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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED CROAGHAUN WIND FARM, CO. CARLOW

VOLUME 2 – MAIN EIAR

CHAPTER 3 – DESCRIPTION OF THE PROPOSED PROJECT

Prepared for: Coillte

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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 summary of the proposed project assessed in the EIAR is contained in Section 3.5.1 and a summary of the statutory development description for consent is contained in Section 3.5.2.

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

- The wind farm (hereinafter referred to as the **'main wind farm site'**);
- Turbine delivery route (hereinafter referred to as the **'turbine delivery route'** or **'TDR'**);
- Grid connection (hereinafter referred to as the **'grid connection'**).

The main wind farm site includes the wind turbines, internal access tracks, hard standings, the permanent meteorological mast, recreational amenity trail and associated signage, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm. The grid connection includes the buried grid connection cable route from the on-site substation to the existing grid substation at Kellistown, Co. Carlow and the proposed off-site substation, also at Kellistown. The turbine delivery route includes all aspects of the route from the M11/N30 junction to the site entrance including proposed temporary accommodation works to facilitate the delivery of wind turbine components.

The proposed main wind farm site includes lands in the townlands of Rossacurra, Cranemore, Kilbrannish North, Bealalaw, Raheenliegh and Aclare.

The proposed turbine delivery route passes through the following townlands: Killbranish South, Killbranish North, Deerpark New, Barnahask, Clonmullen, Newtownberry, Carrickduff, Skeahanagh, Farmley, Collnahorna, Ballynahallin, Ballynabarney, Ryland Upper, Ryland Lower, Coolattin, Moyeady, Tombrick, Mountfin Lower, Ballinturner, Tomgarrow, Tomacurry, Clavass and Kilcanon.

The grid connection connecting the wind farm to the national grid at Kellistown substation traverses the following townlands: Kellistown East, Kellistown West, Rathtoe, Ballycurragh, Ballynunnery, Gilbertstown, Bendinstown, Ardbeam, Elmicon, Killknock, Killane, Raheenkillane, Killmaglush, Turtane, Ballaghmore, Shangarry, Cappawater, Lasmaconly, Myshall, Ballinrush, Cronruss, Aclare, Bealalaw and Rossacurra.

The proposed grid connection to the national grid is considered as part of the overall project in this EIAR but does not form part of this application for consent.

Replanting lands at Sroove Co. Sligo and Crag Co. Limerick have also been assessed for cumulative impacts. Reports detailing environmental assessments carried out on these sites are contained in Appendix 3.3 and 4.4 of this EIAR.

The general layout of the above key elements of the proposed project are shown in Figure 3-1, Figure 3-3 and Figure 3-4The location of the above replant lands can be found in Figure 2-1 Appendix 3.3 and Figure 2-1 of Appendix 3.4.

3.2 Existing Environment

The proposed main wind farm site is located in east County Carlow, within the townlands of Rossacurra, Cranemore, Kilbrannish North, Bealalaw, Raheenliegh and Aclare. The identified site is located at Croaghaun Mountain, the northern-most peak of the Blackstairs Mountains, located north of Mount Leinster, approximately 2km from the Wexford County Border. The main wind farm site is covered by managed coniferous forestry, sections of peat bog and a small area of agricultural land at the south of the site. The site also has a series of walking trails and an associated car park at the southern extent.

The main wind farm site is located in a rural area with no major settlements nearby. The village of Myshall is the most proximate settlement located 1.5km north west of the site, the village of Kildavin is located approximately 4km north east of the site and the district town of Bunclody is located approximately 5.5km east of the wind farm site. The R724 regional route is located to the north of the site and the N80 national secondary route is located to the east of the site. The River Clody runs to the south of the site and drains into the River Slaney located east of the main wind farm site. The most proximate substation to the site is located at Bunclody, a 38kV substation, approximately 8km east of the site.

Settlement in the area is made up of one-off rural housing and farmyards generally located along the road network of the area (Linear settlement pattern). Clusters of dwellings are focused on the local villages of Myshall and Kildavin, and the district town of Bunclody. According to the 2016 census, Myshall has a population of 284, Kildavin has a population of 184, and Bunclody has a population of 1,984.

A house survey was carried out in July 2019 which recorded over 190 no. houses located within 2km of the proposed main wind farm site. This survey noted that houses are primarily placed in clusters and linear settlement patterns. There are 28 no. residential receptors located within 10 no. rotor diameters (1.38Km) of the proposed wind turbines and 1 no. residential receptor located within 1km of the proposed turbines.

Access to the site is primarily via the existing local road L2026 Barker's Road. HGV's shall approach the site via this road from the East.

An existing 80m meteorological mast is currently located on site with permission recently granted to maintain the mast on site for an additional 3-years. (Planning Ref. 19477).

The main wind farm site is situated within five sub-basins as defined by the WFD and shown on Figure 10-2, Chapter 10 – Hydrology and Water Quality. These waterbodies are as follows:

- Clashavey_River_010 – IE_SE_12C00500
- Kildavin_Stream_010_010 – IE_SE_12K040800
- Clody_010 – IE_SW_12C030080
- Burren_020 – IE_SE_14B050110
- Douglas (Ballon)_010 – IE_SE_12D030200

The Burren_020 sub basin forms part of the Barrow Catchment (catchment id: 14), whilst the other four sub basins form part of the Slaney & Wexford Harbour catchment (catchment id: 12). No turbines are planned in Burren_020 sub-basin.

Further information on the existing hydrological environment for the project can be found in Chapter 10.

The main wind farm site encompasses a mixture of habitat types, with conifer plantation dominating. Access tracks and to a lesser extent spoil and bare ground. Dry meadows and grassy verges are present along several lengths of access tracks. Pockets of recently felled conifer woodland, dry calcareous heath, scrub and improved agricultural grassland are also present.

The Blackstairs Mountains SAC and Slaney River Valley SAC are located within 15km of the site. There are no SPAs within 15 km of the main wind farm site. The closest, Wexford Harbour and Slobs SPA is approximately 20km south-east.

Further information on existing habitats for the project can be found in Chapter 8.

Land cover classification for the main wind farm site is presented in Figure 3-2.

The subsoils present within the main wind farm site and wider project comprise till derived from metamorphic rocks, bedrock outcrop or sub-crop and a limited extent of blanket peat. The majority of the proposed grid connection route is underlain by Till derived from Granites with limited areas of bedrock sub-crop or outcrop and alluvium indicated along the proposed grid connection route and at the proposed substation at Kellistown.

During site investigations weathered bedrock was encountered at depths ranging from 0.35m to 2.3m bgl within the main wind farm site. With intact bedrock encountered at between 2.0m to 3.4m bgl. Where intact bedrock was encountered it was generally as medium strong to strong thinly foliated fine-grained SHALE.

Further information on the existing geological and hydrogeological environment can be found in Chapter 9.

There are nine recorded archaeological sites located within the 2km study area around the main wind farm site and only one of these is located within 1km of a proposed turbine location which comprises a standing stone (CW020-028----). This monument is located outside the boundary of the main wind farm site. None of the known archaeological sites within the study area are designated as National Monuments or have been assigned Preservation Orders.

Further details on the existing environment in relation to archaeology and cultural heritage can be found in Chapter 14.

3.2.1 Wind Farms in the Surrounding Area

There is 1no. wind farm in the immediate vicinity of the proposed project, Greenoge Wind Farm, which is located directly east of the proposed main wind farm site.

Greenoge Wind Farm consists of 5 no. wind turbines with a maximum hub height of 80m and rotor diameters ranging between 60m and 90m. Most northerly turbine is a Nordex N90 with a rotor diameter of 90m and a hub height of 80m above ground level. The remaining turbines consist of Nordex N60 wind turbines with a rotor diameter of 60m and hub height of 60m above ground level.

Figure 3-5, illustrates existing wind farms within 20km of the site.

3.3 Landownership

Landownership associated with the proposed project is a combination of Coillte and private landholders.

Planning consent is sought for the project as described in Section 3.5.2.

3.4 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 5 and 8 m/s at 100 m above ground level.

3.5 Proposed Project

The proposed project will primarily consist of a wind farm of up to 7 no. wind turbine generators (WTG's) and 1 no. substation compound along with ancillary civil and electrical infrastructure. The project shall also include infrastructure for community use in the form of walking trail enhancements.

The total Maximum Export Capacity (MEC) of the wind farm is up to 38.5MW. The exact MEC will be dependent on the output power of the models available at procurement stage.

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 proposed turbine will be detailed by the turbine manufacturer on award of the contract.

However, the proposed turbines will have the following specifications:

- Three bladed, horizontal axis type turbine;
- Maximum height envelope of up to 178m from top of foundation to blade tip height;
- Maximum rotor diameter of up to 138m.

The exact make and model of the turbine will be dictated by a competitive tender process, but it will not exceed the maximum size envelope set out above. 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 associated grid connection route (GCR) will consist entirely of underground 38kV cable and will connect the on-site substation to the existing 110/220kV substation at Kellistown, within the townland of Kellistown East. The GCR will be ca. 21.5 km in length, with ca. 20.3 km to be constructed primarily within the existing road corridor. The proposed GCR arrangement is illustrated in Figure 3-4. The 38kV grid connection cable will follow public roads and shall feature horizontal directional drilling (HDD) at up to 8 no. locations to cross existing watercourses and the N80 National Road. Watercourse crossing locations are shown in Figure 10-5 and summarised in Table 10-9.

Works will also be required in proximity to the Kellistown substation to accommodate the proposed project. The works will allow the voltage from the wind farm grid connection to be 'stepped up' to 110kV.

The works will comprise a substation compound which will be self-contained and positioned in a neighbouring field to that of the existing Kellistown substation as shown in Figure 3-4 and accompanying planning drawings. Two locations have been assessed for this off-site substation as part of this EIAR. The locations are shown on Figure 3-4. Further details about this substation can be found in Section 3.5.11. The proposed design for the offsite substation is a worst-case scenario in terms of footprint and scale of infrastructure. The final design for shall be carried out by the network operator subject to upgrade requirements and grid connection agreement.

Large components associated with the wind farm construction will be transported to site via the identified turbine delivery route (TDR). It is proposed that turbine deliveries shall approach the site from the East via Dublin Port, the M11, the N80 and the L2026 Barkers Road through the town of Bunclody. Turbine delivery vehicles shall turn at Kilbrannish North and enter the site from the West.

Key temporary accommodation works will be required at selected locations along the TDR to facilitate the oversized deliveries to the site in the townlands of Ballynahallin, Carrickduff , Kilbrannish South and Kilbrannish North. These works are described in detail in Section 3.5.6.

The project shall include the opening of 1 no. borrow pit on site. The location of the proposed borrow pit is shown in Figure 3-1. The proposed borrow pit shall provide site-won stone that will significantly reduce the amount of construction aggregates that would need to be delivered to site. The proposed borrow pit shall also act as a soil deposition area which will avoid the need to export excess spoil to off-site facilities. It is expected that a significant amount of aggregate shall also be won during the construction of the turbine hardstanding area and at several locations where internal wind farm roads are being constructed .

The project shall include the upgrade of 2.74 km of existing forest tracks and paths that shall be re-purposed as recreational amenity trails for community use as part of the project.

The construction of the project in its entirety is expected to take between 12 – 18 months.

Further details including a construction programme used as a basis of assessments in this EIAR can be found in Section 3.6.

3.5.1 Summary of Proposed Project Assessed in the EAIR

In summary the proposed project will consist of the following:

- Erection of up to 7 no. wind turbines with a tip height of up to 178m;
- 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;
- 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 ESBN specifications and associated compounds including:
    - Welfare facilities;
    - Electrical infrastructure;

- Parking;
- Wastewater holding tank;
- Rainwater harvesting;
- Security fencing;
- All associated infrastructure, services and site works including landscaping;

- Construction of 1 no. off-site electrical substation to ESBN specifications and associated compounds at Kellistown substation including:
  - Control building with welfare facilities;
  - Electrical infrastructure;
  - Parking;
  - Wastewater holding tank;
  - Rainwater harvesting;
  - 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 including a temporary bridge crossing at Kilbranish;
- 1 no. Temporary construction site compound and associated ancillary infrastructure including parking;
- 1 no. on site borrow pit (the borrow pit shall be accessed via wind farm access tracks);
- Tree felling and associated replanting to facilitate construction and operation of the proposed development;
- Installation of medium voltage (20/33kV) and communication underground cabling between the proposed turbines and the proposed on-site substation and associated ancillary works;
- Installation of medium voltage (up to 38kV) underground cabling between the proposed on-site substation and the existing Kellistown substation and associated ancillary works. The proposed grid connection cable works will include 9 no. existing watercourse and drain crossings and the installation of up to 42 no. pre-cast joint bays; Erection of 1 no. permanent meteorological mast to a maximum height of 100m above ground level;
- Upgrade of existing forest tracks and paths that shall be re-purposed as recreational amenity trails for community use.

