Planning and Environmental Consultants

Environmental Impact Assessment Report (EIAR)

Carrig Renewables Wind Farm

Chapter 4 - Description

DOCUMENT DETAILS

Client:	**Carrig Renewable Energy Ltd**
Project Title:	**Carrig Renewables Wind Farm**
Project Number:	**211016**
Document Title:	**Environmental Impact Assessment Report (EIAR)**
Document File Name:	**Ch 4 - Description F – 2023.09.21 - 211016**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	21.09.2023	JF	EMC

Table of Contents

4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the Proposed Development and all its component parts. Two separate planning applications, relating to the Proposed Development, will be made to Tipperary County Council and to Offaly County Council. This chapter also describes elements of the overall project which are not subject to this planning application but are assessed in this EIAR. Construction methodologies for the main infrastructural components of the development are also included in this chapter (or its associated appendices) of the EIAR.

The Overall Proposed Development will consist of the provision of the following:

i. *The construction of 7 no. wind turbines and associated hardstand areas with the following parameters (all within Co. Tipperary):*
   a) *Total tip height range of 179.5m – 185m,*
   b) *Rotor diameter range of 149m – 163m*
   c) *Hub height range of 103.5m to 110.5m*
ii. *1 no. permanent 38kV electrical substation which will be constructed in the townland of Faddan Beg, Co. Tipperary. The proposed electrical substation consists of a single storey control building with welfare facilities, all associated electrical plant and equipment, battery energy storage system, security fencing, all associated underground cabling, wastewater holding tank and all ancillary works and equipment;*
iii. *All works (within County Tipperary and Co. Offaly) associated with the connection of the proposed wind farm to the national electricity grid, via the provision of underground electrical cabling (38kV) to the existing Dallow 110kV substation in the townland of Clondallow, Co. Offaly;*
iv. *Provision of 14 no. joint bays, communication chambers and earth sheath links along the underground electrical cabling route (within Co. Tipperary and Co. Offaly);*
v. *Reinstatement of the road or track surface above the proposed cabling trench along existing roads and tracks;*
vi. *All associated underground electrical and communications cabling connecting the turbines to the proposed wind farm substation (within Co. Tipperary);*
vii. *1 no. meteorological mast with a height of 107m above ground and associated foundation and hard-standing area (within Co. Tipperary);*
viii. *Upgrade of existing tracks and roads and the provision of new site access roads (within Co. Tipperary);*
ix. *All works associated with the provision of a new permanent site entrance off the L5040 local road (within Co. Tipperary);*
x. *Provision of 5 no. new access and egress points along the L5041 local road in the townlands of Cloncorig, Faddan More and Coolderry (within Co. Tipperary);*
xi. *Provision of 4 no. peat repository areas and 3 no. spoil repository areas (within Co. Tipperary);*
xii. *2 no. temporary construction compounds with temporary site offices and staff facilities (within Co. Tipperary);*
xiii. *Accommodation works along the public road network along the N52 national secondary road in the townland of Ballyloughnane to facilitate the delivery of turbine components and other abnormal sized loads (within Co. Tipperary);*
xiv. *Site Drainage;*
xv. *Tree Felling (within Co. Tipperary);*

xvi. Operational stage site signage; and,
xvii. All associated site development works, ancillary works and apparatus.

The application is seeking a ten-year planning permission.

The Proposed Development includes for an onsite 38kV electricity substation and underground grid connection cabling, connecting the Proposed Development to the national electricity grid via the existing Dallow 110kV electricity substation located in the townland of Clondallow, Co. Offaly. The cabling will be located within the public road corridor or existing tracks for its entire length. The total length of the proposed underground grid connection route is approximately 13.7km, of which 10.4km is located within Co. Tipperary and 3.3km is located within Co. Offaly.

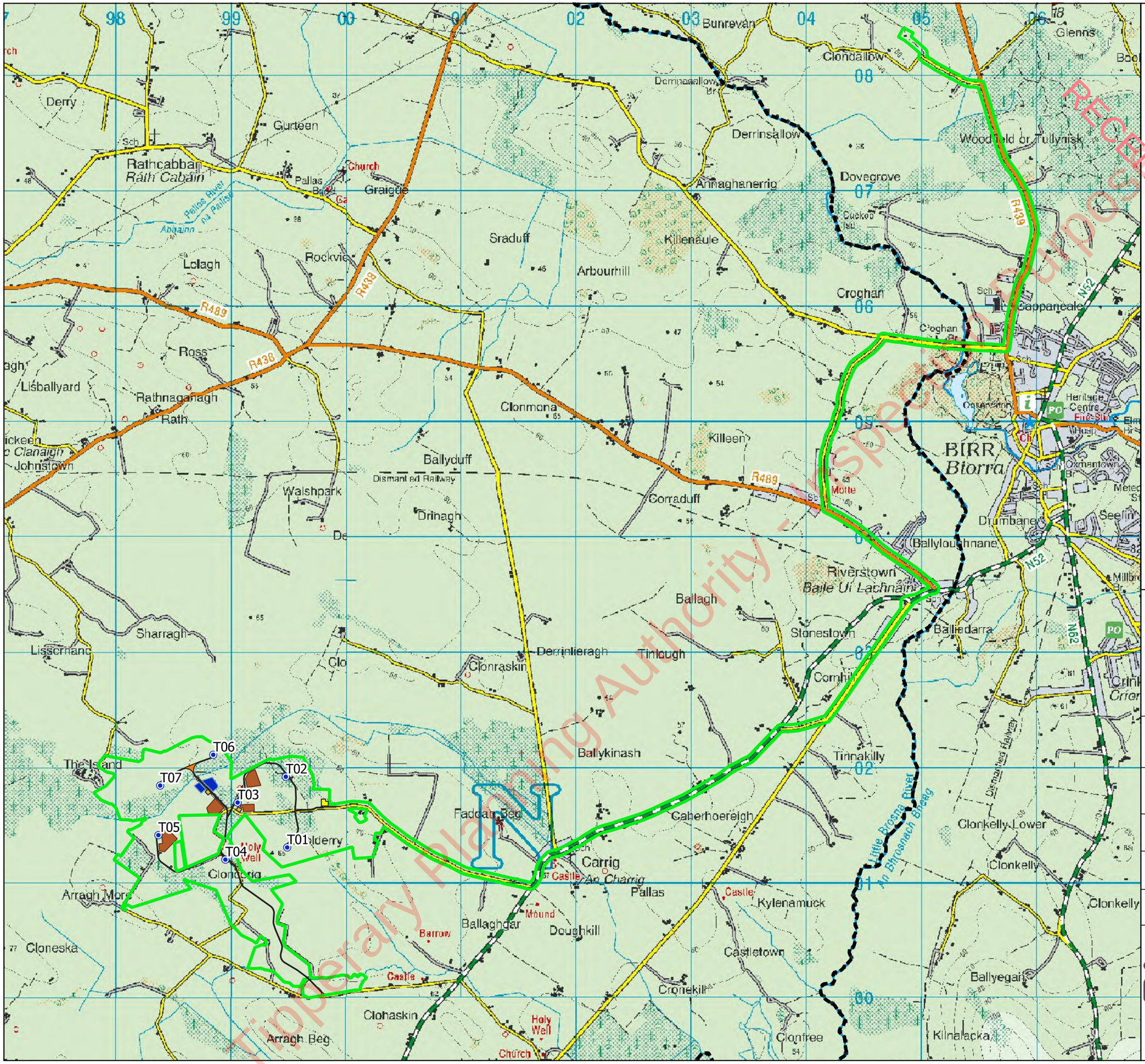
All elements of the Proposed Development in the list above, and described in this chapter, have been assessed as part of this EIAR.

4.2 Development Layout

The layout of the Proposed Development 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. A constraints study, as described in Section 3.2.6.1 of Chapter 3 of this EIAR, has been carried out to ensure that turbines and all ancillary infrastructure are located in the most appropriate areas of the site. The Proposed Development layout makes maximum use of the existing access roads and tracks within the site, thereby minimising the extent of proposed new roads required.

