is shown on Figure 3-2. Wheel wash facilities will be provided within the site near the site entrance point as shown on Figure 3-2.

Facilities to be provided in the temporary site compound will include the following:

- site offices, of Portacabin type construction;
- Portaloos;
- bottled water for potable supply;
- a water tanker to supply water used for other purposes;
- canteen facilities;
- material/non-fuel storage areas;
- employee parking;;
- bunded fuel storage
- contractor lock-up facility;
- diesel generator;
- waste management areas.

The Temporary compound shall be aggregate hard standings surrounded by security fencing, located as shown on the accompanying drawings. Temporary facilities will be removed, and the lands reinstated on completion of the construction phase.

3.3.3.10 Meteorological Mast

1 no. meteorological (Met) mast (PMM's) shall be erected on site at the location shown in Figure 3-2.

The permanent met mast shall be of the following general configuration:

- 100m high lattice steel mast with a shallow concrete foundation. A lightning rod will extend above the masts by 4 meters.

The met mast installation works shall be carried out by a small crew and are described as follows:

- An access track shall be extended towards the mast location from the proposed wind farm access track as shown on Figure 3-2: Wind Farm Site layout The access track shall be 3.5m in width. Temporary and permanent drainage infrastructure shall be extended also.
- A small aggregate crane pad of approximately 10m x 10m in size shall be constructed in front of the proposed mast location.
- General construction methods for the above access track and hard standing shall match those described for wind farm access tracks and hard standings however the dimensions and stone depth requirements of the infrastructure will be considerably less than that required for that serving the wind turbine construction.
- The foundation shall be excavated followed by shuttering, steel fixing and finally concrete pouring by ready mix truck. Excavation and concrete operations shall be carried out in accordance with the CEMP (Appendix 3.1). The foundation shall be 10m x 10m x 1.8m in size.
- Following crane setup, the mast sections shall be delivered and unloaded by truck.
- In accordance with an agreed lifting plan, mast sections shall be lifted by crane into place. Wind speeds shall be monitored at all times during lifting operations by the lead climber and crane operator.
- Mast sections shall be bolted together by climbers.
- Following erection of main mast sections, lightning protection and other ancillary components shall be fixed to the mast.

The mast will be decommissioned using a similar methodology as the construction except in reverse.

Details of the proposed met mast design can be found in the planning application drawings.

3.3.3.11 Tree Felling

Permanent felling of approximately 14.2 ha of forestry is required within the main wind farm site to accommodate the construction of turbine hardstands, access tracks and biodiversity enhancements. 3 no. turbines are located within forestry.

The felling area proposed is the minimum necessary to construct the proposed project and also to comply with any environmental mitigation (bats in particular). In advance of other construction works, clearance felling will commence on site and is expected to take up to 8 weeks.

The above felling hectarage includes some areas which have recently been felled already for commercial timber extraction. It may be the case that these areas are replanted prior to planning permission being granted or commencement of construction as part of the on-going commercial operation of the forest. Regardless the area will be permanently felled to make way for the wind farm infrastructure and therefore this area is included in the total felling hectarage.

The felling will be the subject of a Felling Licence Application to the Forest Service prior to construction as per the Forest Service's policy on granting felling licenses for wind farm developments.

The Forest Service Policy requires that a copy of the planning permission for the wind farm be submitted with a felling license application therefore the felling license cannot be applied for until planning permission is received for the proposed project site.
The license will include the provision of relevant replant lands to be planted in lieu of the proposed tree felling on the site. It should be noted that the majority of forestry within the proposed wind farm site was originally planted as a commercial crop and will be felled and replanted in the coming years should the project not proceed.

To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000).

In this regard, before any felling works commence on site all personnel, particularly machine operators, will be made aware of the following and will have copies of relevant documentation, including:

- The felling plan, surface water management, construction management, emergency plans and any contingency plans;
- Environmental issues relating to the site;
- The outer perimeter of all buffer and exclusion zones;
- All health & safety issues relating to the site.

The proposed tree felling around proposed 'infrastructure' will be limited to:

- Outer footprint of turbine hardstandings including an additional 10m offset from same;
- 20m wide corridors for new and upgraded access tracks;
- Felling Corridors around higher value woodland has been reduced to 10 m to protect as much woodland as possible.
- Up to 87m radius around each turbine tower located in forestry for bat impact mitigation;
- Felling of existing commercial coniferous forestry to make way for broadleaf woodland planting.