3.5.2 Summary of the Statutory Development Description for Consent

The proposed grid connection to the national grid at Kellistown substation including the associated new off-site substation are considered as part of the project's assessment in this EIAR but does not form part of this application for consent. Equally an environmental assessment has been carried out for replant lands at Crag, Co. Limerick and Sroove Co. Sligo and is also not included in the application for consent.

Therefore, the development description as per the statutory newspaper notice and the application form for which consent from Carlow County Council is being sought is as follows:

- Construction of up to 7 no. wind turbines with a maximum overall blade tip height of up to 178m;
- 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 including upgrade of entrance onto L2026.
- All associated drainage and sediment control including , the Installation of new watercourse or drain crossings and the re-use or upgrading of existing internal watercourse and drain crossings;
- Construction of 1 no. permanent onsite 38kV electrical substation to ESBN specifications including:
  - Control building with welfare facilities;
  - Electrical infrastructure;
  - Parking;
  - Wastewater holding tank;
  - Rainwater harvesting;
  - Security fencing;
  - All associated infrastructure, services and site works.
- 1 no. Temporary construction site compound and associated ancillary infrastructure including parking;
- 1 no. on site borrow pit (the borrow pit shall be accessed via wind farm access tracks);
- Tree felling to facilitate construction and operation of the proposed development;
- Installation of medium voltage (20/33kV) and communication underground cabling between the proposed turbines and the proposed on-site substation and associated ancillary works;
- Erection of 1 no. permanent meteorological mast to a maximum height of 100m above ground level;
- Upgrade of existing forest tracks and paths that shall be re-purposed as recreational amenity trails for community use including signage;
- All associated site development works;
- A 10 year planning permission and 35 year operational life from the date of commissioning of the entire wind farm.

3.5.3 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 3-1 shows the proposed main wind farm site layout. The layout reflects the outcome of the iterative design process. Further detail on the design philosophy, constraints and alternative layouts is detailed 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.

Table 3-1: Proposed Turbine Coordinates

Turbine ID	ITM Coordinates	
	X	Y
T1	684562	658173
T2	683931	657531
T3	683391	657113

Turbine ID	ITM Coordinates	
	X	Y
T4	684623	657742
T5	683940	657083
T6	685208	657687
T7	684647	657289

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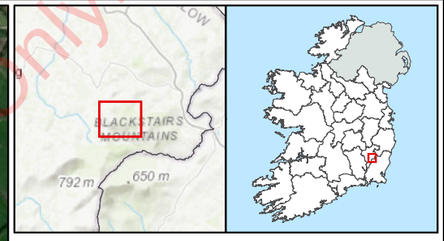

- Proposed Turbine Layout
- Proposed Development Boundary
- Existing 80m Met Mast
- Proposed Permanent 100m Met Mast
- Proposed Grid Connection Route
- Proposed Croaghaun Loop
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turning Heads and Passing Bays
- Proposed Turbine Hardstanding
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation Compound

TITLE: Site Layout			
PROJECT: Croaghaun Wind Farm			
FIGURE NO:	3.1		
CLIENT:	Coillte		
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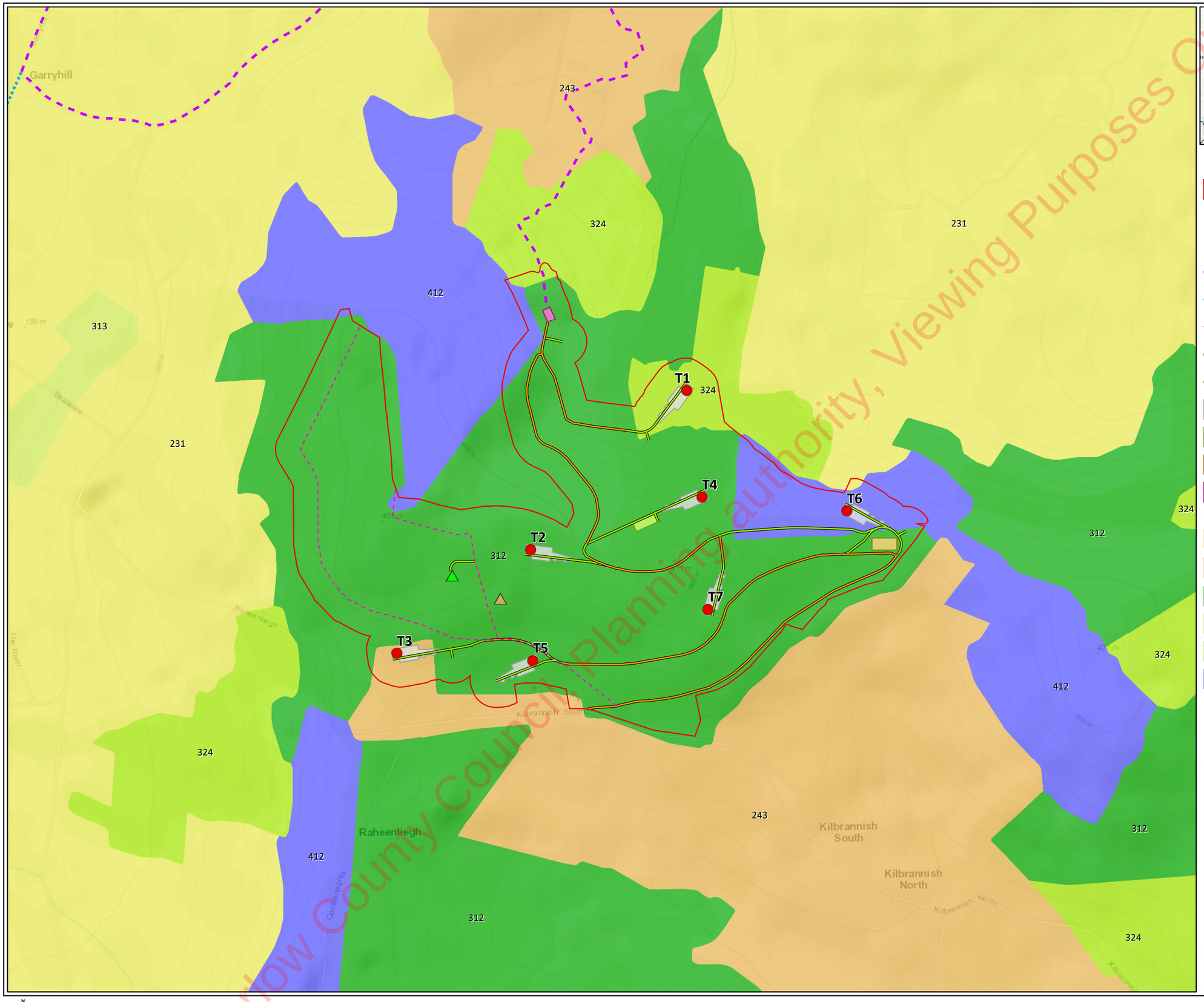

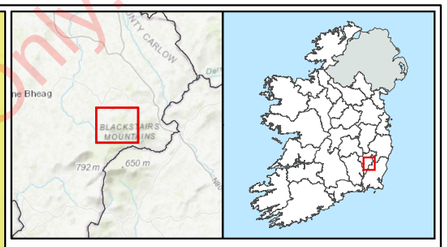

- Proposed Turbine Layout
- Proposed Development Boundary
- Existing 80m Met Mast
- Proposed Permanent 100m Met Mast
- Proposed Grid Connection Route
- Grid Connection Route Variant 1
- Proposed Croaghaun Loop
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turbine Hardstanding
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation Compound

CORINE Land Cover 2018

- 231 Pastures
- 243 Land principally occupied by agriculture with areas of natural vegetation
- 312 Coniferous forest
- 313 Mixed forest
- 324 Transitional woodland scrub
- 412 Peat bogs

TITLE: CORINE Land Cover			
PROJECT: Croaghaun Wind Farm			
FIGURE NO:	3.2		
CLIENT:	Coillte		
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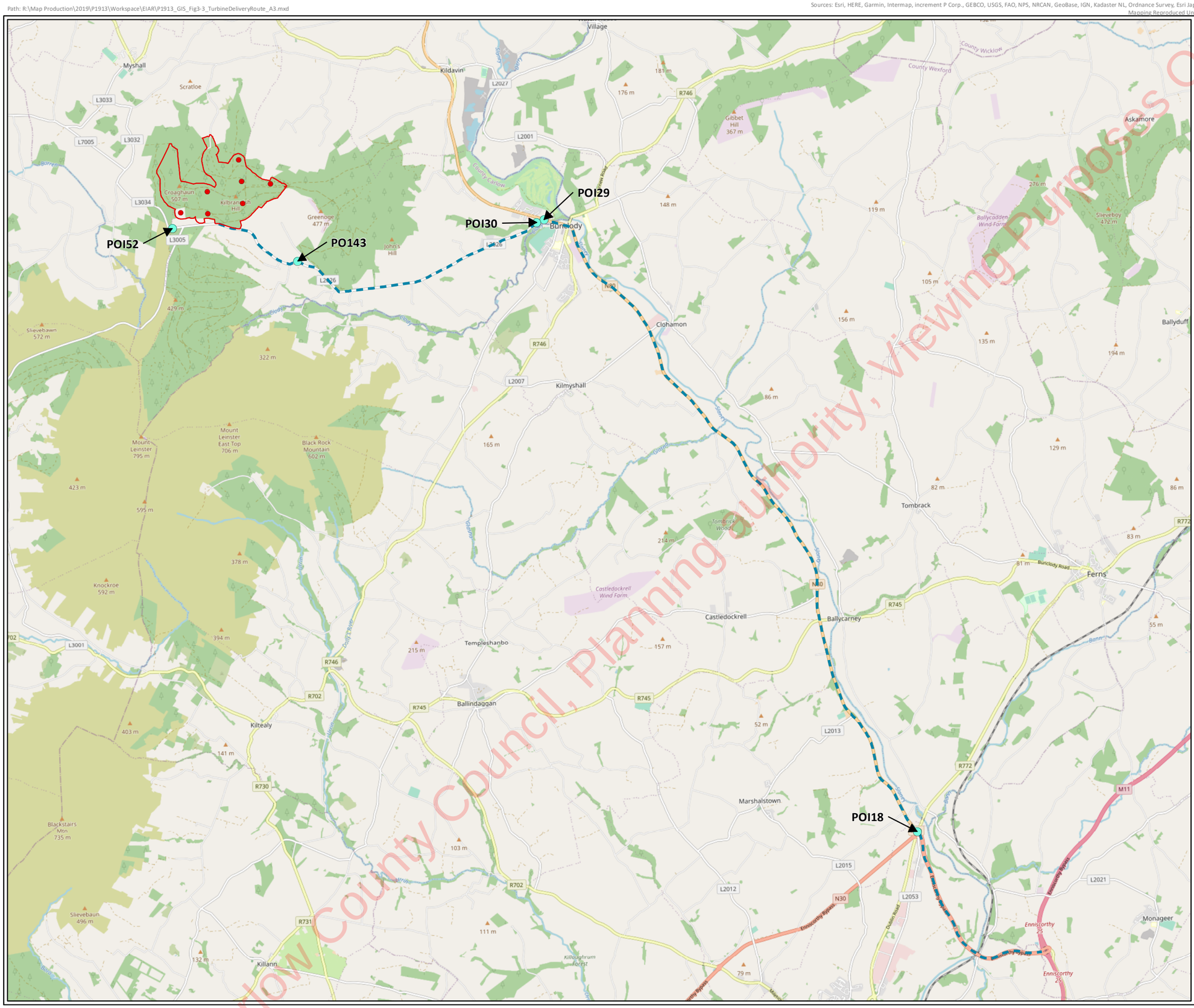