The overall layout of the Proposed Development is shown on Figure 4-1a. This drawing shows the proposed locations of the wind turbines, electricity substation, grid connection route, peat and spoil repositories, construction compounds, internal roads layout, and the main site entrance. The EIAR Site Boundary does not include turbine delivery accommodation works at the L5040 local road junction off the N52 national road. However, these temporary works are assessed as part of the EIAR

A drawing focusing on the core of the development site is shown on Figure 4-1b. Detailed site layout drawings of the Proposed Development are included in Appendix 4-1 to this EIAR.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundation
- Proposed Crane Platform Hardstand
- Proposed Substation and Battery Stoarge Compound
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Construction Compound

Proposed Peat and Spoil Repository Areas

- Peat
- Spoil

Drawing Title

Proposed Site Layout

Project Title

Carrig Renewables Wind Farm

Drawn By	Checked By
JF	EM
Project No.	**Drawing No.**
211016	Fig. 4-1a
Scale	**Date**
1:32,000	2023-09-21

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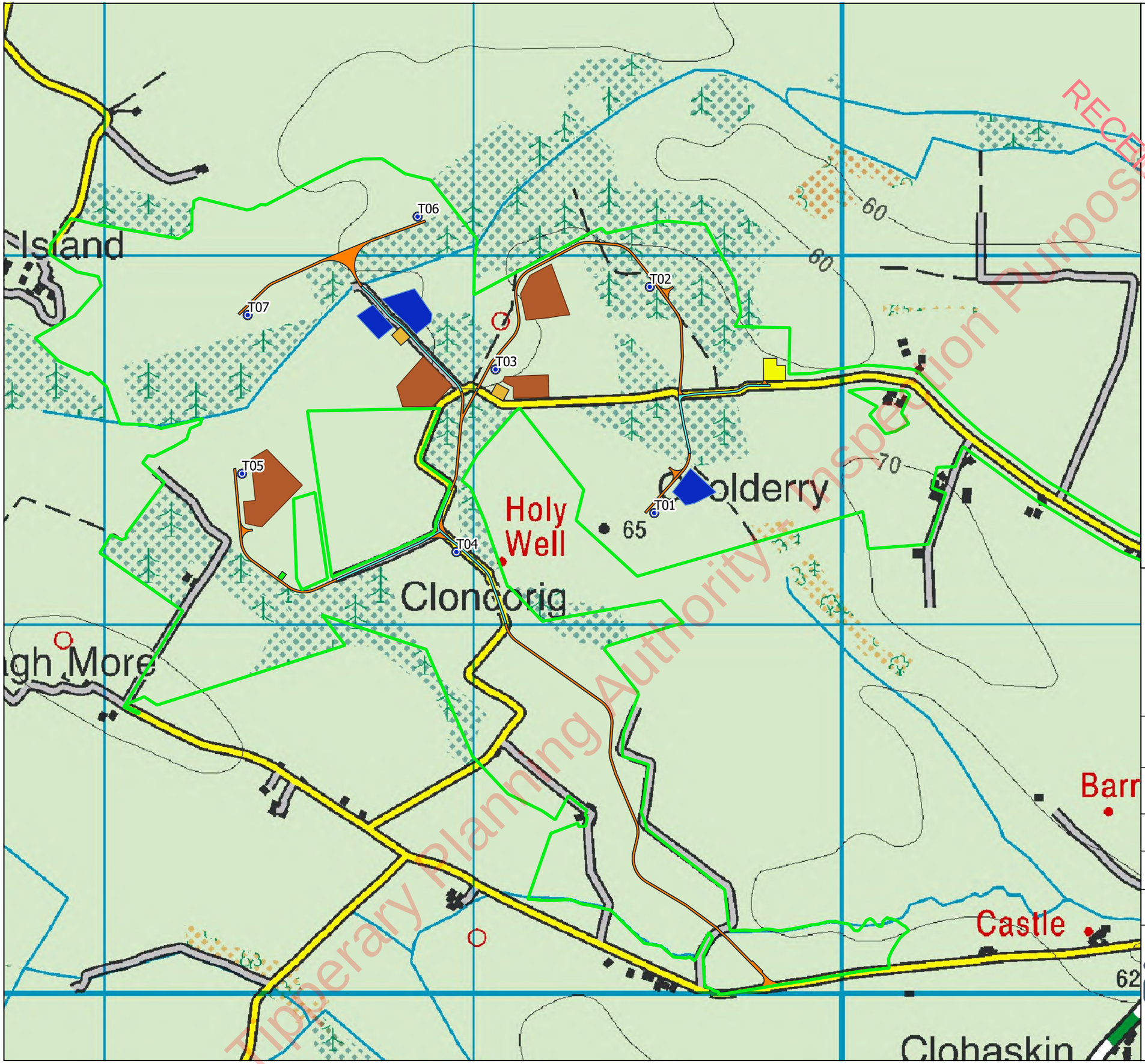

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Drawing Title

Proposed Site Layout

Project Title

Carrig Renewables Wind Farm

Drawn By	Checked By
JF	EM
Project No.	Drawing No.
211016	Fig. 4-1b
Scale	Date
1:10,000	2023-09-21

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4.3 Development Components

This section of the EIAR describes the components of the Proposed Development. Further details regarding Access and Transportation (Section 4.4), Site Drainage (Section 4.7), Construction Management (Section 4.8) and Construction Methodologies (Section 4.9) are provided subsequently in this chapter.

4.3.1 Wind Turbines

4.3.1.1 Turbine Locations

The proposed wind turbine layout has been optimised using industry standard wind farm design software to maximise the energy yield from the Proposed Development, while maintaining sufficient distances between the proposed turbines so as to ensure turbulence and wake effects do not compromise turbine performance. The Grid Reference coordinates of the proposed turbine locations are listed in Table 4-1 below.

The final ground level of the turbine foundations will be determined by the actual ground conditions at each proposed turbine location and may differ slightly from those levels listed in Table 4-1. Also, in accordance with the '*Wind Energy Development Guidelines for Planning Authorities'* (Department of the Environment, Heritage and Local Government (DOEHLG), 2006) micro-siting of the turbine positions may be required within the criteria set out in the guidelines.

Table 4-1 Proposed Wind Turbine Locations and Elevations

Turbine	ITM Coordinates		Top of Foundation Elevation (m OD)
	Easting	Northing	
T1	599442	701335	61
T2	599430	701948	59
T3	599011	701724	58
T4	598905	701229	59.5
T5	598324	701442	61
T6	598800	702139	57.5
T7	598339	701872	59

4.3.1.2 Turbine Type

Wind turbines use the energy from the wind to generate electricity. A wind turbine, as shown in Plate 4.-1 below, consists of four main components:

- Foundation unit
- Tower
- Nacelle (turbine housing)

- Rotor

Plate 4-1 Wind turbine components

The proposed wind turbines to be installed on the site will have the following dimensions:

- Turbine Tip Height – Maximum height 185 metres, Minimum height 179.5 metres
- Hub Height – Maximum height 110.5 metres, Minimum height 103.5 metres
- Rotor Diameter - Maximum diameter 163 metres, Minimum length 149 metres.
- Blade Length – Maximum Length 81.5 metres, Minimum Length 74.5 metres

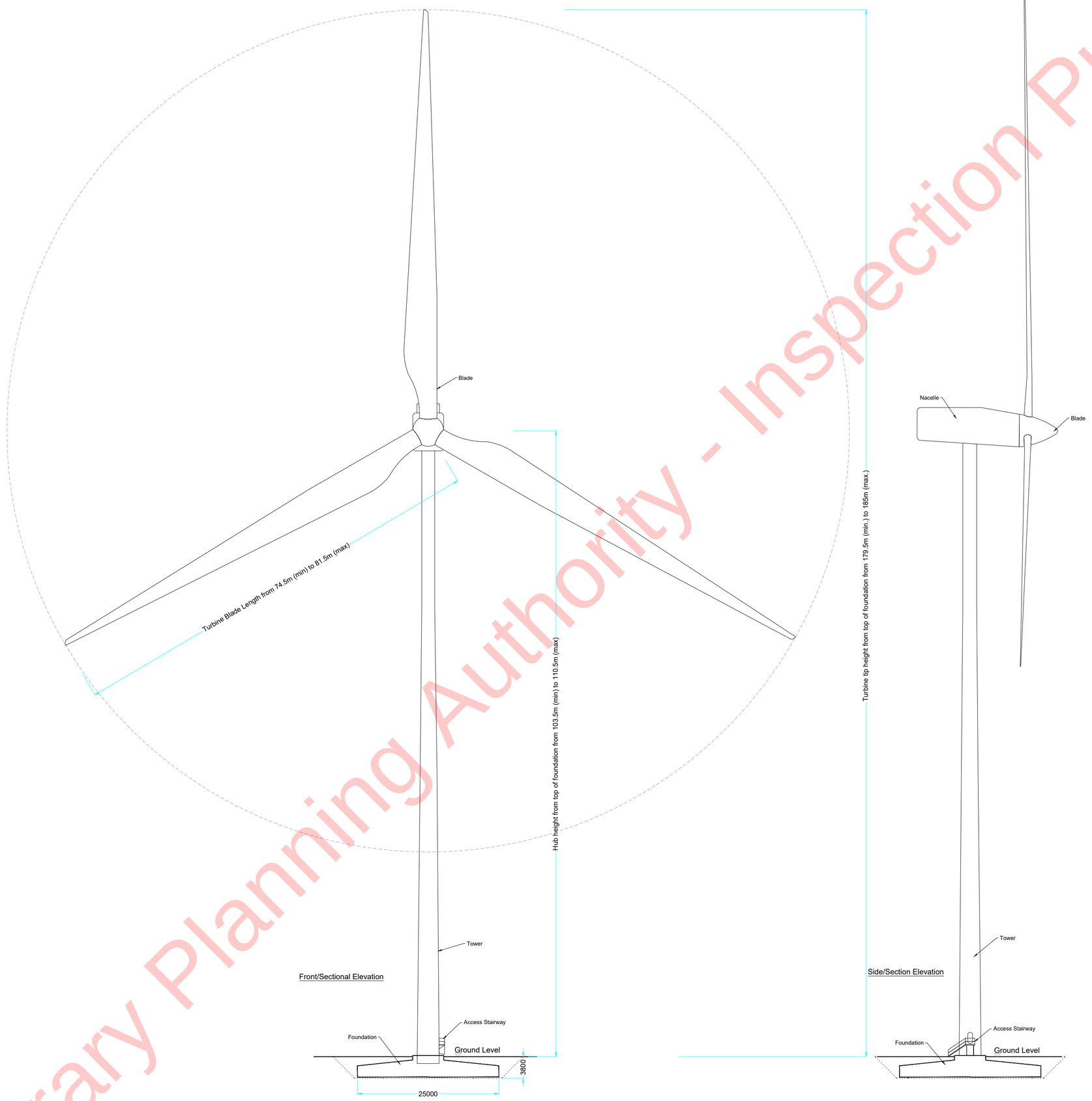
Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics, with only minor cosmetic differences differentiating one from another. The wind turbines that will be installed on the Proposed Development site will be conventional three-blade turbines, that will be geared to ensure the rotors of all turbines rotate in the same direction at all times.