3.3.4 Biodiversity Enhancement and Management Plan (BEMP) Measures

A Biodiversity Enhancement and Management Plan (BEMP) has been prepared to outline a set of land management prescriptions as part of proposed Fahy Beg Wind Farm Development.

The measures set out in the BEMP include those designed to protect and enhance existing habitats. Higher value habitats will be actively managed to maintain and improve their value and lower value habitats will see specific interventions designed to improve their attractiveness for a range of species. Appropriate planting will increase the available feeding, roosting and nesting cover for wildlife.

The BEMP programme will run for the lifetime of the windfarm and many of the proposed features (e.g. tree and hedgerow planting) will have a longer-lasting biodiversity benefit.

The planting of new broadleaf woodland as described in the BEMP is not designed to mitigate or address particular potential impacts associated with the construction, operation or decommissioning of the proposed wind farm. It is instead a commitment provided to yield a lasting biodiversity benefit to the area around Fahy Beg.

It is expected that measures associated with the implementation of the proposed BEMP will be equivalent to standard agricultural activities and will be maintained by the involved landowners.

3.3.5 Grid Connection

The proposed grid connection cable route is indicated in Figure 3-4 and planning application drawings. A detailed description of the proposed grid connection and associated construction methodologies can be found in the CEMP in Appendix 3.1. Details of proposed grid connection infrastructure are provided in planning application drawings.

3.3.5.1 Grid Connection Cabling

The grid connection route (grid connection) will consist entirely of underground 38kV cable and will connect the on-site substation to the existing 110kV substation at Ardnacrusha, within the townlands of Ballykeelaun and Castlebank.

The grid connection will be 10.612 km in length, with 10.335 km to be constructed within the existing road corridor. The proposed grid connection arrangement is illustrated in Figure 3-4.

Connection works from the onsite substation to Ardnacrusha substation will involve the installation of ducting, joint bays and ancillary infrastructure and the subsequent running of cables along the existing road network. This will require delivery of plant and construction materials, followed by excavation, laying of cables and subsequent reinstatement of trenches and road surfaces.

Connection works within the Ardnacrusha Substation Site will be carried out by the network operator in accordance with a future grid connection offer. Grid connection works included in this application for consent are presented in the accompanying planning application drawings.

It is expected that full road closures will be put in place to facilitate cabling works in combination with lane closures, partial road closures and stop/go systems. This will enable the works to be completed as quickly and as safely as possible, with minimal disruption time for residents of the area. These works shall be undertaken on a rolling basis with short sections closed for short periods before moving onto the next section. This is described in more detail in Chapter 13 - Traffic and Transportation.

As part of the scoping and consultation process for the project, searches of existing utility services were carried out to identify areas where major assets exist such as high voltage electricity cables or gas mains. Private utility and telecommunications companies were also consulted during this period.

In advance of the construction phase cable detection tools, a ground penetrating radar and slit trenches will be used, as appropriate, to verify the exact locations of existing services. The final locations of the proposed cable routes in the public roads and in the verge along the public road will be within the area indicated and assessed in this EIAR and will minimise conflicts with other services.

It is desirable that a minimum separation distance of 300mm will be maintained from existing services. New cable ducts will be laid below existing services wherever possible.

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). A rope will be inserted into the ducts to facilitate cable-pulling later.

The as-constructed detail of the cable duct locations will be carefully recorded. Cable marker strips will be placed above the ducts and two communication ducts will also be laid. An additional layer of cable marker strips will be laid above the communication ducts and the trench backfilled. Back-filling and reinstatement in public roads will be to a specification to be agreed with the road authority, at a minimum matching the pre-construction surface.

TLI have prepared a construction methodology report which is included in Appendix 3.3.

Plate 3-1: Cable Duct Laying in Trefoil Configuration

The following is a synopsis of the key activities for the installation of the grid connection:

- All relevant bodies i.e., ESBN, Gas Networks Ireland, Eir, Clare County Council, Irish Water etc., will be contacted and all drawings for all existing services will be sought to reconfirm the conditions identified in this EIAR.
- Immediately prior to construction taking place the area where excavations are planned will be surveyed and all existing services will be identified, and temporary warning signs erected where necessary.
- For cable works in the public road, the traffic management plan will be implemented.
- An excavator will be used to excavate the trench to the dimensions of approximately 600mm wide by approximately 1.2m deep.
- Once the trench has been excavated, a bedding layer of sand or concrete will be installed and compacted. All concrete will be offloaded directly from the concrete truck into the trench.