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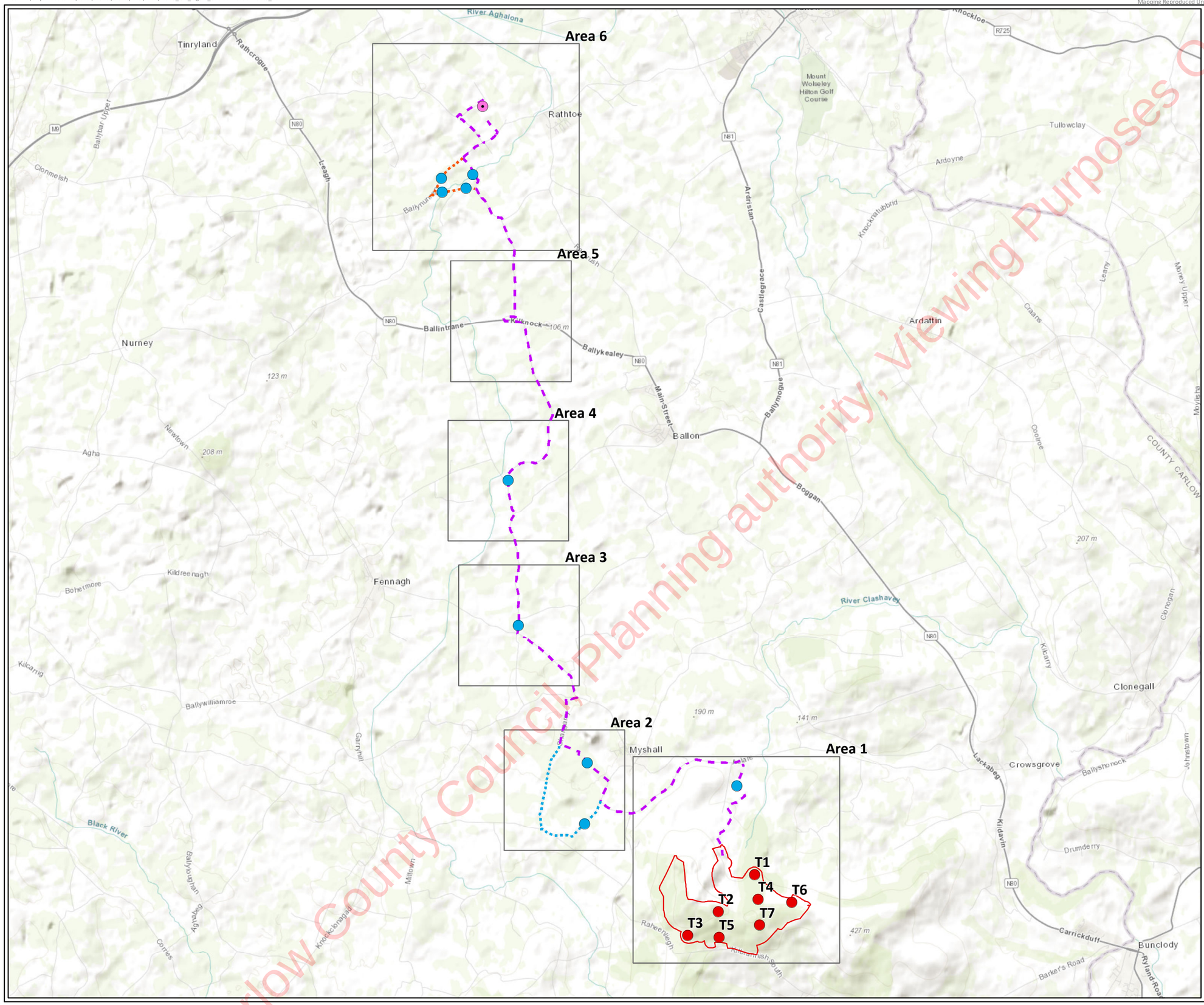

- Proposed Turbine Layout
- Proposed Development Boundary
- Watercourse Crossings
- Kellistown Substation
- Proposed Grid Connection Route
- Grid Connection Route Variant 1
- Grid Connection Route Variant 2

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TITLE:	Grid Connection Route General Arrangement Overview		
PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	3.4.1		
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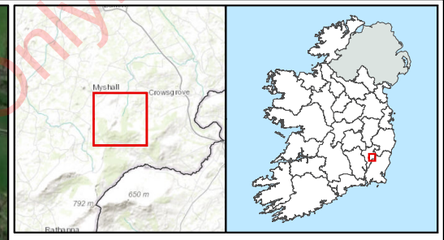

- Proposed Turbine Layout
- Proposed Development Boundary
- Watercourse Crossings
- Existing 80m Met Mast
- Proposed Permanent 100m Met Mast
- Proposed Grid Connection Route
- Grid Connection Route Variant 1
- Proposed Croaghaun Loop
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turbine Hardstanding
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation Compound

TITLE:	Grid Connection Route General Arrangement Area 1
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	3.4.2
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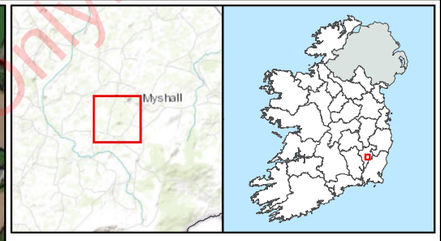

Watercourse Crossings

Proposed Grid Connection Route

Grid Connection Route Variant 1

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PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	3.4.3		
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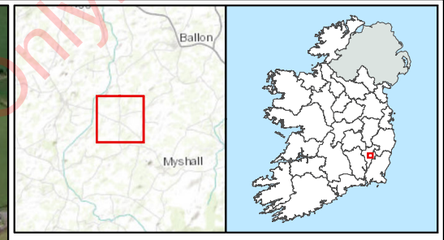

Watercourse Crossings

Proposed Grid Connection Route

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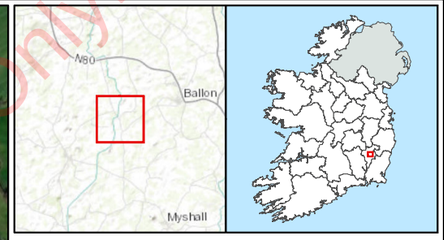

Watercourse Crossings

Proposed Grid Connection Route

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Proposed Grid Connection Route

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PROJECT:	Croaghaun Wind Farm		
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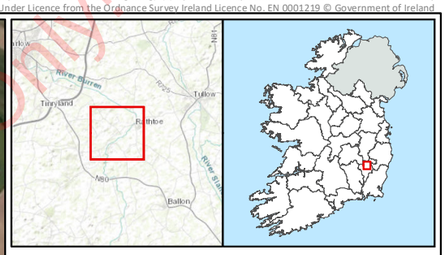

- Watercourse Crossings
- Kellistown Substation
- Off-site Substation Compounds
- Proposed Grid Connection Route
- Grid Connection Route Variant 2

TITLE:	Grid Connection Route General Arrangement Area 6		
PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	3.4.7		
CLIENT:	Coillte		
SCALE:	1:15000	**REVISION:**	0
DATE:	16/11/2020	**PAGE SIZE:**	A3

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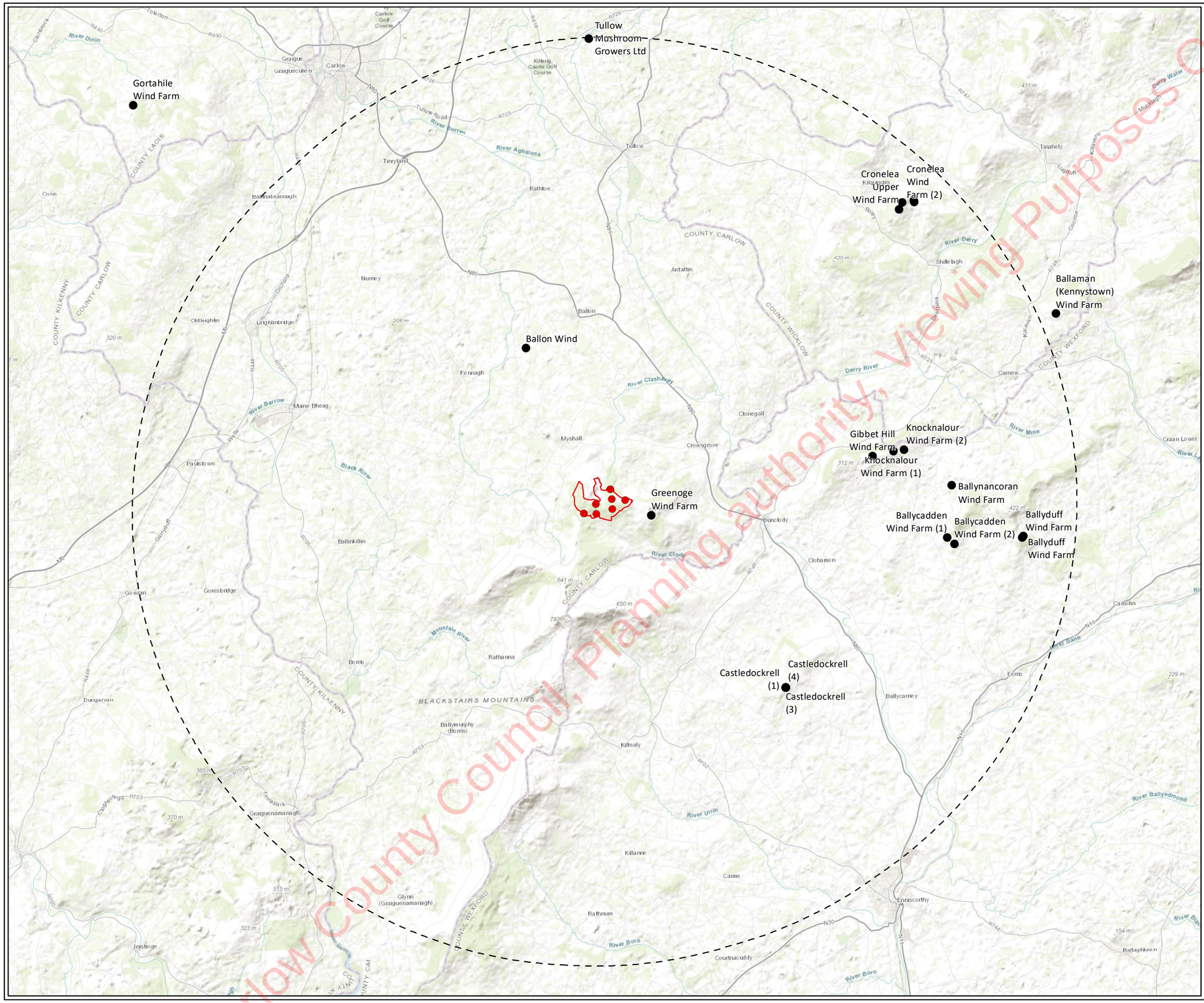
N W E S

0 0.5 1 2 Kilometers

Path: R:\Map Production\2019\P1913\Workspace\EIAR\P1913_GIS_Fig3-5_RenewableEnergyDevelopments_A3.mxd



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0 2.5 5 10 Kilometers

TITLE:	Renewable Energy Developments in the Vicinity of the Proposed Development		
PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	3.5		
CLIENT:	Coillte		
SCALE:	1:165000	**REVISION:**	0
DATE:	16/11/2020	**PAGE SIZE:**	A3

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3.5.4 Power Output

The proposed wind farm will have an estimated Maximum Export Capacity (MEC) of up to 38.5MW 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.

A rated capacity of 38.5 MW has been used below to calculate the power output of the proposed wind farm. Assuming an installed capacity of 38.5 MW, the proposed wind farm has the potential to produce approximately 118,041 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: 38.5 MW

The 118,041 MWh of electricity produced by the proposed wind farm would be sufficient to supply approximately 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]).

The Census of Ireland recorded a total of 20,537[2] private households in Carlow in April 2016. Based on a capacity factor of 35%.

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.

3.5.5 Turbines

3.5.5.1 Turbine Description

The proposed turbines will have a tip height of up to 178m. Detailed drawings, which accompany the planning application, show a turbine that may be used for the proposed project. However, the exact make and model of the turbine will be dictated by a competitive tender process which is informed by the energy production efficiencies of various turbines on the market at the time but will not exceed the maximum size envelope set out within the project description and assessed in this EIAR. The proposed wind turbine design envelope which has been assessed in the EIAR allows for flexibility of the turbine component configuration within the tip height limit.

[1] https://www.cru.ie/wp-content/uploads/2017/07/CER17042-Review-of-Typical-Consumption-Figures-Decision-Paper-1.pdf
[2] https://www.cso.ie/en/csolatestnews/presspages/2017/cp4hf/

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 turbines, that will be designed to ensure the rotors of all turbines rotate in the same direction at all times. Each discipline within the EIAR has assessed various types and sizes of turbines within the overall envelope based on the worst-case scenario for that discipline; that is, the design envelope parameters that would produce the greatest potential impact. For example, modelling for bird collision risk was carried out based on a turbine with the maximum rotor diameter of 138m and the maximum tip height of 178m. The exact combination of rotor diameter and hub height will be dictated by the final selection of the turbine make and model at turbine selection stage/pre-construction but will in any case comply with the environmental impact limits set out in this EIAR.

The turbine will be of the generic 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.

Croaghaun 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).