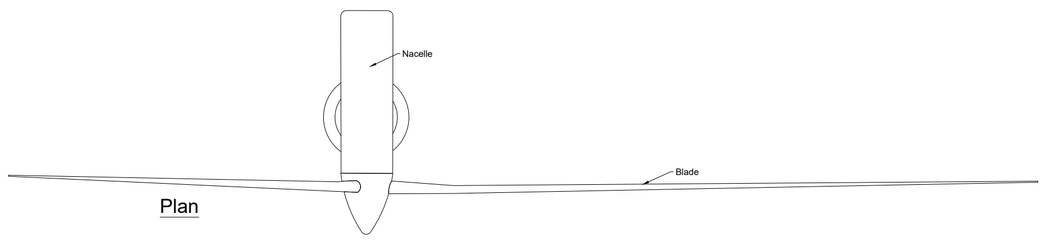
For the purposes of this EIAR, various types and sizes of wind turbines, within the proposed ranges outlined above, have been selected and considered in the relevant sections of the EIAR. This allows for a robust assessment the proposed range of dimensions. Turbine design parameters have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport and ecology (specifically birds), as addressed elsewhere in this EIAR.

It should also be noted that the assessment of the development footprint of the Proposed Development site, within this EIAR, is based on the maximum potential footprint for all of the infrastructural elements. This precautionary approach is taken as the assessment of the maximum development footprint will, in the absence of mitigation measures, give rise to the greatest potential for significant effects. Should the development footprint be less than the maximum, the potential for significant effects will also be reduced.

A drawing of the proposed wind turbine is shown in Figure 4-2. Figure 4-2 also shows the turbine base layout, including turbine foundation, hard standing area, assembly area, access road and surrounding works area.

The individual components of a geared wind turbine nacelle and hub are shown in Figure 4-3 below.





Drawing Notes

1. Proposed wind turbines to have a maximum ground to blade tip height of up to 185m.
2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Ground level represents the top of turbine foundation.

DRAWING TITLE:
Wind Turbine Elevations & Plan

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY: KD	CHECKED BY: EmC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-2
SCALE: 1:500 @A1	DATE: 21.09.2023

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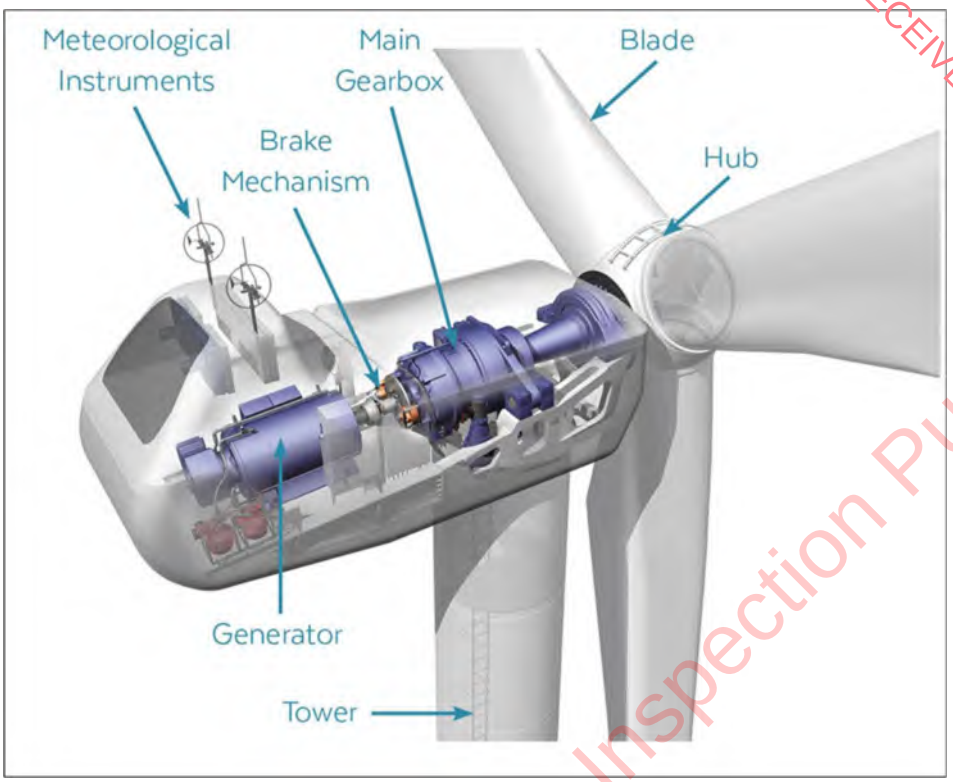


Figure 4-3 Turbine nacelle and hub components

4.3.1.3 Turbine Foundations

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground level. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square, depending on the requirements of the final turbine supplier and a foundation area large enough to accommodate modern turbine models has been assessed in this EIAR. The turbine foundation transmits any load on the wind turbine into the ground. The maximum horizontal and vertical extent of the turbine foundation will be 25m and 4m respectively, which has been assessed in the EIAR and is shown in Figure 4-4.

After the foundation level of each turbine has been formed using piling methods or on competent strata (i.e. bedrock or subsoil of sufficient load bearing capacity), the “Anchor Cage” (anchors the first section of the turbine tower to the foundation) is levelled and reinforcing steel is then built up around and through the anchor cage. The outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill to finished surface level (Plate 4-2 below).

Plate 4-3 Turbine 'Anchor Cage' and finished turbine base

4.3.1.4 Hard Standing Areas

Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base. These will facilitate access, turbine assembly and turbine erection. The hard-standing areas are used to accommodate cranes used in the assembly and erection of the turbine. The hardstands also allow for the offloading and storage of turbine components, and generally provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations, once completed, by placing crushed stone over the foundation. The arrangement and positioning of hard standing areas are dictated by turbine suppliers. Figure 4-4 shows a turbine base layout (Turbine No. 1), including turbine foundation, hard standing area, assembly area, access road and surrounding works area.

The proposed hard standing areas for each individual turbine are shown as part of the detailed layout drawings included in Appendix 4-1 and represent the maximum sizes required. However, the extent of the required areas at each turbine location may be optimised on-site within the parameters set out and assessed in this EIAR. This will depend on the turbine supplier's exact requirements.

4.3.1.5 Assembly Area

Levelled assembly areas will be located on either side of the hard-standing area as shown on Figure 4-4. These assembly areas are required for offloading turbine blades, tower sections and hub from trucks until such time as they are ready to be lifted into position by cranes and to assist the main crane during turbine assembly. The extent of the area required for the assembly areas is shown on Figure 4-4 and the detailed drawing in Appendix 4-1.

4.3.1.6 Power Output

Modern wind turbine generators currently have a typical generating capacity in the 4 to 7 MW range, with the generating capacity continuing to evolve upwards as technology improvements are achieved by the turbine manufacturers. Turbines of the exact same make, model and dimensions can have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. The exact power rating of the installed turbine will be designed to match the wind regime on the Proposed Development site and will be determined by the selected manufacturer.

For the purposes of this EIAR, a rated output of 6.2 MW has been chosen to calculate the power output of the proposed 7-turbine renewable energy development, which would result in an estimated installed capacity of 43.4 MW.

Assuming an installed capacity of 43.4 MW, the Proposed Development therefore has the potential to produce up to 133,064 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 output of the wind turbines: 43.4 MW

The 133,064 MWh of electricity produced by the Proposed Development would be sufficient to supply approximately 31,682 Irish households with electricity per year, based on the average Irish household using 4.2 MWh of electricity[1] (this latest figure is available from the March 2017 CER Review of Typical Consumption Figures Decision Paper).

The 2016 Census of Ireland recorded a total of 59,071 occupied households in Co. Tipperary. Per annum, based on a capacity factor of 35%, the Proposed Development would therefore produce sufficient electricity for the equivalent of over 54% of all households in Co. Tipperary.

With regards to the modern turbine range of 4 – 7MW, the resulting electricity produced would range from 85,848MW to 150,234MW. The lower end of this range (85,848MW) would be sufficient to supply approximately 20,440 Irish households with electricity per year, based on the average Irish household using 4.2MWh of electricity. The higher end of this range (150,234MW) would be sufficient to supply approximately 35,770 Irish households with electricity per year, based on the average Irish household using 4.2MWh of electricity. Based on the 2016 Census of Ireland results for Co. Tipperary, the output range would produce sufficient electricity for the equivalent of 35% and 61% respectively.