- PVC ducts for electrical and communication cables will be installed on top of the compacted base layer material in the trench.
- When ducts have been installed in the correct position on the trench base layer, sand or Lean-mix cement will be carefully installed in the trench around the ducts.
- A red cable protection strip will be installed above duct surround layer of material and for the full length of the cable route.
- Suitable backfill material (lean mix cement) will be installed on top of the ducts surround material to a level 300mm below the finished surface level.
- Yellow marker warning tape will be installed for the full width of the trench, and for the full length of the cable route, 300mm from the finished surface level.
- The finished surface of the road, road verge, or agricultural land will be reinstated as per its original condition or to the requirements of the Area Engineer.

Construction methodologies for the crossing of watercourses by the grid connection cable ducts are described below.

3.3.5.2 Watercourse Crossings Along the Grid Connection

The grid connection cable route contains 4 no. bridge crossings of EPA mapped watercourses and 4 no. culvert crossings of unmapped watercourses noted during site visits. The 4 no. bridge crossings will be traversed using horizontal directional drilling (HDD). The remaining crossings will traversed by undercrossing or overcrossing methods, depending on the depth of the culvert or using open trenching.

Further details of watercourse crossing methods along the proposed grid connection cable route can be found in the CEMP in Appendix 3.1 and Appendix 3.3.

3.3.5.2.1 Horizontal Directional Drilling (HDD) Operations

HDD will be employed at 4 no. locations along the proposed grid connection route as part of the project as shown on the site layout plans.

The operation shall take place from one side of the watercourse within the public road corridor and will be carried out by an experienced HDD specialist. Each crossing is expected to take place in a single day under one mobilisation.

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.

A pilot hole will be bored as per the agreed alignment and shall be tracked and controlled using a transmitter in the drill head. By tracking the depth, position and pitch of the drill head the operator can accurately steer the line of the drilling operation. The drilling operation is lubricated using a fluid. When the pilot hole has been drilled to the correct profile, its diameter is increased if necessary to match the external diameter if the cable duct. The flexible plastic ducting is then pulled through the pre-drilled hole and sealed at each end until required for cable installation.

A detailed method statement with site specific mitigation measures for this activity is included in the CEMP (Appendix 3.1). In the case of HDD operations within the public road corridor, the works shall be carried out in accordance with measures described in the Traffic Management Plan contained within the CEMP.

3.3.5.2.2 Standard Trench Crossings of Existing Culverts or Services (Ducting Below or Above)

- For the crossing of buried pipe drains, culverts or services, if encountered, ducts shall be installed above or below the existing infrastructure.

When crossing existing culverts or buried services, the following methodology will be employed:

- The general method of trench construction will follow the procedure outlined above for Installation of cable ducting.
- The service infrastructure shall be located and marked by an engineer in accordance with the Code of Practice for Avoiding Underground Services.
- All services will be safeguarded and protected in accordance with the asset owner's specifications.
- Within 500mm of the existing service, hand digging will be employed to expose it.
- Cable ducts shall pass over or under the existing service, depending on the depth of the service and other constraints.
- A minimum separation distance of 300mm shall be maintained between the cable ducts and the existing service.
- Existing services within the trench shall be left in the same condition as they were found. Any issues shall be reported to the asset owner immediately.

Details for crossing existing culverts and services are presented in accompanying planning application drawings. Further detail on construction methods for crossing existing culverts and services can be found in Appendix 3.1.

3.3.5.3 Joint Bays and Communication Chambers

Joint bays are pre-cast concrete chambers where individual lengths of cables are joined to form one continuous cable. A joint bay is constructed in a pit. The bay is 4.5m x 2m x 1.5m deep. A reinforced precast concrete slab is laid in the bay to accommodate the jointing enclosure.

Suitable joint bay locations along the grid connection route have been identified and assessed as part of the EIAR. Figure 3-1 shows a standard ESBN 38kV single circuit joint bay.

ESBN and Clare County Council shall be consulted as part of the detailed design of joint bays and associated link box and communications chambers which will be within the parameters assessed in this EIAR.

It is expected that 14 no. of joint bays will be required for the grid connection. All joint bays shall be located in public roads. The location of joint bays are shown on accompanying planning application drawings.

Precast concrete cable joint bays will be installed within excavations in line with the trench. The cable joint bays are backfilled and the finished surface above the joint bay reinstated as per its original condition. The cable joint bays are re-excavated a second time during cable pulling and jointing, after which the finished surface above the joint bays is reinstated again to its original condition.