Further to this the proposed layout has sought to achieve an optimum separation distance between dwellings and the proposed turbines by providing a separation distance of 750m between turbines and the closest dwellings and their associated curtilages. The Draft Revised Guidelines outlines a minimum 500m or 4 times tip height set back. There is one dwelling located within 1km of the wind turbines at a distance of 984m.

3.5.5.2 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.

3.5.5.3 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 shape and size of the foundation can vary depending on the turbine manufacturer however it is up to 22m in diameter and up to 4m in depth.

The upper sections of the tower are bolted to the lower ones in sequence. The base of the tower is 4-5m in diameter, tapering to approximately 2-3m, 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 exact details of the turbine tower will be dictated by final selection of the turbine make and model for maximum efficiency of wind energy production.

3.5.5.4 Turbine Transformer

The turbine will have a transformer located within the tower. The turbine will generate electricity at approximately 660volts, 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.

3.5.5.5 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

3.5.6 Turbine Delivery Route Access Tracks and Hardstandings

3.5.6.1 Turbine Delivery Route (TDR)

The proposed turbine delivery route is presented in Figure 3-3. A Delivery Route Selection and Assessment was carried out to identify the optimum delivery route to site and is presented as Appendix 13-1 of this EIAR.

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

- Loads will depart Dublin Port and travel through the Dublin Port Tunnel to the M50;
- Loads will travel south on the M50;
- Loads will continue south on the N11 and M11;
- Loads will depart the M11 and continue west on the N30;

- Loads will continue north west on the N30 and onto the N80 to Bunclody;
- Loads will travel through Bunclody on the N80 before departing left onto the L2026 travelling west;
- Loads will continue west on the L2026 to the proposed site entrance.

Key elements of the temporary accommodation works for the delivery of turbines are summarised below;

- POI18: N30 / N11 Roundabout, Townland of Ballynahallin - Load bearing surface through the centre of the roundabout island. Temporary removal of street furniture;POI29: N80 / L2026 Junction, Townland of Carrickduff – Removal of street furniture, removal of low wall and trees. Preparation of local load bearing surfaces for vehicle over-run. Removal of overhead utilities and obstructions;
- POI30: L2026 West of Bunclody, Townland of Carrickduff – Preparation of local load bearing surface and localised vegetation trimming. Removal of stone wall. Removal of street furniture;
- POI43: L2026 Kilbrannish, Townland of Kilbrannish South – Removal of road signs and telegraph pole. Road widening with localised load bearing surface to verges. Removal of trees and vegetation, construction of a temporary bridge crossing;
- POI52: Proposed Turning Point, Townlands of Kilbrannish South and Kilbrannish North – Extension of existing car park hard standing to facilitate vehicle turning. Load bearing surface to existing field. Removal of trees and vegetation.

The general location of accommodation works are shown in Figure 3-3 and identified as “Points of Interest (POI’s)”. The location and nature of proposed temporary accommodation works are described in further detail in Chapter 13.

3.5.6.2 Internal Access Tracks

Up to 5.3 km of internal access tracks will be required to be upgraded as part of the project and 3.9 km of new internal access tracks will be required. Figure 3-1 illustrates the internal access tracks within the proposed main 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.

An extensive network of agricultural and forestry access tracks exists within the site. These existing access tracks have been utilised wherever possible for the proposed project.

All access tracks will be up to 5m wide along straight sections and wider at bends as required. 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.

The need for floating roads is not expected at this site.

It is predicted that the stone required for the construction of the internal access roads will be sourced from licenced quarries in the vicinity and an on-site borrow pit as shown in Figure 3-1.

Access track formation will consist of a minimum 500mm hardcore on geo-textile membrane.

The predicted construction methodology for newly constructed tracks 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 track.
- Surplus excavated material will be placed along the side of sections of the tracks in suitable locations as identified in the soil management plan and dressed to blend in with surrounding landscaping and partially obscure sight of the track.

3.5.6.3 Turbine Hardstandings

A turbine hardstanding area consists of a main crane pad hardstanding of up to 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 the operation of the wind farm.

3.5.7 Temporary Site Facilities

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 3-1. A wheel wash facility will be provided near the site entrance. Croaghaun will have 1no. temporary compound located near the entrance to the site which will include welfare facilities and offices.

Temporary compounds 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.

Facilities to be provided in the temporary site compounds 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
- storage areas
- employee parking
- bunded fuel storage
- contractor lock-up facility
- diesel generator
- waste management areas

3.5.8 Main Wind Farm Site Entrance

Croaghaun Wind Farm shall have one site entrance which will be used for both construction and operation. Access to the site shall be via an existing Coillte forestry entrance on the L2026. The location of the site entrance is shown on Figure 3-1.

This site entrance shall be upgraded in accordance with TII design guidelines DN-GEO-03060 and is capable of achieving sightlines of 160m in both directions at a setback distance of X=3m. Refer to drawing number P1913 – 0103-0001.

3.5.9 Grid Connection

The CRU introduced a new grid connection policy in April 2018 to replace the older systems of Gates and non-GPA (*Group Processing Approach*) – the Enduring Connection Policy (ECP-1: 2018 Batch). The purpose of the ECP is to provide more frequent opportunities for projects to connect to the network. Applicants are required to have gained planning permission for the wind farm in order to lodge an application for the grid connection as of the first ECP-1 stage. A subsequent grid application process is expected to commence as soon as reasonably practical after ECP-1 has concluded.

3.5.9.1 Grid Connection Cable Route

The proposed wind farm will have an export capacity of up to 38.5 MW, depending on final turbine technology installed. Connection will be sought under the Enduring Connection Process (ECP) grid access regime. Following consultation with EirGrid to date and an in-depth examination of grid capacity as part of this project, it is anticipated that the project will connect from the onsite substation via underground 38kV cable to the Kellistown 110/220kV substation in the townland of Kellistown East. The cable will be installed along the public road and shall feature horizontal directional drilling at up to 8 no. locations to cross existing watercourses and the N80 National Road. The proposed grid connection is shown in Figure 3-4. No overhead lines are proposed for this connection.

As shown in Figure 3-4, two grid connection route variants have been assessed in addition to the primary route which makes use of private agricultural lands at two separate locations to both minimise the overall length of the route and reduce the number of watercourse crossings required for the project. In both cases, where the primary route leaves the public road and passes through private lands, an alternative route variant has been assessed which involves the cable route following the public road corridor. Two separate cable route options for entering the proposed substation at Kellistown substation (see Section 3.5.9.2) have also been assessed. For the purposes of assessing worst case, the maximum possible route length and number of watercourse crossings based on the route permutations available have been used for quantities and material calculations. Should the proposed primary route be constructed, the total number of watercourse crossings shall amount to 5no. (2no. in the public road corridor and 3no. in private lands). The maximum possible number of watercourse crossings required is 7no. and would involve the inclusion of both route variants in the final grid connection. In this scenario, 6no. watercourse crossings will be located in the public road corridor and 1no. will be on private lands.

Electricity generated from wind turbines shall be collected at medium voltage (20/33 kV) by an internal circuit of buried cables which will follow on-site access tracks. This circuit shall be terminated at a proposed onsite substation and exported to the grid via a 38 kV buried cable to the existing Kellistown substation.

Connection works to Kellistown substation will involve the installation of ducting, joint bays, drainage and ancillary infrastructure and the subsequent running of cables predominantly long the existing road network. This will require delivery of plant and construction materials, followed by excavation, laying of cables and subsequent reinstatement of trenches.

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.

Where the grid connection route crosses the N80 National Road, horizontal directional drilling (HDD) will be used, namely a 38kV duct crossing at the location shown on Figure 3-4.

The locations of the launch and reception pits will be adequately spaced from the carriageway to ensure the bore is at such depth as not to conflict with the drainage or surface of the national road. There is sufficient room available to accommodate the necessary equipment. The cables will be laid at sufficient depth below the road to stay below existing drainage and not impact on the road foundations. There will be a detailed consultation and agreement with TII in advance of completing the works.

The locations of start and finish points for the HDD have been identified following desktop assessments, site visits and consultation with TII. Site investigation was carried out near the proposed crossing location to confirm the suitability of the proposed crossing method at this location. Site investigation works are described in detail in Chapter 9 of the EIAR.

For watercourse crossings along the proposed grid connection cable route, refer to Section 3.5.10.

3.5.9.2 Proposed Substation at Kellistown

Works will also be required in proximity to the Kellistown substation to accommodate the proposed project. The works will allow the voltage from the wind farm grid connection to be 'stepped up' to 110kV. The proposed substation compound will be self-contained and positioned in a neighboring field to that of the existing Kellistown substation as shown in Figure 3-4 and accompanying planning drawings. As previously stated, two locations have been assessed for this off-site substation as part of this EIAR. The proposed design for the offsite substation is a worst-case scenario in terms of footprint and scale of infrastructure. The final detailed design for shall be carried out by the network operator subject to upgrade requirements and grid connection agreement.

The two arrangement options that have been assessed as part of the project as illustrated in Figure 3-4.

The dimensions of the proposed substation compounds will be up to 61m x 50m and will include a substation control building and electrical components necessary to import the electricity generated from the wind farm to the existing Kellistown substation. 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 20m by 11m and up to 6m in height. The control building will include the grid operator control rooms, an office space and welfare facilities for staff. 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. The wastewater storage tank alarm will be part of a continuous stream of data from the site's turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. This approach for managing wastewater on site has become standard practice on wind farm sites, which are often proposed in areas where finding the necessary percolation requirements for on-site treatment can be challenging and has been accepted by numerous Planning Authorities and An Bord Pleanála as an acceptable proposal Existing facilities in the surrounding area have been assessed for the purposes of this planning application. A list of waste facilities in the locality can be found Section 3.6.12.

3.5.10 Watercourse Crossings

3.5.10.1 Internal Access Track Watercourse Crossings

The proposed project layout does not cross any significant stream within the site boundary. Minor drains such as manmade agricultural and forest drains will be crossed using 450mm diameter pipes.

Where cross drains are to be provided to convey the drainage across the track, the sizes of these cross drains are 225 mm diameter pipes.

Silt Protection Controls (SPCs) are proposed at the location of the drain crossings SPCs will consist of a minimum of silt traps containing filter stone and filter material staked across the width of the swales and upstream of the outfall to any watercourse.

A description of construction methodologies for watercourse crossings is presented in in the CEMP and Section 3.6.

3.5.10.2 Watercourse Crossings Along the GCR

The following table summarises existing watercourse and service crossing locations and the proposed method for crossing same along the grid connection route:

Table 3-2: Grid Connection Route Watercourse Crossings

Feature ID	ITM_X	ITM_Y	Grid cable method crossing
GCR-WCC1	679096.96	670298.85	HDD in public road corridor
GCR-WCC2	679110.52	670057.43	HDD in public road corridor
GCR-WCC3	679529.02	670126.05	HDD in public road corridor
GCR-WCC4	680262.95	665039.41	HDD in public road corridor
GCR-WCC5	680437.80	662507.73	HDD in public road corridor
GCR-WCC6	681594.32	659057.55	Ducts laid in flat profile within concrete bridge beam in road deck
GCR-WCC7	684252.84	659716.09	HDD in private field

Feature ID	ITM_X	ITM_Y	Grid cable method crossing
GCR-WCC8	679645.23	670366.41	HDD in private field
GCR-WCC9	681641.77	660121.93	HDD in private field

For crossings where HDD has been identified as the preferred crossing method, open cut trenching methods are proposed in dry conditions where there is no-flow in the watercourse and there is no risk of in-stream works. In such instances, cable ducts will be laid under the stream bed which would then be fully reinstated to its pre-existing condition.

A description of construction methodologies for watercourse crossings is presented in in the CEMP in Appendix 3.1 and Section 3.6, and in Chapter 10 of this EIAR>

3.5.10.3 Turbine Delivery Route (TDR) Watercourse Crossings

Crossings listed below were indentfied between the M11-N30 junction and the proposed entrance to themain wind farm site during TDR inspections.

- Toom 12 (12T49)
- Slaney (12S02)
- Moyne Lower (12M71)
- Moyne 12 (12M82)
- Marshalstown 12 (12M61)
- Tomgarrow 12 (12T37)
- Mountfin Lower (12M57)
- Tombrick 12 (12T34)
- Glasha 12 (12G01)
- Newtownbarry 12 (12N14)
- Clody (12C03)
- Unnamed Stream (tributary of the River Clody, just west of Bunclody)
- Deerpark New (12D25)
- Kilbrannish North (12K82)

There are a total of 14 watercourse crossings along the TDR from the roundabout at M11-N30 and the site entrance. No modifications were identified as being required at these stream crossings, except for crossings over the Kilbrannish North Stream at the local road L2026.