4.3.2 Site Roads

4.3.2.1 Road Construction Types

To provide access within the Proposed Development site and to connect the wind turbines and associated, infrastructure, existing roads and tracks will need to be upgraded and new access roads will need to be constructed. The road construction design, as per the Peat and Spoil Management Plan in Appendix 4-2, has taken into account the following key factors:

1. *Constructability;*
2. *Serviceability requirements for construction and wind turbine delivery and maintenance vehicles*
3. *Peat Depth;*
4. *Horizontal longitudinal and cross-fall gradient of the roads;*
5. *Minimisation of excavation arisings;*
6. *The requirement to minimise disruption to peat hydrology;*

Whilst the above key factors are used to determine the road design the actual construction technique employed for a particular length of road will be determined on the prevailing ground conditions encountered along that length of road.

The Proposed Development site makes use of the existing road network insofar as possible. It is proposed to upgrade approximately 4.5 km of existing site roads and tracks, and to construct approximately 1.9 km of new access road on the Proposed Development site. It is proposed to construct passing bays along the proposed access road network.

[1] *March 2017 CER (CRU) Review of Typical Consumption Figures Decision Paper* https://www.cru.ie/document_group/review-of-typical-consumption-figures-decision-paper/

The construction types proposed are as follows:

- Construction of New Roads
  - Founded
  - Floating
- Upgrade of existing access roads
  - Founded
  - Floated

The locations where the above construction types are proposed is shown in Figure 1-1 of Gavin & Doherty Geosolutions (GDG) Peat Management Plan. This document is included as Appendix 4-1 of this EIAR.

Upgrade of Existing Access Roads

The existing access tracks on site were constructed using both excavate and replace and floated construction techniques. Based on site walkovers, the existing access tracks were typically noted as being in relatively good condition. Upgrading works will involve both widening and resurfacing of the existing access track. The construction methodology for upgrading existing sections of excavated and floating roads or tracks is detailed in Section 3.2 of GDG's Peat Management Plan in Appendix 4-2. A section of existing excavated road for upgrade is shown in Figure 4-5. A section through an existing floating road to be upgraded is shown in Figure 4-5.

Construction of New Excavated Roads

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site. Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat (<1.0m) provided sufficient placement/reinstatement capacity is available on site for the excavated peat. The methodology for the construction of new excavated roads is detailed in Section 3.1 of the Peat Management Plan in Appendix 4-2. This methodology includes construction procedures that will minimise any adverse impact on peat stability.

A section of a new excavated road is shown in Figure 4-5.

4.3.2.2 Public Road Widening

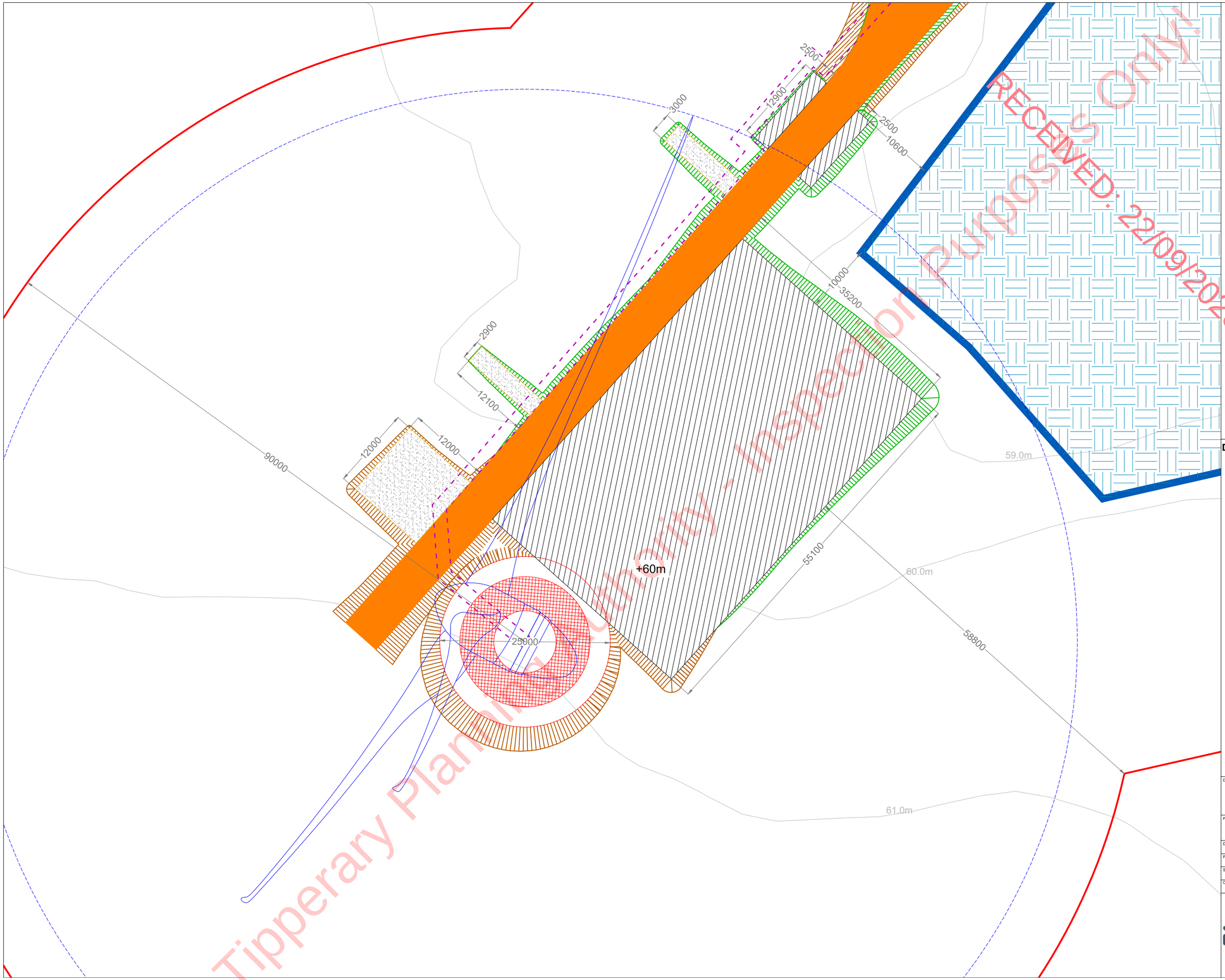
The Proposed Development includes for widening of approximately 460 meters of the L5041 local road situated within the core of the Proposed Development site. The widening works are required to facilitate the construction phase of the project. Specifically, the works will involve widening the existing road corridor to achieve a running width of approximately 5 meters.

In this regard, widening will be undertaken on one side of the road along straight sections. At the existing junction north of Turbine No. 4, widening will occur on both sides of the road.

The process of widening the section alongside the current public road will adhere to the road construction methodologies outlined in Appendix 4-2 of the EIAR.

Upon completion of the construction phase, the public road corridor's boundaries will be reinstated to their original width or to meet the requirements of the Roads Section of the Local Authority.. This restoration process will involve the use of stock-proof fencing or an earthen/granular fill berm where necessary. The widening and boundary reinstatement is illustrated in Figure 4-6.

While no works are proposed to the existing L5041 carriageway, a pre- and post-construction condition survey will be undertaken and upon completion of the construction phase, the surface of the public road carriageway along the 460m section of the L5041 will be reinstated as per the specifications of Tipperary County Council.



Project Design Drawing Notes

1. Drawings issued are for planning application purposes only.
2. Drawings not to be used for construction/contract conditions.
3. Copyright, all rights reserved. No part herewith may be copied or reproduced partially or wholly in any form whatsoever without the prior notice of the copyright owner McCarthy Keville O'Sullivan.
4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
5. All contractors, whether main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary (Tipperary County Council)
- Proposed New Site Road
- Previously Permitted Road
- Soft Levelled Area
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Proposed Internal Cabling Route
- Spoil Repository Area
- Cut
- Fill

N

DRAWING TITLE:
Typical Turbine Hardstanding Area

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY: KD	CHECKED BY: EM/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-4
SCALE: 1:500 @ A3	DATE: 21.09.2023