Construction work areas and traffic management measures will be setup at 2 no. consecutive cable joint bays simultaneously. The underground cable will be pulled through the installed ducts from a cable drum set up at one joint bay and using a winch system which is set up at the next joint bay, the cable is pulled through.

The cables are jointed within the precast concrete cable joint bays. The finished surface above each cable joint bay is reinstated to its original condition, and the construction work area removed.

Further details of joint bay construction can be found in Appendix 3.1.

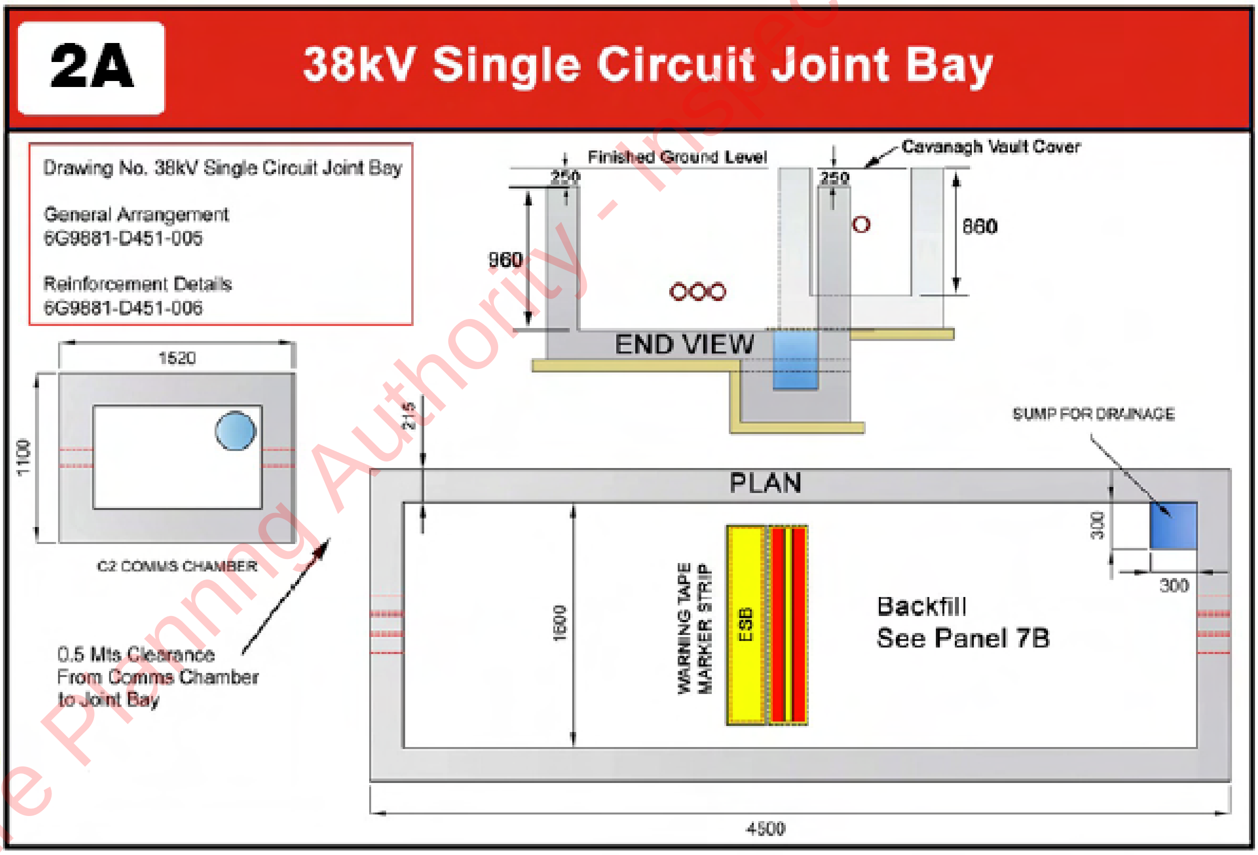

Figure 3-7: ESBN 38kV Single Circuit Joint Bay

3.3.6 Turbine Delivery Route

3.3.6.1 Route Description

Large components associated with the wind farm construction will be transported to site via the identified turbine delivery route (TDR).

Temporary accommodation works will be required at selected locations along the TDR to facilitate the delivery of large components to the site. The delivery route is presented in Figure 3-3. A Delivery Route Selection and Assessment was carried out to identify the optimum delivery route to the Site and is presented in Appendix 13-1 of this EIAR.