3.5.10.3.1 POI43 – Crossing of Kilbranish North River at Kilbranish

It is proposed to cross the Kilbranish North River at this location using the existing road bridge as described in Section 3.5.6.for standard construction vehicles.

Also proposed for oversized vehicles for turbine delivery purposes is a temporary bridge crossing which is assessed as part of the EIAR and located directly south of the existing bridge structure at the location shown in and accompanying drawings.

The temporary bridge will be of adequate length and will be designed to ensure that no in-stream works will be required and that the existing stream banks are not disturbed during construction. Sufficient free-board will be allowed for in the proposed bridge design to allow for 1 in 100-year fluvial flood conditions.

In order that flood flows will not be obstructed, the stream crossings will be sized to convey a 1 in 100-year flood flow.

The temporary bridge will comprise of a modular steel structure that shall be assembled and erected on site by a crane. A temporary stone access track and hard standing will be constructed to facilitate the installation of the crossing as well as laying of aggregate load bearing surface to public road verges. The works will include the removal of hedgerows and trees within the footprint of the works, construction of concrete bridge supports which will be built from both the field and public road and lifting of the assembled bridge structure into place. The bridge components will be delivered to site on standard HGV's. A cross section of the proposed steel bridge is shown in Plate 3-3.

Site investigation has been carried out at this location to determine the depth of rock and suitability of ground conditions for the proposed structure. The bridge will only be used for oversized turbine component deliveries. Following completion of turbine component deliveries, the bridge shall be removed and disassembled. The temporary aggregate track hard standing areas shall be removed and fully reinstated. Concrete bridge supports shall be left in situ.

A construction methodology is detailed in Section 3.6 and in the CEMP.

Plate 3-1: POI43 – Temporary Bridge Crossing Location

Plate 3-2: Temporary Bridge Location and General Arrangement

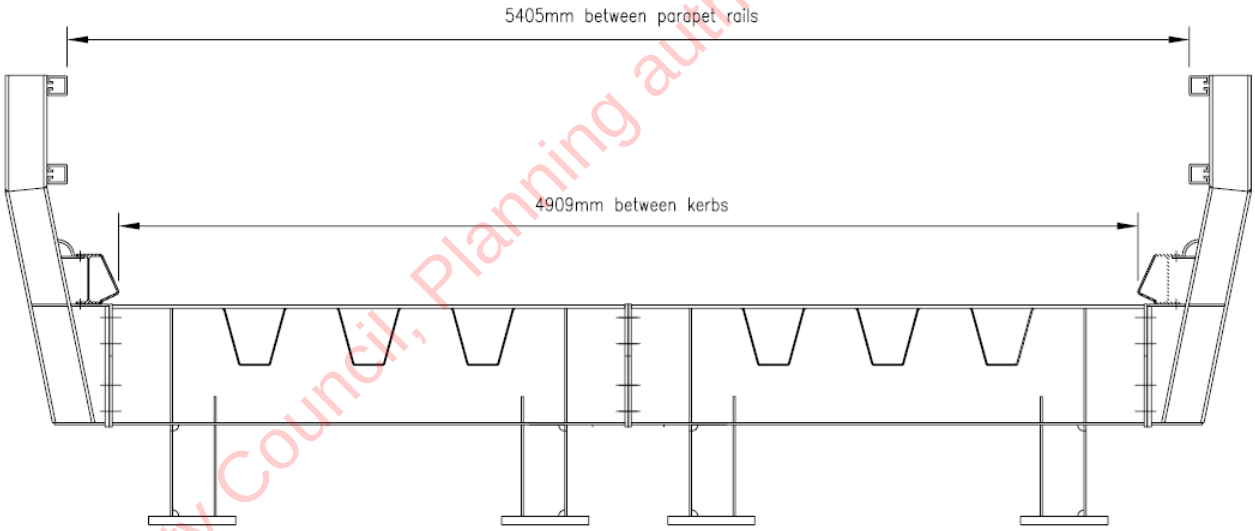

Plate 3-3: Temporary Bridge Cross Section

3.5.11 Onsite Electricity Substation

A permanent onsite electricity substation will be constructed within the proposed main wind farm site as shown in Figure 3-1. This will provide a connection point between the wind farm and the proposed grid connection point at the existing Kellistown substation.

As described in Section 3.5.9, electricity generated from wind turbines shall be collected at medium voltage (20/33 kV) by an internal circuit of buried cables which will follow on-site access tracks.

This circuit shall be terminated at a proposed onsite substation and exported to the grid via a 38 kV buried cable to the existing Kellistown substation.

The dimensions of the substation compounds will be up to 50m x 25m 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 19m by 9m 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. The wastewater storage tank alarm will be part of a continuous stream of data from the site's turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. This approach for managing wastewater on site has become standard practice on wind farm sites, which are often proposed in areas where finding the necessary percolation requirements for on-site treatment can be challenging and has been accepted by numerous Planning Authorities and An Bord Pleanála as an acceptable proposal. Existing facilities in the surrounding area have been assessed for the purposes of this planning application. A list of waste facilities in the locality can be found Section 3.6.12.

3.5.12 On-site Electrical Cabling

As described in Section 3.5.9, electricity generated from wind turbines shall be collected at medium voltage (20/33kV) by an internal circuit of buried cables which will follow on-site access tracks. This circuit shall be terminated at a proposed onsite substation. Electricity generated from the site will be exported to the grid via a 38kV buried cable to the existing Kellistown substation. The grid connection location is shown in Figure 3-4.

Internal collector circuit cable routes are shown on the planning application drawings and will generally 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. The specification for the cables and cable-laying will be in accordance with ESBN requirements.

The width of a cable trench with a trefoil formation will be 600mm, a flat formation would require a wider trench width. The depth of cover to the ducts carrying the cables will usually be up to 900mm cover to the top of the upper duct in public roadways and grassed areas.

The depth of trench for the cables will be up to? 1200mm and the depth of cover for the cables will usually be up to? 900mm. However, in certain instances, for example when crossing a bridge with shallow cover, a shallower depth of 450-950mm could be utilised. In those circumstances, the particular design will be agreed with ESBN and additional cable protection measures such as steel plates or reinforced concrete cover may be required.

Cables laid within the site in field locations will be laid to a depth of up to 1100mm to the top of the upper duct. 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.

3.5.12.1 Internal and Grid Connection Cable Installation

The specifications for cables and cable installation will be in accordance with ESBN requirements. A description of cable installation works is presented in Section 3.6 and the CEMP.

3.5.12.2 Buried Drains and Service Crossings

Watercourse crossings required for the proposed 38kV cable route to Kellistown sub-station are summarised in Table 3-2.

For the crossing of other services, if encountered along this route, the following options for construction may be used:

- Piped Culvert Crossings – Where sufficient cover is available, the cable ducts will be laid above the culvert with a minimum separation distance, 300mm to be agreed with the local authority and ESBN.
- Piped Culvert Crossings - Where sufficient cover is not available, the cable ducts will be laid under the culvert with a minimum separation distance, 300mm to be agreed with the local authority and ESBN.
- Flatbed Formation over Culverts - where the cable duct is to be installed over an existing culvert where sufficient cover is not available, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert. The duct will be laid in this trench in a flatbed formation over the existing culvert and will be encased in 6mm thick steel galvanized plate with a 30N concrete surround as per ESBN specification.

3.5.12.3 Joint Bays

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 up to 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 3-6 shows a standard ESBN 38kV single circuit joint bay and communications chamber arrangement. ESBN and Carlow County Council shall be consulted as part of the detailed design of joint bays.

It is expected that up to 42 no. of joint bays will be required for the grid connection. Of these, up to 34no. joint bays shall be located in public roads with up to 8 no. located on private lands.

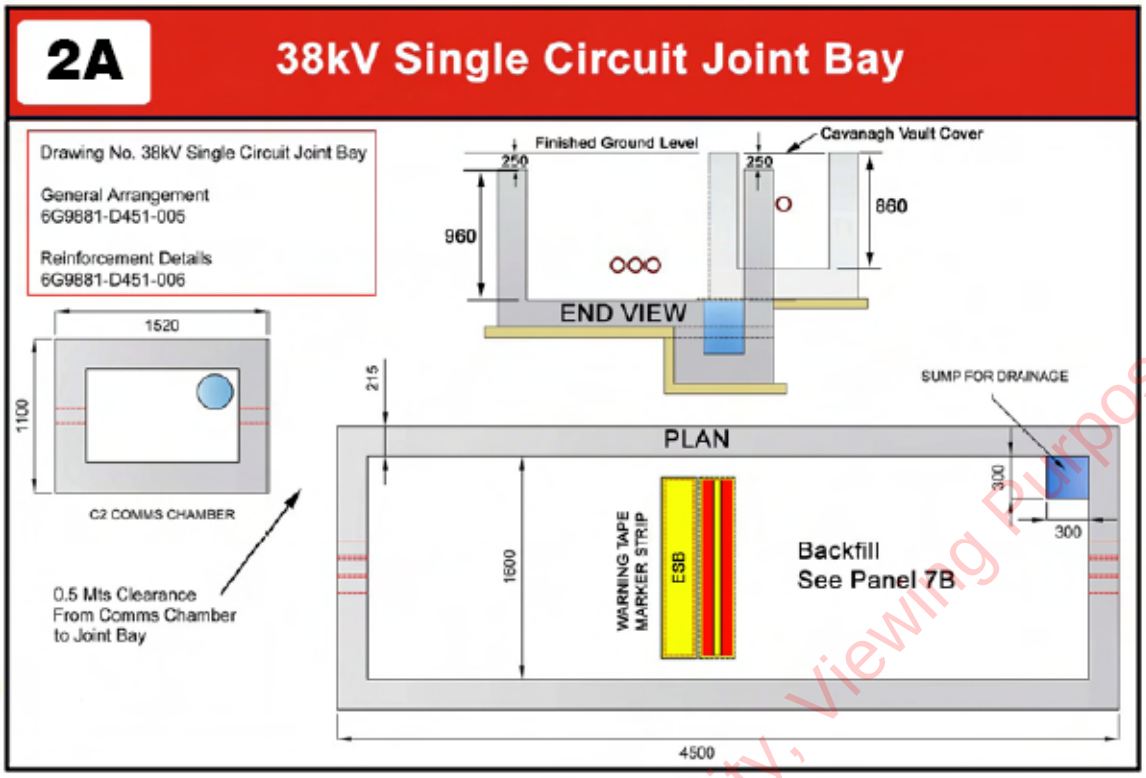

Figure 3-6: ESBN 38kV Single Circuit Joint Bay

3.5.13 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 general public. For the grid connection construction, cable trenching will be carried out with the aid of either lane closures or road closures, which will ensure that the trenching works are completed as expeditiously as possible. Due to the length of cabling within the road corridor, these works will be conducted over a period of up to 10-months (ca. 44weeks). Road closures will be applied for by the appointed contractor and will outline local diversions whilst maintaining local access at all times for residents, farms and businesses. Road closures will be subject to the applicable statutory processes as implemented by the Roads Authority. Road closures will be facilitated by the existing road network. 'Rolling road closures' will be implemented, whereby the site will progress each day along a road, which will have the effect of reducing the impact for local residents.

A traffic management plan for the cable trenching will be adopted , in consultation with Carlow County Council, to provide a safe environment for road users and construction workers.

A Traffic Management Plan is contained in the Construction Environmental Management Plan (CEMP) which is included in Appendix 3-1 of Volume 3. 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.

3.5.14 Peat Management

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.

Berms will be created from suitable excavated material and are located on the opposite side of infrastructure to any interceptor drains. The berms will therefore not obstruct flow or risk siltation to interceptor drains. Berms will be placed outside the roadside drains which drain the new access tracks. Further details on soils and peat management can be found in Chapter 9 of this EIAR and the Soils Management Plan contained within the CEMP in Appendix 3-1.

3.5.15 Drainage

The drainage system will be constructed alongside all turbine hardstands, internal access tracks, borrow pit, 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.

Further details on the hydrology and drainage are contained in Chapter 10 Hydrology and Water Quality, the CEMP in Appendix 3-1 and in the Planning Drawings. The number of stilling ponds, dimensions and their locations are provided in Surface Water Management Plan which is located in Appendix 3.1.

3.5.16 Borrow Pit

A proposed borrow pit location has been identified as a potential source of site won general fill for construction activities. The location was selected as potential sources of general fill (Class 1 material) for the proposed project using the criteria of no peat deposits, low landslide susceptibility and proximity to existing access tracks and proposed infrastructure.