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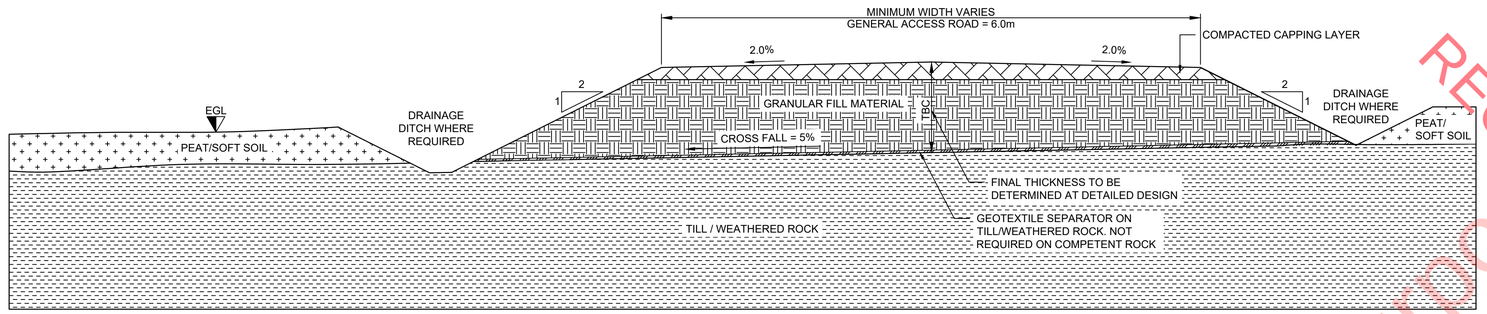
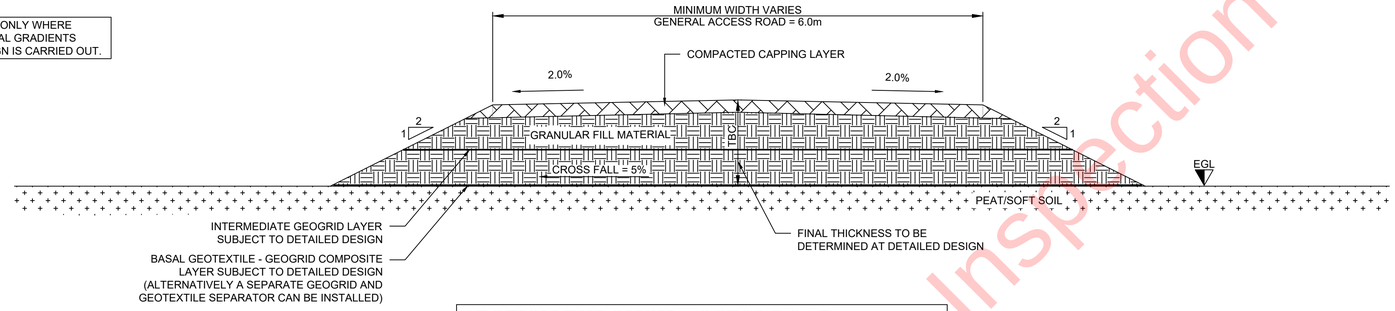


SECTION THROUGH ACCESS ROAD NEW CONSTRUCTION: FOUNDED - DETAIL 01

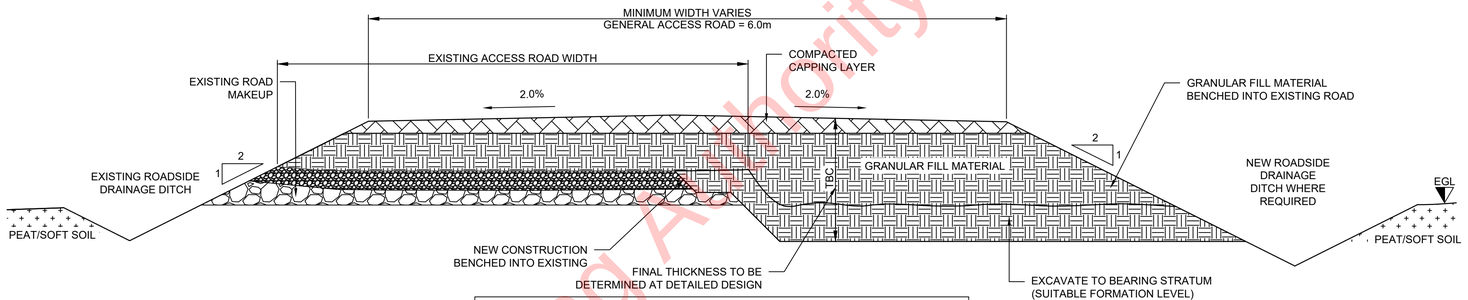
SCALE: 1:25

FLOATING ROADS TO BE CONSTRUCTED ONLY WHERE CROSSFALLS ARE <5% AND LONGITUDINAL GRADIENTS ARE <5% UNLESS A SITE SPECIFIC DESIGN IS CARRIED OUT.



SECTION THROUGH ACCESS ROAD NEW CONSTRUCTION: FLOATED - DETAIL 02

SCALE: 1:25



SECTION THROUGH WIDENING OF EXISTING ACCESS ROAD: FOUNDED - DETAIL 03

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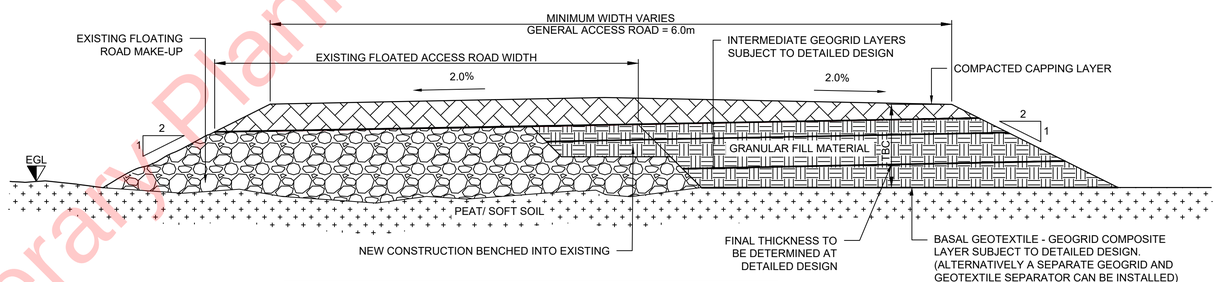

SECTION THROUGH WIDENING OF EXISTING ACCESS ROAD: FLOATED - DETAIL 04

SCALE: 1:25

NOTES:

1. THIS DRAWING IS FOR PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT PURPOSES AND SHOULD NOT BE USED AS DETAILED DESIGN OR FOR CONSTRUCTION.
2. DO NOT SCALE FROM DRAWINGS.
3. THE STRENGTH OF THE SUBFORMATION SOILS TO BE ASSESSED BY A SUITABLY QUALIFIED GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION / PLACEMENT OF FILL.
4. DRAINAGE TO BE PROVIDED TO PREVENT WATER DEGRADATION OF THE SUBFORMATION SOILS IN-LINE WITH DRAINAGE STRATEGY.

HEALTH & SAFETY:

1. NO OPERATIVES TO ACCESS ANY UNSUPPORTED TRENCHES. TRENCHES TO BE ADEQUATELY BATTERED BACK OR SUPPORTED WHERE NECESSARY. SAFE TEMPORARY BATTER ANGLES TO BE ASSESSED IN ACCORDANCE WITH CIRIA REPORT 97 "TRENCHING PRACTICE".

REV:	S2-P02	DATE:	17/08/23	DRAWN BY:	JMG	CHECKED BY:	C.E.
DESCRIPTION:	UPDATED TO ADDRESS MKO COMMENTS						
REV:	S2-P01	DATE:	30/05/23	DRAWN BY:	EFC	CHECKED BY:	CE
DESCRIPTION:	ISSUED FOR INFORMATION						