Large components associated with the wind farm construction will be transported to the Site via the identified turbine delivery route (TDR). The proposed route to site is as follows:

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

3.3.6.2 Temporary Accommodation Works

All temporary accommodation works associated with the TDR shall be fully reinstated following the construction stage. Overhead utilities and obstructions will need to be removed at several locations to provide adequate overhead clearance. The removal of overhead utilities will be by either temporary disconnections or permanent re-routing. Such works will be carried out by the utility providers in advance of turbine delivery to site. Further details and assessment of these works are provided in Chapter 13- Traffic and Transportation and Chapter 11 - Population and Human Health & Material Assets.

Temporary accommodation works will only be required during the operational phase in the unlikely event of a major turbine component replacement. The temporary accommodation works will not be required for the decommissioning phase as turbine components can be broken up on site and removed using standard HGVs.

Key elements of the temporary accommodation works for the delivery of turbines are summarised below in Table 3-2 and full details of all accommodation works area provided in Chapter 13- Traffic and Transportation. Planning permission is being sought for proposed temporary accommodation works at TDR Nodes 28-32. Works associated with the remainder of the TDR Nodes shall be permitted through a road opening license.

Table 3-2: TDR Temporary Accommodation Works

TDR Node Reference Number (POI__)	Location	Summary Description of Proposed Temporary Accommodation Works
3	Foynes Port Access Road / N69	Remove Road Signs, Lamp posts. Clear Vegetation. Lay of load bearing surface.
6	N69 Tree Canopy	Trimming of tree canopy
8	N69 Clarina Roundabout	Temporary removal of street furniture. Placement of temporary load bearing surface. Removal of trees and vegetation.
9	N69/N18 Dock Road West Roundabout	Placement of temporary load bearing surface.
10	N69/N18 Dock Road East Roundabout	Temporary removal of street furniture. Overrun and oversail of public road verge. Placement of temporary load bearing surface.
11	M7 Junction 27	Placement of temporary load bearing surface to roadside verges.
12	R494 Birdhill Roundabout	Street furniture removal and temporary load baring surface laid
18	R494 Roundabout at Templehollow	Street furniture removal and temporary load baring surface laid
19	R493 Roundabout Northeast of Cloverfield	Removal of street furniture. Load baring surface laid.
20	R436 Bends South of Cloverfield	Vegetation to be trimmed.
21	R463 Bends Southwest of Bellisle	Vegetation and trees to be trimmed
23	R463 Ardcloony Bridge at Garranroe	Vegetation to be trimmed. Temporary removal of utility pole. Temporary load bearing surface laid.
25	R463 Bends South of Knockadrohid	Trimming of vegetation. Temporary removal of utility pole.
26	R463 Bends South of Knockadrohid	Trimming of vegetation. Temporary removal of utility pole.
27	R463/R466 Junction	Load bearing surface to be laid. One junction box, utility marker post, road signs and tree stumps should be removed. Existing utilities to be protected.
28, 29, 30	R466 Bends Northwest of O'Briensbridge Cross	Load bearing surface to be laid. Trees, vegetation and hedgerows to be trimmed.

TDR Node Reference Number (POI__)	Location	Summary Description of Proposed Temporary Accommodation Works
31	R466 Bends Southeast of Bridgetown	Load bearing surface to be laid. Road sign, trees, fence and vegetation to be removed. Vegetation, road sign and trees to be removed. Embankment to be reprofiled.
32	R466 Left Bend at Bridgetown	Load bearing surface to be laid. Road sign, trees, fence and vegetation to be removed.

3.3.7 Replant Lands

Replacement replanting of forestry in Ireland is subject to license in compliance with the Forestry Act 2014 as amended. The consent for such replanting is covered by the Forestry Regulations 2017 (S.I. No. 191 of 2017). The total amount of felling proposed for the project is 14.2 hectares. It should be noted that the clearfelling of trees in the State requires a felling licence. The associated afforestation of alternative lands equivalent in area to those lands being permanently clearfelled is also subject to licensing ('afforestation licensing').

The Forest Service of the Department of Agriculture, Food & the Marine is Ireland's national forest authority and is responsible for all forest licensing. The Applicant commits to not commencing the project until both felling and afforestation licences are in place and this ensures the afforested lands are identified, assessed and licensed appropriately by the relevant consenting authority.

3.4 Project Construction

3.4.1 Construction Activities

In the event that the Planning Authority decides to grant planning permission for the proposed project, tree felling, upgrading of existing site tracks and the provision of new site tracks will precede all other activities. Drainage infrastructure will be constructed in parallel with the track construction. This will be followed by the construction of the turbine hardstanding areas and foundations.