The proposed borrow pit will have a footprint area of approximately 5,000m^2. This will provide a potential volume of approximately 45,000m^3 of site won granular fill, which when combined with bedrock excavated at hardstand locations will provide sufficient fill material for the proposed access roads and hardstands. A breakdown of volumes is provided in Chapter 9.

At the borrow pit location approximately 1.5m of overburden material will be required to be stripped to access the underlying deposits. This material will be temporarily stockpiled adjacent to the borrow pit prior to re-use in the reinstatement of the borrow pit. No permanent stockpiles of material will remain after construction.

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.

The location of the proposed on-site borrow pit is shown in Figure 3-1.

3.5.17 Temporary Stockpile Areas

Due to the possibility of soil-borne diseases, all topsoil recovered from each individual farm property within the proposed main wind farm site will remain on the same property.

These stockpiles will be covered and where required, drainage and sediment controls including temporary silt fencing will be put in place. The topsoil will be re-used for landscaping and will also be used for reinstatement purposes around turbine bases and hardstanding areas within the same farm property.

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. Further details on the drainage of the site are contained in Chapter 10, , the CEMP in Appendix 3-1 and in the Planning Drawings.

3.5.18 Tree Felling

Much of the proposed main wind farm site comprises commercial coniferous forestry. 3 no. turbines are located within forestry and consequently tree felling will be required as part of the project. Permanent felling of approximately 24.4 ha of coniferous forestry is required within and around the wind farm infrastructure to accommodate the construction of some turbines, hardstands, crane pads, access tracks and the proposed onsite substation. The above felling hectarage includes some areas which have recently been felled already for commercial timber extraction.

The felling area proposed is the minimum necessary to construct the proposed project and comply with any environmental mitigation (bats in particular).

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 as discussed in Section 3.5.19 below. It should be noted that the forestry within the proposed main wind farm site was originally planted as a commercial crop and will be felled in the coming years should the project proceed or not.

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).

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 method of tree felling near 'infrastructure' will be limited to:

- 20m wide corridors for new and upgraded access tracks;
- 10m buffer surrounding hardstandings;

- 12m buffer surrounding compounds;
- 8m corridor for buried cables in private lands;
- 80m radius around each turbine located in forestry for bat impact mitigation;
- 50m radius around the on-site meteorological mast.

3.5.19 Replant Lands

As described in Section 3.1, replanting lands at Sroove Co. Sligo and Crag Co. Limerick have been assessed for cumulative impacts. Reports detailing environmental assessments carried out on these sites are contained in Appendix 3.3 and 4.4 of this EIAR.

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).

As it is proposed to fell approximately 24.4 ha of coniferous forestry for the proposed project, replant lands of the same area are required. The replacement replanting of forestry can occur anywhere in the State subject to licence.

Potential replanting sites have been identified at Sroove, Co. Sligo and Crag, Co. Limerick. The total area identified for replanting is 34.8ha. The Sroove site has been technical approved and planted. A technical approval application for the Crag site for the has been submitted by the applicant to forest service. If these replant lands become unavailable, other similarly approved lands will be used for replanting should the proposed project receive planning permission.

3.5.20 Permanent Meteorological Masts

1 no. permanent meteorological (Met) mast shall be erected on site as shown in Figure 3-1.

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

- Up to 100m high lattice steel mast with a shallow concrete foundation, fixed to ground anchors by 3no. guy-wires.

A construction sequence for the proposed masts is described in Section 3.6.10.

An existing 80m meteorological mast has been constructed on site with permission granted for a 3-year period by Carlow County Council (Planning Ref. 19477). The location of this mast is shown on Figure 3-1.

3.5.21 Recreational Amenity Trail

The project includes the upgrade of 2.74 km of existing forest tracks and paths that shall be re-purposed as recreational amenity trails for community use and shall include trail signage and way-markers. All signage and way-markers shall be positioned within the corridor of the proposed trail upgrades. The location and alignment of the proposed amenity trail is shown in Figure 3-1. Further details on trail construction are included in Section 3.6.11. An example of recreational amenity trail labelled vista photograph at a viewing point is presented in Figure 3-7.

Figure 3-7: Example of Recreational Amenity Labelled Vista Photograph

3.6 Project Construction

3.6.1 Construction Programme

As discussed in Section 3.5, 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												
Offsite substation												
Grid connection cable works												
Private electrical network												
Landscaping, reinstatement, demob												

Figure 3-8: Proposed Construction Programme

3.6.2 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 and shall be submitted to the planning authority

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, 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.

3.6.3 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 (which will be the subject of a separate planning application) will be completed. An outline of construction techniques is contained in the CEMP in Appendix 3-1.

3.6.4 Site Access Tracks and Drainage

Access tracks are required to facilitate the construction of the proposed main wind farm site and to provide access to each of the turbines. Drainage infrastructure will be constructed in parallel with the access track construction.

Existing forest track drainage is extensive throughout the main 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 main wind farm site.

The drainage system for the existing tracks and roads will largely be retained. During the main wind farm site walkover it was observed that most of the existing tracks were approximately 4 m wide. It is proposed to widen approximately 5.26km of existing roads by approximately 1 m, with some additional widening at bends. 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.

3.6.5 Cable Trenches

The proposed grid connection cable route is indicated in Figure 3-4: Proposed Grid Connection RouteFigure 3-4. 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 records of services such as watermains, sewers, gas mains and other power cables will be obtained from the relevant service providers. 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 with 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 the two communication ducts will also be laid. An additional layer of cable marker strips will be laid above the communication ducts and the trench back-filled. 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. 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.

Plate 3-4: Cable Duct Laying in Trefoil Configuration

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

- All relevant bodies i.e. ESBN, Gas Networks Ireland, Eir, Carlow County Council, Irish Water etc. will be contacted and all drawings for all existing services will be sought to confirm the conditions predicted 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. Clear and visible temporary safety signage will be erected all around the perimeter of the live work area to visibly warn members of the public of the hazards of ongoing construction works.
- An excavator will be used to excavate the trench to the dimensions of approximately 600mm wide by approximately 1.2m deep.
- A silt filtration system will be installed on all existing drainage channels for the duration of the cable construction to prevent contamination of anywatercourse.
- Any ingress of ground water will be removed from the trench using submersible pumps and pumped to the nearest available existing drainage channel.
- Once the trench has been excavated, a bedding layer of sand or 15 Newton concrete will be installed and compacted. All concrete will be offloaded directly from the concrete truck into the trench.
- PVC ducts will be installed on top of the compacted base layer material in the trench.

- Once the ducts have been installed, couplers will be fitted and capped to prevent any dirt etc. entering the unjointed open end of the duct. In poor ground conditions, the open end of the duct will be shimmed up off the bed of the trench to prevent any possible ingress of water and dirt into the duct. The shims will be removed once the next length of duct has been joined to the duct system.
- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to ensure recording of exact location of the ducts, and hence the operational electricity cable. These co-ordinates will be plotted on as-built record drawings for the grid connection cable operational phase.
- When ducts have been installed in the correct position on the trench base layer, sand (in road trench) or Lean-mix CBM4 (CL1093) (off road trench) will be carefully installed in the trench around the ducts so as not to displace the duct and compacted.
- Spacer templates will be used during installation to ensure that the correct cover of duct surround material is achieved above, below and at the sides of the duct in the trench.
- A red cable protection strip will be installed above duct surround layer of material and for the full length of the cable route.
- A layer of Lean-mix CBM4 (CL1093) (in road) or excavated material (off road) will be installed on top of the duct 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 Carlow Area Engineer.
- 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.
- When trenching and ducting is complete, the installation of the grid connection cable will commence between the wind farm onsite sub-station to the existing substation at Kellistown.
- 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.

For simplicity, each cable circuit is referred to as a cable in the remainder of this document.

3.6.6 Watercourse Crossings

Watercourse crossings can generally be classified as follows:

- Existing structures (bridges or culverts) that need to be crossed by infrastructure (access tracks or cables) associated with the proposed project, without a need to modify the existing structure;
- Installation of new structures to facilitate the crossing of existing watercourses by infrastructure associated with the proposed project;

- Existing structures that need to be either replaced or upgraded to facilitate the crossing of existing watercourses by infrastructure associated with the proposed project;
- Crossing of existing open streams or drains by cable ducts.

As described in Section 3.5.10, there are no significant watercourse crossings required for new access tracks within the proposed main wind farm site.

The proposed methods for crossing existing watercourses along the grid connection route are described in Table 3-2. Construction details outlining crossing methods for watercourses listed in Table 3-2can be found in the accompanying drawings.

The methodology/sequence of works associated with the proposed watercourse crossing methods are described below.

3.6.6.1 Horizontal Directional Drilling (HDD) Under Existing Structure (Electrical Cables)

HDD will be employed at up to 8 no. locations along the proposed grid connection route as part of the project as shown on the site layout plans. 7 no. of these locations will be for the crossing of existing watercourses and 1 no. will be for a road crossing. The primary method for crossing watercourses shall be by HDD however in some cases it is considered appropriate to employ traditional techniques Table 3-2 indicates which crossings along the grid connection route can be crossed by alternative methods to HDD. Ducts crossing minor watercourses and drains using open cut techniques shall be carried out in accordance with the methodology described in Section 3.6.6.5. Such works shall only take place in dry conditions and when there is no flow present in the watercourse or drain in question. 48

The operation shall take place from one side of the watercourse either within private lands or within the verge of 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.

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 in Appendix 3-1.

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 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 included with the application.

Minimum environmental protection measures to be implemented on site shall include the following:

- A site-specific drilling design, risk assessment and method statement shall be prepared by the contractor prior to the works.
- If drilling fluids are required, a biodegradable fluid such as CLEARBORE shall be used rather than Bentonite.
- HDD operations to be limited to daytime hours and conditions when low levels of rainfall are forecast.
- The depth of the bore shall be at least 3m below the bed of the watercourse.
- Visual inspection to take place at all times along the bore path of the alignment.
- A field response plan to minimize loss of returns of drilling fluid and actions to restore returns shall be provided.
- Silt fences will be constructed around proposed work areas prior to commencement of works.
- No refuelling will take place within 50m of the watercourse or any sensitive habitats.
- Pre-construction verification surveys shall take place at drilling sites to confirm the presence of any sensitive species.
- A qualified biological monitor will be onsite for the duration of the drilling operation.

The depth of the bore shall be at least 3m below the level of the public road and stream bed. A detailed survey of buried services within the public road to confirm the conditions predicted in this EIAR will be carried out by the contractor prior to commencement of the operation. The council will be made aware in advance of the operation and invited to oversee the activity.

Where the grid connection route crosses the N80 National Road, horizontal directional drilling (HDD) will be used.

The locations of the launch and reception pits will be adequately spaced from the carriageway to ensure the bore is at such depth as not to conflict with the drainage or surface of the road or associated infrastructure.

There is sufficient room available to accommodate the necessary equipment. The cables will be laid at sufficient depth below the road to stay below the drainage and without impacting on the road foundations.

3.6.6.2 Concrete Bridge Beam in Road Deck with Ducts in Flat Profile (Electrical Cables)

An alternative to HDD at 1 no. bridge crossing locations is to install the cable ducts in flat formation with a concrete encasement referred to as a concrete bridge beam. The methodology for this option is described as follows:

- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in the CEMP.
- Setting out and location of services will be carried out in the same manner as for trench excavations.
- Traffic management to be set up as per traffic management plan contained within the CEMP in Appendix 3-1.
- The road surface along the route will be milled by road plainer and skid steer.

- A 360-degree excavator will first remove the top layer from the route along the roadside and load onto a haulage truck. This material will be recycled, then the excavation of trench will commence and a trained spotter will be used to assist machine operators while reversing or when their visibility becomes restricted.
- Excavator to run at low revs to avoid damage to the existing structure by sudden movement.
- A banksman to dig trial holes after each layer of the road surface is removed. The maximum depth will be exposed to allow for the greatest cover to be achieved.
- Where necessary as per the engineer's design, protective steel plates will be placed at the base of the excavation such as over the top of bridge key stones.
- Ducts will be placed into trench manually, having been delivered to road side embankment/verge areas by way of tractor and pipe trailer and then offloaded by hand.
- Concrete is then poured between and 50mm over the ducts maintaining the required spacing's as per the engineer's design.
- A protective steel plate is placed to the sides and over the newly laid ducts as per the engineer's design.
- Cable marker strips in accordance with ESB code :2955103 are placed on top of the steel plates.
- Additional concrete is then placed over the marker tape followed by steel reinforcing mesh.
- Additional concrete is then placed on top of the mesh to the required finished level.
- Depending on the finished levels, if the finish level is below ground level than the remaining depth will be filled with approved fill material the following day after the concrete has set.
- Warning tape will be placed above the concrete beam. The top level will be finished as per the Local Authority Requirements.