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www.gdgeo.com

ISSUED AS: FOR INFORMATION

CLIENT: MKO

PROJECT TITLE: CARRIG RENEWABLES WIND FARM

DRAWING No: 4-5 - - - - - -

Revision: -S2-P02

DRAWING TITLE: ACCESS ROAD STANDARD DETAILS

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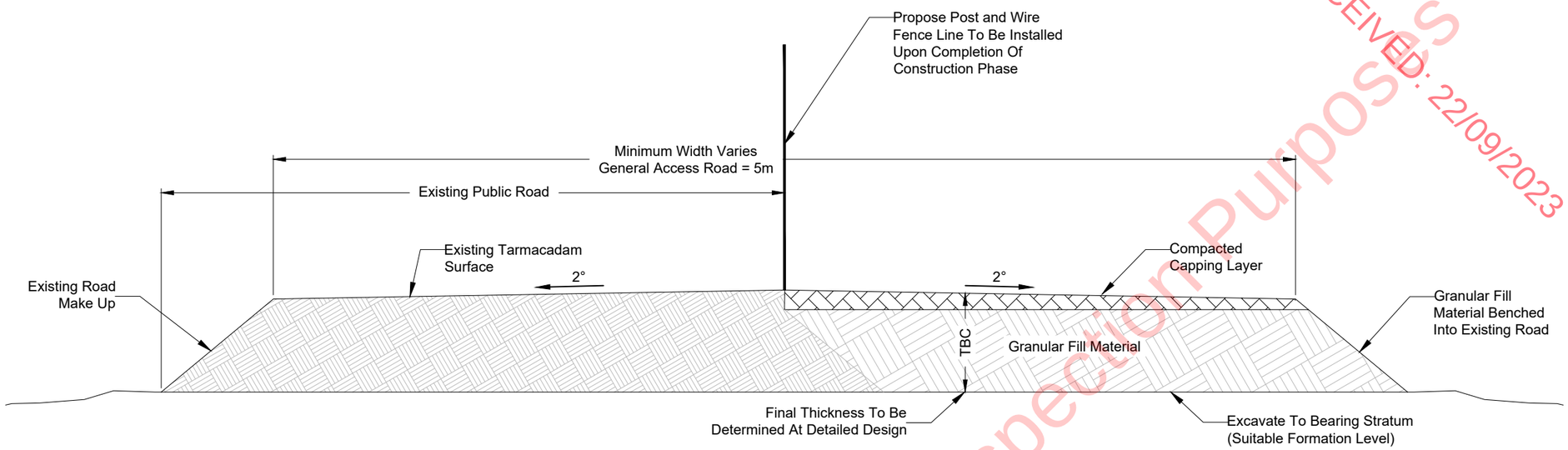
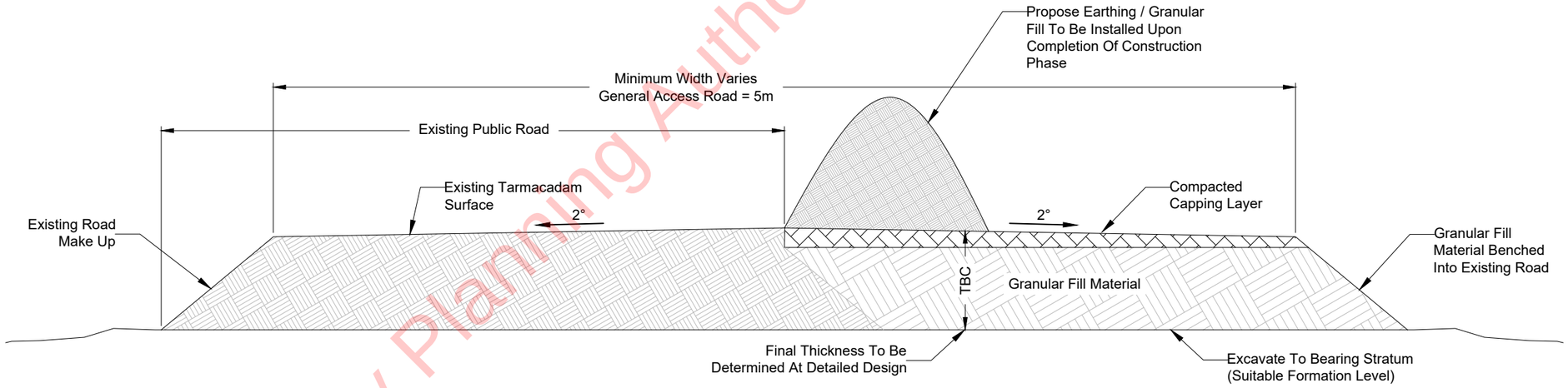
DRAWN BY:	EFC	CHECKED BY:	C.E.	APPROVED BY:	J.O'D

Drawing Notes

1. Widening can occur to either side of existing roads dependent on site conditions.
2. Depths of road fill to vary dependent on site conditions.



Cross Section Widening of Existing Public Road
Post and Wire Fence to Reinstate Boundary



Cross Section Widening of Existing Public Road
Earthing / Granular Fill to Reinstate Boundary

DRAWING TITLE:
Public Road Widening and Barrier Reinstatement Details

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-6
SCALE: 1:20 @ A3	DATE: 21.09.2023

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4.3.3 Site Underground Electrical (33kV) and Communications Cabling

Each turbine will be connected to the on-site electricity substation via underground 33 kV (kilovolt) electricity cabling. Fibre-optic cables will also connect each wind turbine and the met mast to the onsite substation. The electricity and fibre-optic cabling connecting to the onsite substation compound will be run in cable ducts approximately 1.2 metres beneath ground level, along the sides of roadways or under the roadways. The route of the cable ducts will follow the access track to each turbine location and are illustrated on the site layout drawings included as Appendix 4-1, the exact number and configuration of cable ducting may vary within the cabling trench. Figure 4-7 below shows two variations of a typical cable trench, one for off-road trenches and one for on-road trenches. The cabling may be placed on either side of the roads, on both sides of the road or within the road. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

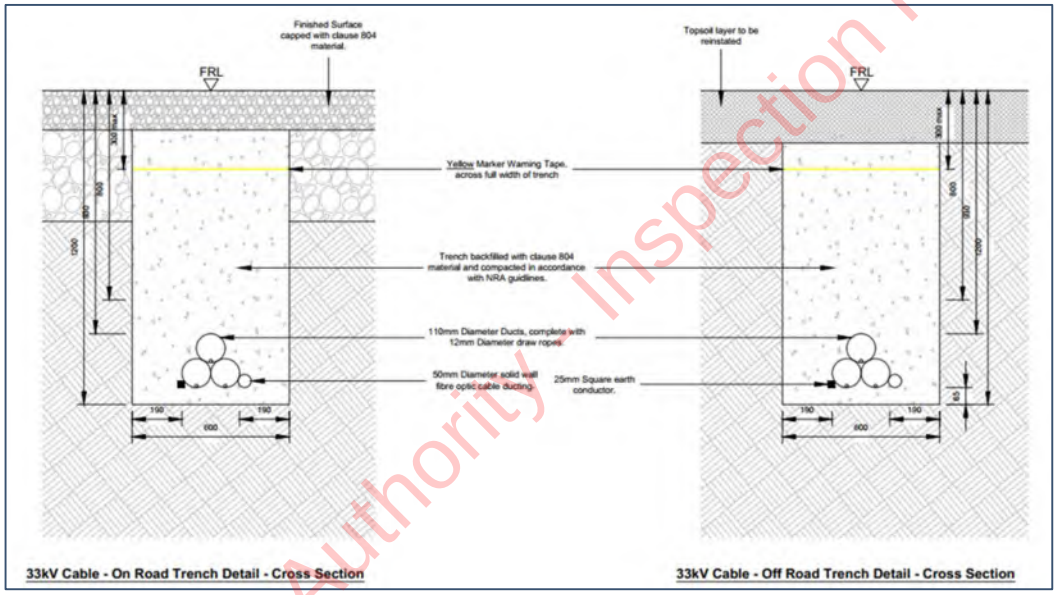
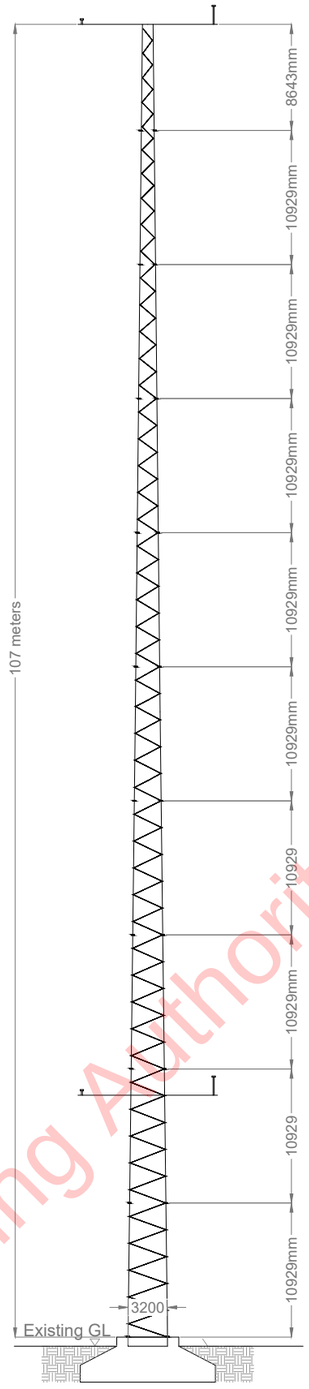


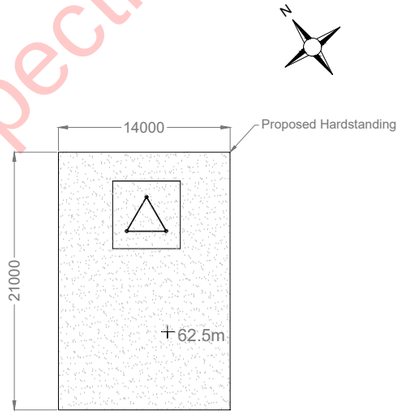
Figure 4-7 Cable trench cross section detail

Clay plugs (water flow barrier) will be installed at regular intervals of not greater than 50 metres along the length of the trenches where required to prevent the trenches becoming conduits for runoff water. Backfill material will be compacted in layers with approved engineer's specified material, which may be imported onto the Proposed Development site should sufficient volumes of suitable material not be encountered during the excavation phase of the proposed infrastructure.

4.3.4 Meteorological Mast

One meteorological (met) mast is proposed as part of the Proposed Development site. The met mast will be equipped with wind monitoring equipment at various heights. The proposed met mast will be located at E598433, N701165 (ITM) as shown on the Proposed Development site layout drawing in Figure 4-2. The mast will be a free-standing slender lattice structure 107 metres in height. The mast will be constructed on a hard-standing area sufficiently large enough to accommodate the equipment that will be used to erect the mast. The proposed meteorological mast is shown in Figure 4-8.