In parallel with these works the on-site electrical works i.e., the sub-station and internal cable network as well as off-site connection works to the national grid will be completed. Construction techniques are outlined in the CEMP in Appendix 3-1.

The hours of construction activity for the project will be limited to avoid unsociable hours as per Section 8.5 (d) of the code of practice for BS 5228: Part 1: 1997. Construction operations shall generally be restricted to between 08:00 hours and 19:00 hours Monday to Saturday. It should be noted that it may be necessary to commence turbine base concrete pours earlier due to time constraints incurred by the concrete curing process. Work on Sundays or public holidays will only be conducted in exceptional circumstances or in an emergency. Additional emergency works may also be required outside of normal working hours as quoted above. Further details on working hours and restrictions of same are provided in the CEMP in Appendix 3.1.

3.4.2 Construction Programme

The construction of the project in its entirety is expected to take between 12-18 months. The proposed construction programme upon which assessments in the EIAR have been based is presented in Figure 3-8 below.

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Mobilisation and site setup	■											
Site clearance and felling	■	■										
Internal access tracks	■	■	■	■	■	■						
Turbine hard standings		■	■	■	■	■	■					
Turbine foundations			■	■	■	■	■	■				
Turbine Installation							■	■	■	■		
Onsite substation						■	■	■	■	■		
Grid connection cable works						■	■	■	■	■	■	
Private electrical network							■	■	■	■	■	■
Landscaping, reinstatement, demobilisation											■	■

Figure 3-8: Outline Project Construction Programme

The implementation of the BEMP measures shall be carried out in parallel with wind farm landscaping and reinstatement.

3.4.3 CEMP

A Construction and Environmental Management Plan (CEMP) is contained in Appendix 3-1 of Volume 3.

The CEMP sets out the key environmental management measures associated with the construction, operation and decommissioning of the proposed project, to ensure that during these phases of the project, the environment is protected, and any potential impacts are minimised. The final CEMP will be developed further at the construction stage, on the appointment of the main contractor to the project to address the requirements of any relevant planning conditions, including any additional mitigation measures that are conditioned.

The CEMP document is divided into six sections:

Section 1: *Introduction* provides details on the existing site and the proposed project.

Section 2: *Existing Site Environmental Conditions* provides details of the main existing geotechnical, hydrological, ecological and archaeological conditions onsite. These conditions are to be considered by the Contractor in the construction, operation and decommissioning of this proposed project.

Section 3: *Overview of Construction Works*, this section provides an overview of the construction works proposed and drainage and sediment controls to be installed.

Section 4: *Environmental Management Plan (EMP)*, this section outlines the main requirements of the EMP and outlines controls for the protection of the environment for example soil management, waste management, traffic management, site drainage management, site reinstatement & decommissioning, habitat and archaeology management etc.

Section 5: *Safety & Health Management Plan,* this section defines the work practices, procedures and management responsibilities relating to the management of health and safety during the design, construction and operation of the proposed project.

Section 6: *Emergency Response Plan* contains predetermined guidelines and procedures to ensure the safety, health and welfare of everybody involved in the project and to protect the environment during the construction phase of the proposed project.

3.4.4 Traffic Management

A careful approach will be taken to planning the entirety of the works associated with the proposed project to ensure minimal impacts on road users and the public.

A Traffic Management Plan will be adopted, in consultation with Clare County Council, to provide a safe environment for road users and construction workers. A Traffic Management Plan is contained in the CEMP in Appendix 3.1. In the event permission is granted for the proposed project the Traffic Management Plan shall be finalised following the appointment of the contractor for the main construction works to address the requirements of any relevant planning conditions, including any additional mitigation measures that are conditioned and shall be submitted to the planning authority for agreement.

Quarries and Associated Haul Routes

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.

The surrounding licenced quarries currently in operation and the indicative haul routes to the site are identified in Chapter 13 – Traffic and Transportation.

3.4.5 Soil and Peat Management

Management of all excavated soils and peat shall be carried out in accordance with the Soils Management Plan contained within the CEMP in Appendix 3-1.

There are no peat deposition areas required as part of this project following assessment of the existing environment. Any peat excavated for the construction of access roads within the site will be re-used on site in berms and for landscaping purposes and along the margins of the access roads. Topsoil will be re-used for landscaping and will also be used for reinstatement purposes around turbine bases and hardstanding areas.