It is expected based on site inspections that when the above method is employed, sufficient cover will be in place to facilitate the ducting without any need to raise the level of the road carriageway or result in the need to alter the bridge parapets walls.

3.6.6.3 Standard Trench Crossings of Existing Culverts or Services (Electrical Cables)

For the crossing of buried pipe drains, culverts or services, if encountered, the following options for construction may be used:

- Piped Culvert Crossings – Where sufficient cover is available, the cable ducts will be laid above the culvert with a minimum separation distance, 300mm to be agreed with the local authority and ESBN.
- Piped Culvert Crossings - Where sufficient cover is not available, the cable ducts will be laid under the culvert with a minimum separation distance, 300mm to be agreed with the local authority and ESBN.
- Flatbed Formation over Culverts - where the cable duct is to be installed over an existing culvert where sufficient cover is not available, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert. The duct will be laid in this trench in a flatbed formation over the existing culvert and will be encased in a reinforced concrete surround as per ESBN specification.

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. Plate 3-5 shows design details for ducts passing in flat formation above existing culverts and buried services.
- 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.

Piped Culvert Crossing – Ducting Over Culvert

Where sufficient cover exists above the culvert, the trench will be excavated above the culvert and the ducts will be installed in the trefoil arrangement passing over the sealed pipe where no contact will be made with the watercourses. This method of duct installation is further detailed in Plate 3-5.

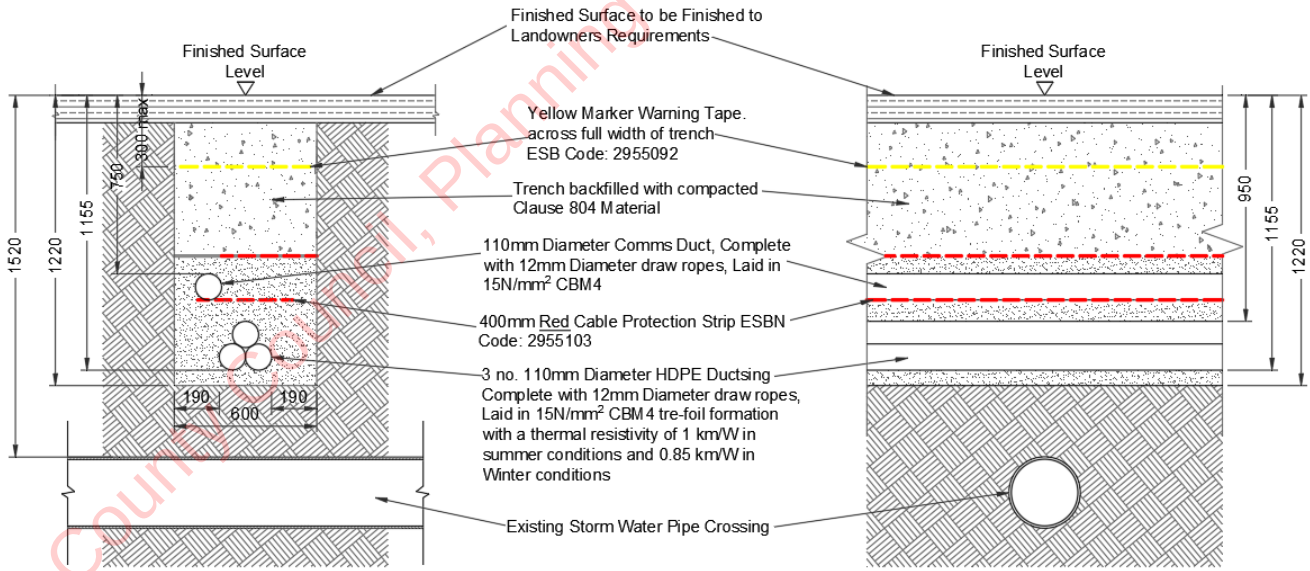

Plate 3-5: Piped Culvert Crossing – Ducting Over Culvert Crossing Details

Piped Culvert Crossings – Ducting Under Culvert

Where the culvert consists of a socketed concrete or sealed plastic pipe where sufficient cover over the culvert does not exist to accommodate the cable trench, a trench will then be excavated beneath the culvert and cable ducts will be installed in the trefoil arrangement under the sealed pipe.

This method of crossing is illustrated in Plate 3-6 below. If these duct installation methods cannot be achieved or utilized, the ducts will be installed by alternative means as set out in the following sections.

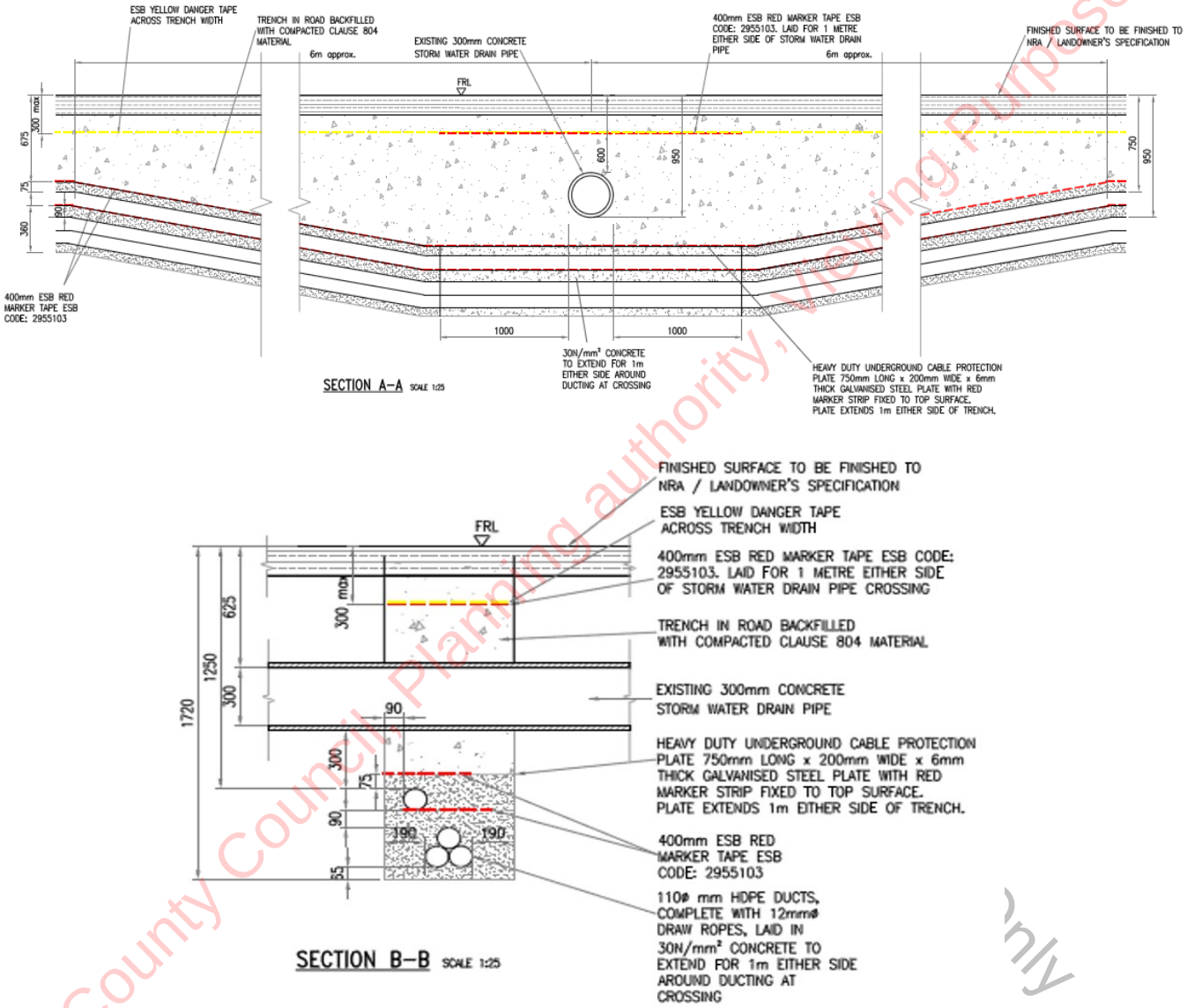

Plate 3-6: Piped Culvert Crossings - Ducting under Culvert Crossing Details

Flatbed Formation Over Culverts

Where cable ducts are to be installed over an existing culvert where sufficient cover cannot be achieved by installing the ducts in a standard trefoil arrangement, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert. The ducts will be laid in a flatbed formation over the existing service and will be encased in a reinforced concrete surround as per Eirgrid specification.

After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench. This will be done gradually to comply with minimum duct and cable design bend requirements. In transition sections between trefoil and flat formation, the base of the trench shall be graded to eliminate stepping and minimum bedding and surround material will be maintained throughout.

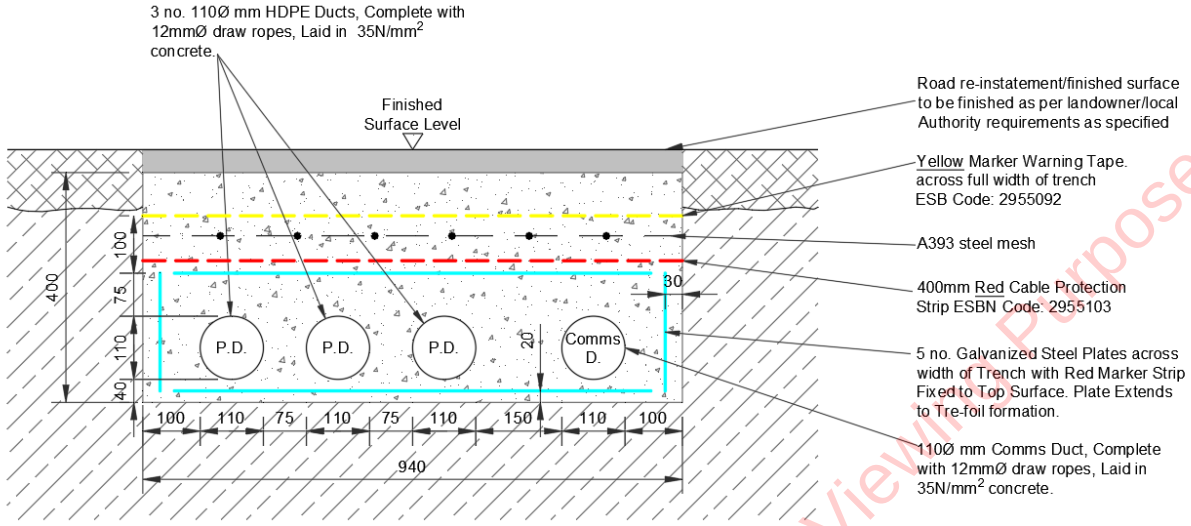

Plate 3-7: Flatbed Formation Detail

3.6.6.4 Minor Watercourses and Drain Crossings (Access Tracks)

It is expected that all 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.

Pipe culverts will be installed in accordance with the design shown in Plate 3-8 below.

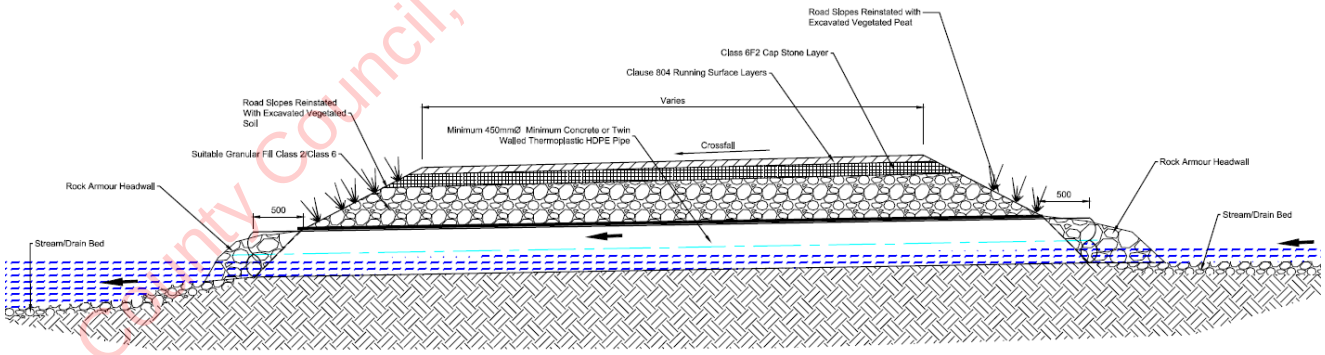

Plate 3-8: Piped Culvert Crossing Long Section

For a minor watercourse/drain crossing using a piped culvert, the following methodology will be used.