Met Mast Compound Plan

DRAWING TITLE:
Proposed Metrological Mast

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-8
SCALE: 1:500 @ A3	DATE: 21.09.2023

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4.3.5 Temporary Construction Compounds

Two temporary construction compounds, both measuring approximately 1,265 square metres in area will be located within the Proposed Development site. The primary construction compound will be located adjacent to the existing road leading to Turbines No. 6 and No. 7 and the secondary construction compound will be located adjacent to the hardstand of Turbine No. 3.

The locations of the proposed construction compounds are shown on the Proposed Development site layout drawing in Figure 4-1b. The layouts of the construction compounds are shown on Figure 4-9 and Figure 4-10.

The construction compounds will consist of temporary site offices, staff facilities, construction materials storage and car-parking areas for staff and visitors. Turbine components will be brought directly to the proposed turbine locations following their delivery to the site.

Temporary toilets, located within staff portacabins, will be used during the construction phase. Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by a permitted waste collector to wastewater treatment plants.

Once the proposed wind farm has been commissioned both compounds will be removed. These areas will be reinstated with previously excavated peat and spoil and either be reseeded or left to revegetate naturally.

4.3.6 Grid Connection

4.3.6.1 Onsite 38 kV Substation

It is proposed to construct a 38kV electricity substation within the Proposed Development site, as shown in Figure 4-1a and Figure 4-1b. The proposed onsite 38kVsubstation is located within commercial forestry plantation and will be accessed via a proposed new wind farm site road of the L5041 local road the internal Proposed Development site proposed road network.

The footprint of the proposed onsite 38kVsubstation compound measures approximately 3,121.7 square metres in area and will include 1 no. control buildings and the electrical substation components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the onsite 38kV substation to the national grid. The layouts and elevations of the proposed onsite 38kVsubstation are shown on Figure 4-11 and 4-12. The construction and exact layout of electrical equipment within the onsite 38kVsubstation will be to EirGrid / ESB Networks specifications.

Further details regarding the connection between the onsite 38kVsubstation compound and the national electricity grid are provided in Section 4.3.2.4 below.

The onsite 38kVsubstation compound will include steel palisade fencing (approximately 2.5metre high or as otherwise required by ESB), and internal fences will also segregate different areas within the main substation.

4.3.6.2 Wind Farm Control Building

The wind farm control building will be located within the substation compound and will measure 21.5 metres by 7.3 metres and six metres in height. Layout and elevation drawings of the control building are included in Figure 4-13. The wind farm control building will include staff welfare facilities for the staff that will work on the Proposed Development during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the Proposed Development there will be a very small water requirement for occasional toilet flushing

and hand washing and therefore the water requirement of the Proposed Development does not necessitate a potable source. It is proposed to either harvest rainwater from the roofs of the buildings or, alternatively, install a groundwater well adjacent to the substation in accordance with the Institute of Geologists Ireland, *Guide for Drilling Wells for Private Water Supplies* (IGI, 2007). The well will be flush to the ground and covered with a standard manhole. A pump house is not required as an in-well pump will direct water to a water tank within the roof space of the control building. Bottled water will be supplied for drinking, if required.

It is not proposed to treat wastewater on site. Wastewater from the staff welfare facilities in the control building will be managed by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants.

Such a proposal for managing the wastewater arising on site has become almost standard practice on Proposed Development sites, which are often proposed in areas where finding the necessary percolation requirements for on-site treatment would be challenging and has been accepted by numerous Planning Authorities and An Bord Pleanála as an acceptable proposal.

The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. Full details of the proposed tank alarm system can be submitted to the Planning Authority in advance of any works commencing on-site. The wastewater storage tank alarm will be part of a continuous stream of data from the Proposed Development site's turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007(as amended), will be employed to transport wastewater away from the Proposed Development site.

4.3.6.3 Battery Storage

A battery-based energy storage system (BESS) will adjoin the 38kV substation compound. The BESS primarily consists of 4 no. steel containers assembled in rows at the development site.

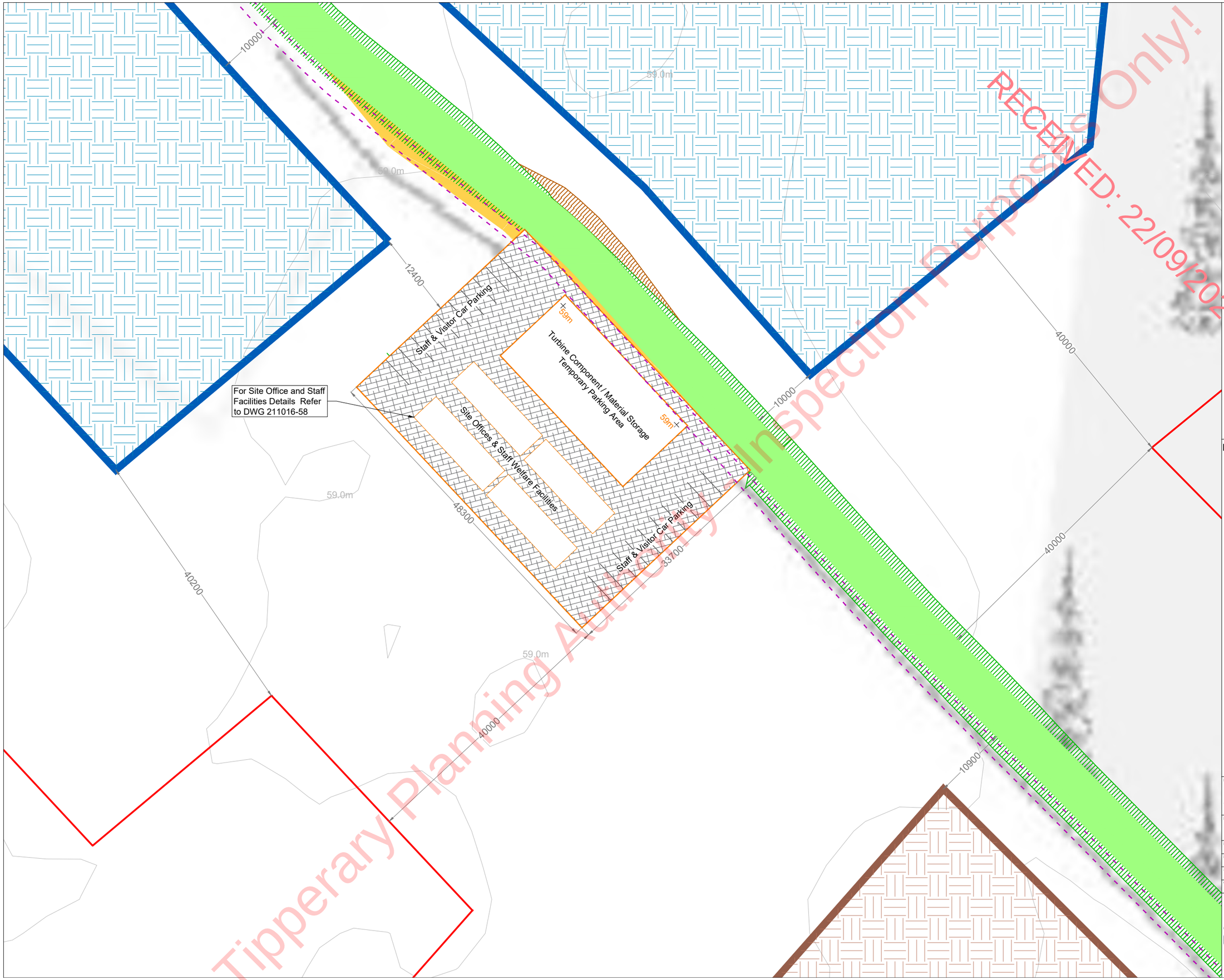
Prior to installing the steel containers, clearance of the site area, levelling of the ground surface and creation of a hard stand will be undertaken. These containers and the adjacent infrastructure house the batteries, inverters, transformers, fire suppression equipment and associated electrical components. The containers will be mounted onto concrete plinth foundations. The containers shall be spaced to allow airflow around the containers, feeding their climate control systems.

In addition to the modular steel containers, other components of the development include:

- A grid transformer within the electrical compound;
- Above ground cable junction boxes/ cabling cabinets and cable racks/steel trunking facilitating the necessary electrical connections between containers;
- Underground ducting and cabling;
- A security fence around the perimeter of the proposed development;
- Communications equipment; and,
- Lightning protection poles.

The battery storage compound will operate continuously, linked to the on-site substation. It will be monitored in tandem with the overall development and there will be sporadic maintenance visits as required.

The BESS containers are shown in Figure 4-14.