Further details on soils management can be found in Chapter 9 of this EIAR and the Soils Management Plan contained within the CEMP in Appendix 3-1.

3.4.6 Surface Water Management and Site Drainage

A key design philosophy employed for Fahy Beg Wind Farm is the use of existing forestry and agricultural tracks and associated drainage alongside the implementation of Sustainable Drainage Systems (SuDS). This design approach ensures that existing drainage patterns will be maintained throughout the site.

An appropriate drainage design is the primary mitigation measure for the protection of waterbodies, incorporating silt protection infrastructure and control measures to reduce the rate of surface water runoff from the wind farm site.

The drainage system will be constructed alongside all turbine hardstands, internal access tracks, substation and the temporary construction compound. The drainage system for the existing tracks and roads will largely be retained. Where the roads require widening, this will involve the re-location of existing roadside swales to allow for widening.

As standard and best practice approach, surface water runoff attenuation and drainage management are key elements in terms of mitigation against impacts on surface water bodies.

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, minimising 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 waste 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 surface water.

'Clean' water is separated from 'dirty' water utilizing interceptor drains as illustrated in Figure 3.10 below. The interceptor drains will be installed on the upslope side of the construction area. This will reduce the amount of water from construction area that will need to be treated before it can be safely discharged into the environment. Collected clean water will be carried under wind farm infrastructures by cross drains at regular intervals to ensure the original hillside flow is not impeded. The maximum distance between the cross drains will be 250m. The cross drains will be connected to a diffuse outfall to allow collected water to disperse overland.

The proposed access tracks will be constructed from a permeable aggregate material to allows the runoff to infiltrate underground. The excess water will drain into the swales which will be connected, during the construction stage, to the settlement ponds. The settlement ponds will have a diffuse outfall which will disperse the flow across the site. On completion of the works the settlement ponds will be filled in and the swales will be connected to a diffuse outfall.

The proposed access roads and associated drainage infrastructure will follow contours as much as possible to reduce the gradient of the road and road drains (swales). This will reduce velocities within the swales, and consequently erosion.

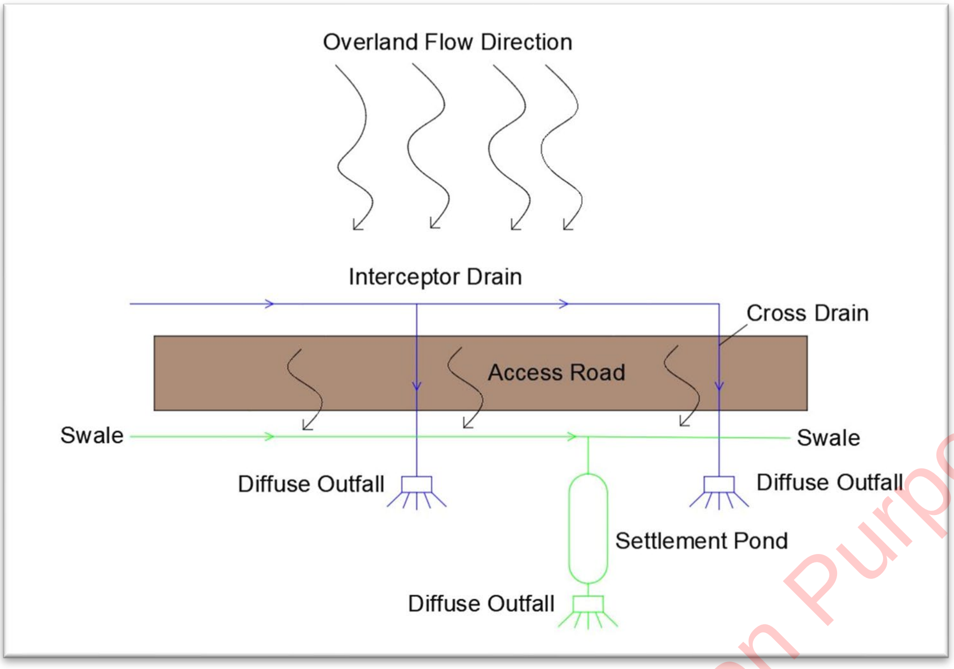

Figure 3-9: Drainage Diagram

The settlement ponds will be designed in the accordance with CIRIA C648. The volume of a settlement pond is related to the area draining into it. Any upslope runoff from site will be diverted from ponds. This is achieved by interceptor drains as discussed above.