- 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 CEMP in Appendix 3-1.
- Pipe culvert installation will only take place during dry periods.
- The bed of the watercourse will be prepared using a mechanical digger and hand tools to the required levels in accordance with the design.
- A bedding layer will be laid in the base of the minor watercourse/drain using Class 6 aggregate material and blinding to the desired levels in accordance with the design.
- The pipe is laid in one lift or in sections using a crane in accordance with an approved lift plan.
- Bedding material is placed and compacted around the pipe to the desired levels in accordance with the design.
- 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.
- The pipe is covered using compacted Class 6N fill material in accordance with the design up to the levels required by the access track sub formation.
- Rock armour headwalls will be constructed where necessary to protect pipe ends and the base of slope embankments on either side of the track.
- For small drain crossings, pipes of suitable diameter will be laid directly into the bed of the drain.

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.

3.6.6.5 Minor Watercourses and Drain Crossings (Cable Trenching)

For a minor watercourse/drain crossing, the following methodology will be used.

- The cable trench construction will finish at least 10m from the nearside bank of the minor watercourse/drain.
- No water flow shall be present in the watercourse/drain during the works. Duct installation will only take place during dry periods to ensure no in-stream works and an environmental monitor shall supervise the works.
- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in the CEMP in Appendix 3-1.
- The bed of the watercourse will be excavated using a mechanical digger and hand tools to the required levels in accordance with the design along the alignment of the cable route.
- Once the trench has been excavated, a bedding layer of sand will be installed and compacted.
- PVC ducts will be installed on top of the compacted base layer material in the trench.
- Once the ducts have been installed, couplers will be fitted and capped to prevent any dirt etc. entering the unjointed open end of the duct. In poor ground conditions, the open end of the duct will be shimmed up off the bed of the trench to prevent any possible ingress of water and dirt into the duct. The shims will be removed once the next length of duct has been joined to the duct system.

- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to ensure recording of exact location of the ducts, and hence the operational electricity cable. These co-ordinates will be plotted on as-built record drawings for the grid connection cable operational phase.
- When ducts have been installed in the correct position on the trench base layer, sand or will be carefully installed in the trench around the ducts so as not to displace the duct and compacted.
- A red cable protection strip will be installed above duct surround layer of material.
- A layer of excavated material will be installed on top of the duct surround material to the correct level.
- Yellow marker warning tape will be installed for the full width of the trench.
- The bed of the watercourse, stream banks and agricultural land will be reinstated as per their original condition.

3.6.6.6 POI43 – Crossing of Kilbranish North River at Kilbranish

As described in Section 3.5.10, the method of crossing the Kilbranish North River in the form of a temporary bridge located directly south of the existing bridge structure has been assessed as part of this EIAR?.

The temporary bridge will comprise of a modular steel structure that will be assembled and erected on site by a crane. A temporary stone access track and hard standing will be constructed to facilitate the installation of the crossing as well as laying of aggregate load bearing surface to public road verges. The works will include the removal of hedgerows and trees within the footprint of the works, construction of concrete bridge supports which will be built from both the field and public road and lifting of the assembled bridge structure into place. The bridge components will be delivered to site on standard HGV's.

A construction methodology is detailed below and in the CEMP.

- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in Section 4 of the CEMP (Appendix 3.1).
- A temporary access track and hard standing and associated temporary drainage infrastructure shall be constructed in accordance with the methodologies described in Sections 3.6.4 and 3.6.7.
- Bank protection will be installed as necessary to ensure that the existing stream banks are not disturbed during construction.
- The line of the access track and crossing will be marked out on site by a site engineer
- The extent of the excavation for bridge supports will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter. Bridge foundations will be designed and positioned at least 2.5m from the river bank.
- The excavated material will be stored within the site at locations identified in the Soil Management Plan.
- A layer of concrete blinding will be laid directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface, followed by placement of the concrete blinding layer for the bridge supports.
- Steel reinforcement will be fixed in accordance with the designer's drawings & schedules and the supports will be shuttered.
- Concrete will be placed and compacted to the levels and profile indicated on the construction drawings.

- Upon completion of the concreting works the bridge supports will be covered from the elements and left to cure for a sufficient period in accordance with the design specification.
- The bridge supports will be backfilled using the material arising during the excavation and landscaped using the top-soil set-aside during the excavation. The suitability of backfill material is to be approved by the project geotechnical engineer.
- Following adequate curing, the temporary steel bridge components shall be delivered to site and assembled.
- The assembled bridge structure shall be lifted into position by a crane in accordance with an approved lifting plan.
- The structure shall be fixed to the bridge supports using holding down bolts and high strength cementitious bearing grout between the bearing base plates and the concrete supports.
- The temporary aggregate track hard standing areas shall be removed and fully reinstated. Concrete bridge supports shall be left in situ.

3.6.7 Turbine Hardstands

A turbine hardstanding area will be constructed at the base of each turbine to provide a solid area for the main 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 quarries in the vicinity and from turbine hardstanding areas and borrow pit at locations shown in Figure 3-1.

Hard standing formation will consist of a minimum 500mm hardcore on geo-textile membrane. The construction methodology for newly constructed tracks 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.
- Surplus excavated subsoil will be used to reinstate borrow pits.

3.6.8 Turbine Foundation

The base of the foundations are excavated to competent bearing strata. Based on site investigations carried out to date, it is expected that turbines for the Croaghaun Wind Farm will have foundation depths of up to 4m and a base diameter of up to 22m. Flexibility of +/- 1.5m in the finished levels is required to allow for sloping topography and ground conditions.

Excavated soil will be placed in the temporary storage areas adjacent to the turbines in accordance with the soil management plan. Formwork and reinforcement are placed, and the concrete poured. Once the concrete is set the earthing system is put in place and the foundation is backfilled with suitable material.

3.6.9 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.

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 construction phase, including civil, electrical and grid works, and turbine assembly will take between approximately 12 – 18 months.

3.6.10 Erection of Permanent Met Masts

The works shall be carried out by a small crew and the following mobile plant:

- Low-loader
- Flatbed trucks
- Works Van
- Telescopic Handler
- Mobile Crane

The sequence of works are as follows:

- The site of the mast location shall be marked out and the necessary area cleared of vegetation.
- Mark out mast base and anchor positions in accordance with detailed design drawings. Mast anchor positions are at approximately 30m and 50m radius from the mast in the direction of each corner of the mast's triangular base.
- A temporary access track shall be extended towards the mast location from the existing forest track network. The access track shall be up to 3.5m in width.
- Temporary and permanent drainage infrastructure shall be extended also.
- A small 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 in Sections 3.6.4 and 3.6.7 however the dimensions and stone depth requirements of the access 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.
- Excavate holes for anchors to required depth and install anchors.
- 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.

- Before raising of the third mast section, 10mm stainless steel guy ropes are fitted at the lugs on the top triangular section of the mast. These ropes are connected using shackles and are uncoiled to hang down when the section is erected.
- Following erection of main mast sections, lightning protection and other ancillary components shall be fixed to the mast.

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

3.6.11 Recreational Amenity Trail

As previously described, the project includes the upgrade of 2.74 km of existing forest tracks and paths that shall be re-purposed as recreational amenity trails for community use.

It is proposed that the stone required for the construction of the recreational amenity trail will be sourced from quarries in the vicinity. Details of quarries in the vicinity of the project can be found in Chapter 13. The locations of these quarries along with haul routes are shown in Figure 13.4.

Formation will consist of a minimum 150mm hardcore on geo-textile membrane. The proposed? construction methodology for newly constructed trails will be as follows:

- The existing ground shall be graded to receive geotextile membrane.
- CL804 structural aggregate shall be placed and compacted in a single layer to the required depth.
- Suitable gravel to a depth of up to 50mm shall be laid to create the finished trail surface.
- Drainage shall be constructed in parallel with the trail construction and shall tie in with both the existing forestry drainage wind farm access track drainage infrastructure. Where steep gradients exist, cut off drains shall be located at suitable intervals;
- Surplus topsoil will be placed along the side of the trail and dressed to blend in with surrounding landscaping;
- Surplus excavated subsoil will not be generated by the works;
- Trail widths shall range from 1.5m to 3m;
- Trail signage and way-markers shall be paced at several locations along the trail.

3.6.12 Waste Management

A Waste Management Plant 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 off site to licensed facilities. 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.

The waste manager will have overall responsibility to instruct all site personnel including sub-contractors to comply with on-site requirements. They will ensure, at an operational level, that each crew foreman is assigned direct responsibility.

Waste Generated

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

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

Sanitary waste will be removed from site by a licensed waste disposal contractor. All portaloo units located on site during the construction phase will be operated and maintained in accordance with the manufacturer's instructions and will be serviced under contract with the supplier. All such units will be removed off-site following completion of the construction phase.

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

Waste Minimisation/Reduction

All efforts will be made by site management to minimise the creation of waste throughout the project. This will be done by:

- material ordering will be optimised to ensure only the necessary quantities of materials are delivered to site;
- material storage areas will be of a suitable design and construction to adequately protect all sorted materials to ensure no unnecessary spoilage of materials occurs which would generate additional waste;
- all plant will be serviced before arriving on site. This will reduce the risk of breakdown and the possible generation of waste oil/hydrocarbons on site;
- all operators will be instructed in measures to cut back on the amount of wastage for trimming of materials etc. for example cutting of plywood, built into the amount ordered;
- educating foremen and others to cut/use materials such as ply wisely for shutters etc.;
- prefabrication of design elements will be used where suitable to eliminate waste generation on site;
- where materials such as concrete are being ordered, great care will be practiced in the calculation of quantities to reduce wastage.

Waste Reuse

When possible, materials shall be re used onsite for other suitable purposes e.g.:

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

It is important to clarify that any excess excavated material that will be used for fill, re-instatement, or similar activities, within the main wind farm site boundary is not technically categorised as a waste material under relevant waste legislation, rather this material is exempt from waste classification.

Article 2 (1) (c) of Directive 2008/98/EC on waste, transposed through Article 26 (1) (c) of the European Communities (Waste Directive) Regulations (S.I. 126 of 2011) identifies the following as being an exemption from waste regulation:

> *"uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated".*

It is envisaged that surplus material will be re-instated in its natural condition on the site from which it was excavated, this material is not considered as waste.

Waste Recycling, Recovery & Disposal

In accordance with national waste policy, source separation of recyclable material will take place. This will include the provision of receptacles for the separation and collection of dry recyclables (paper, cardboard, plastics etc.), biological waste (canteen waste) and residual waste.

Receptacles will be clearly labelled, signposted and stored in dedicated areas.

The following source segregated materials containers will be made available on site at a suitable location:

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

The materials will be transported off-site by an authorised contractor to a permitted recovery centre and these materials will be processed through various recovery operations.

Residual waste generated on-site may require disposal. This waste will be deposited in dedicated receptacles and collected by the permitted waste management contractor and transported to an appropriate facility. All waste movements will be recorded, which records will be held by the waste manager on-site.

A list of existing licensed waste facilities is presented in Table 3-3 below.

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

Licensed Waste Facility	Type of Waste
New Ross Recycling Centre, New Ross, Co. Wexford	Plastic, metals, oil, paper, cardboard, glass, electrical goods
Holmestown Waste Management Facility, Barntown, Co. Wexford	Plastic, metals, oil, paper, cardboard, glass, electrical goods, green waste, domestic waste
Gorey Recycling Centre, Gorey, Co. Wexford	Plastic, metals, oil, paper, cardboard, glass, electrical goods
O Toole Skip Hire and Bring Waste Site, Fenagh, Co. Carlow	Concrete, timber, soil/clay, green waste
Veolia Ireland, Purcellsinch, Co. Kilkenny	Hazardous Waste
Glenbrien Wastewater Treatment Plant, Gleann Oir, Co. Wexford	Wastewater treatment
Wexford Wastewater Treatment Plant, Strandfield, Co. Wexford	Wastewater treatment
Portlaoise Wastewater Treatment Plant, Portlaoise, Co. Laois	Wastewater treatment
Dunlavin Wastewater Treatment Plant, Dunlavin, Co. Wicklow	Wastewater treatment

3.7 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 a caretaker will oversee the day to day running of the proposed wind farm.

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. It should be noted that section 7.2 of the Planning Guidelines 2006 includes for the following:

> *'The inclusion of a condition which limits the life span of a wind energy development should be avoided, except in exceptional circumstances'*

In this respect, 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.

3.8 Decommissioning

On decommissioning, cranes will disassemble the above ground turbine components which would 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 with the exception of T3 and T6 hard standings which will be fully reinstated. .

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

The recreational trails and associated signage shall be left in situ.

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

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