Suspended solids will settle out only when the water is still. It is necessary to retain the water in the settlement pond for several hours to allow the suspended solids to settle out. Retention time depends on the particle size, disturbance of the water, depth of water, temperature and particle density. Retention time of 2h is applied for designing the ponds as outlined in CIRIA C648. This will allow silts to settle out.

CIRIA C648 recommends designing the outfall from the ponds to accommodate 1 in 10 years storm event, for this project the outfalls will be designed to accommodate flows associated with 1 in 100-year event. The settlement ponds will be 1.0m deep. The proposed size of the settlement ponds is provided in the Surface Water Management Plan (SWMP) contained in Appendix 10.2.

The existing access roads, where required, will be upgraded. If the existing drainage infrastructure does not prevent mixing of clean and dirty water, it is proposed to improve drainage at these locations by implementing drainage methodology proposed for new access roads.

Further details on hydrology and drainage are contained in Chapter 10 Hydrology and Water Quality, the Surface Water Management Plan (SWMP) which is contained in Appendix 10.2 and on accompanying planning application drawings. The proposed drainage is shown on Planning Drawings Series- 0100.

3.4.7 Waste Management

A Waste Management Plan for the project has been included in the CEMP in Appendix 3.1.

The Developer, in conjunction with appointed contractor, will prevent, reduce, reuse and recover as much of the waste generated on site as practicable and ensure the appropriate transport and disposal of residual waste to off-site to licensed facilities. The location of these facilities area identified in Table 3-3. This is in line with the relevant National Waste Management Guidelines and the European Waste Management Hierarchy, as enshrined in the Waste Management Act 1996, as amended.

Any waste generated during the project construction phase will be collected, source separated and stored in dedicated receptacles at the temporary compound during construction. It will be the responsibility of the contractor for the main construction works (when appointed) to nominate a suitable site representative such as a Project Manager, Site Manager or Site Engineer as Waste Manager who will have overall responsibility for the management of waste.

Table 3-3: Licensed Waste Facilities in the Vicinity of Fahy Beg Wind Farm

Facility	Type of wasted accepted
Longpavement landfill site, Monabraher, Longpavement, Co. Limerick	Landfill waste
Bord Na Móna Recycling Limited, Nenagh, Co. Tipperary	Mixed recycling
Doora Landfill Site, Doora, Co. Clare	Landfill waste
Birdhill Recycling Centre, Birdhill, Co. Tipperary	Mixed recycling
Scarriff Recycling Centre, Scarriff, County Clare	Mixed recycling
Thomas O'Neill Timber Recycling	Timber recycling
Clare Waste and Recycling Company Limited, Tuamgraney, Co. Clare	Mixed recycling

3.5 Operation and Lifespan

During the operational period, the turbines will operate automatically on a day-to-day basis, responding by means of anemometry equipment and control systems to changes in wind speed and direction. The turbine manufacturer or a service company will carry out regular maintenance of the turbines. Scheduled services will typically occur twice a year.

The operation of the wind turbines will be monitored remotely, and an operative working from a remote headquarters will oversee the day to day running of the proposed wind farm.

The applicant requests the grant of permission is on the basis of a 35-year operational period from the date of full operational commissioning of the wind farm. With permission for the onsite substation sought in perpetuity given that the substation will form part of the national electricity network. Therefore, the substation will be retained as a permanent structure and will not be removed.

35 years is the anticipated minimum useful lifespan of wind turbines which are being produced for the market today. The lifespan of wind turbines has been increasing steadily in recent years and allowing this duration will improve the overall carbon balance of the development, therefore maximising the amount of fossil fuel usage that will be offset by the wind farm. Leaving the wind turbines in-situ until the end of their useful lifespan would be optimum from an environmental viewpoint, particularly in relation to carbon savings.

It is expected that maintenance activities associated with the implementation of the proposed BEMP measures will be equivalent in nature to agricultural activities and will be carried out by the involved landowners. The BEMP measures are described in detail in Appendix 3.4.

3.6 Project Decommissioning

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 foundation pedestals 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 all the internal site access tracks and turbine hard standings will be left in place. These will continue to be used for forestry and agriculture. Turbine foundation pedestals and hardstandings shall be covered over with topsoil previously stripped and used for landscaping purposes during the construction stage and left to revegetate naturally.

The temporary accommodation works along the TDR will not be required for the decommissioning phase as turbine components can be dismantled on site and removed using standard HGVs.

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

It is expected that the decommissioning phase will take no longer than 6 months to complete.

A detailed decommissioning plan will be agreed in advance of construction with Clare County Council.

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