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7. Layout plans show Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary (Tipperary County Council)
- Previously Permitted Road
- Proposed Internal Cabling Route
- Peat Repository Area
- Spoil Repository Area
- Cut
- Fill

N

DRAWING TITLE:
Proposed Temporary Construction Compound no.1

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EM/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-9
SCALE: 1:500 @ A3	DATE: 21.09.2023

OS SHEET No.: 3698,3699,3700,3701,3702,3756,3757,3578,3759,3760,3814, 3815,3816,3817,3818,3872,3873,3874,3875,3876,3929,3930,3931,3932,3933

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7. Layout plans show Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

+59m

58.0m

59.0m

8000

9500

10500

48300

33800

36800

40000

46800

40000

Staff & Visitor Car Parking

Turbine Component / Material Storage
Temporary Parking Area

59m

Site Offices & Staff Welfare Facilities

Staff & Visitor Car Parking

For Site Office and Staff Facilities Details Refer to DWG 211016-58

Drawing Legend

- Planning Application Boundary (Tipperary County Council)
- Previously Permitted Road
- Proposed Internal Cabling Route
- Peat Repository Area
- Cut
- Fill

N

DRAWING TITLE:
Proposed Temporary Construction Compound no.2

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EM/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-10
SCALE: 1:500 @ A3	DATE: 21.09.2023

OS SHEET No.: 3698,3699,3700,3701,3702,3756,3757,3578,3759,3760,3814, 3815,3816,3817,3818,3872,3873,3874,3875,3876,3929,3930,3931,3932,3933

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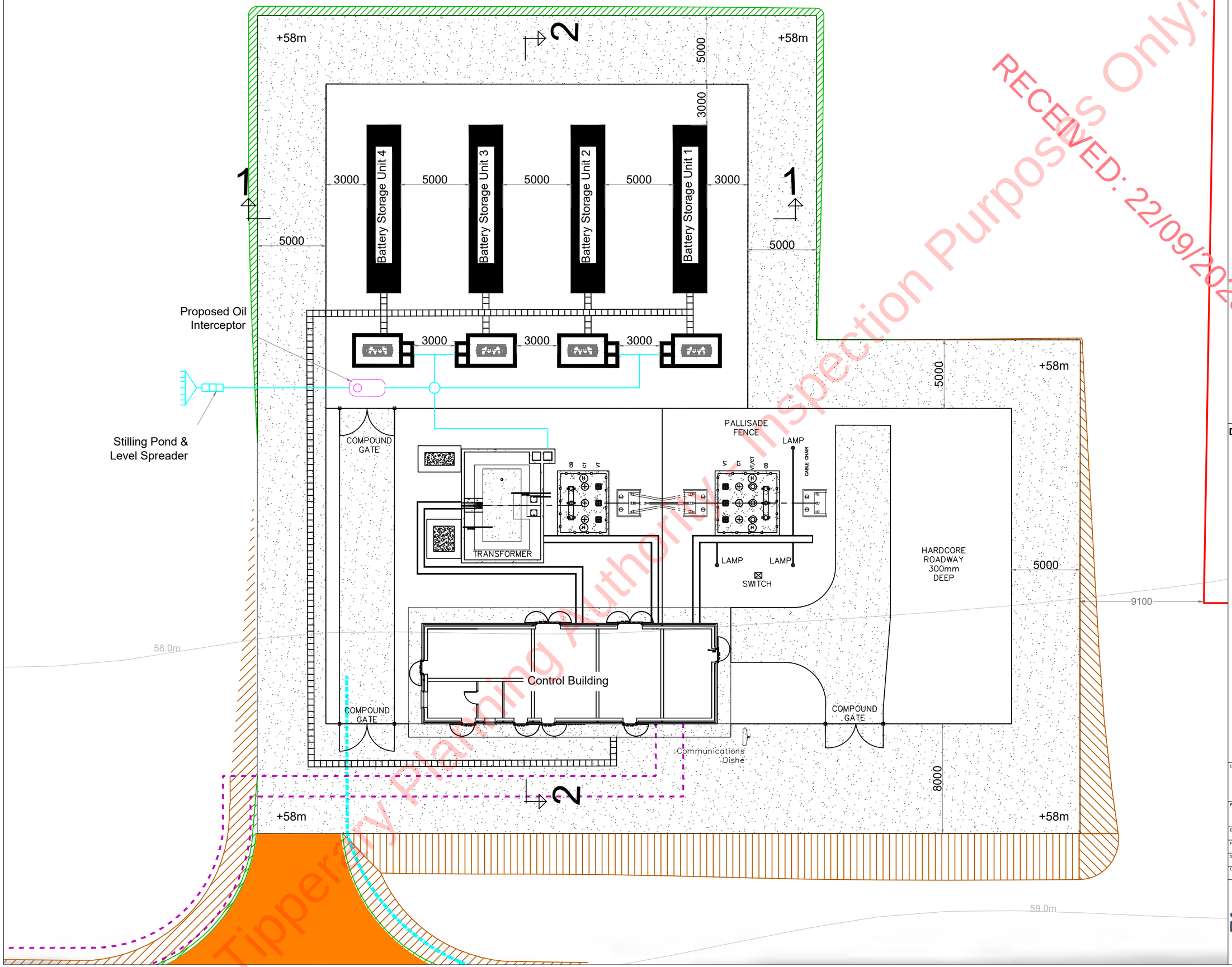

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7. Layout plans show Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary (Tipperary County Council)
- Proposed New Site Road
- Proposed Internal Cabling Route
- Proposed 38kV Underground Grid Connection Cabling Route
- Cut
- Fill

N

DRAWING TITLE:
Proposed Onsite 38kV Substation Layout

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EM/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-11
SCALE: 1:250 @ A3	DATE: 21.09.2023

OS SHEET No.: 3698,3699,3700,3701,3702,3756,3757,3758,3759,3760,3814, 3815,3816,3817,3818,3872,3873,3874,3875,3876,3929,3930,3931,3932,3933

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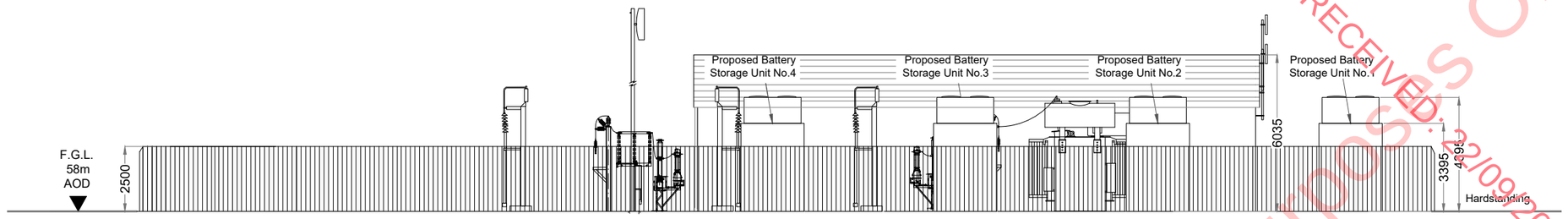
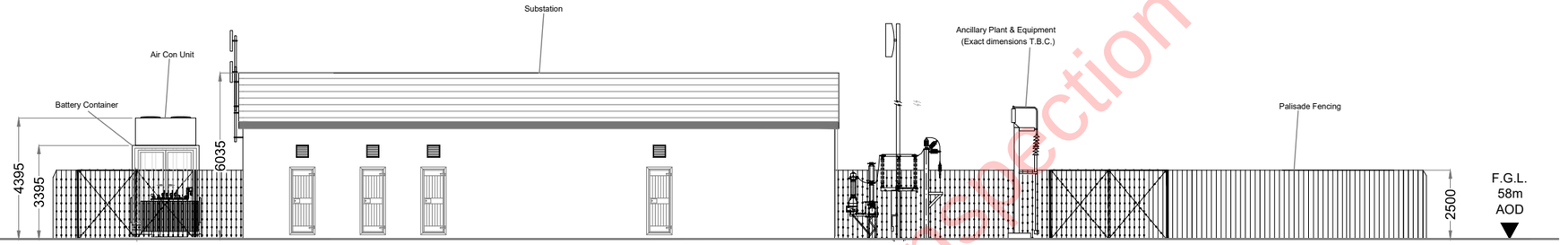
Drawing Notes

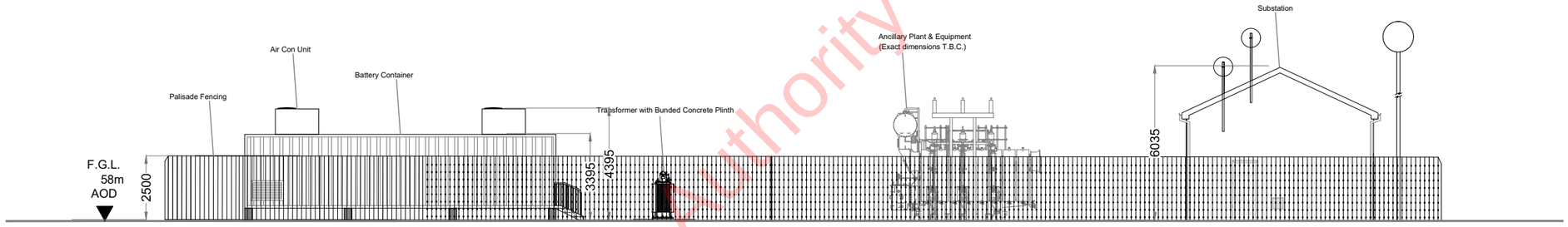
1. Layout and arrangements of substation buildings and electrical equipment is shown indicatively and for illustration purposes only as final specifications of buildings and electrical equipment is to be dictated by Eirgrid/ESB networks requirements.



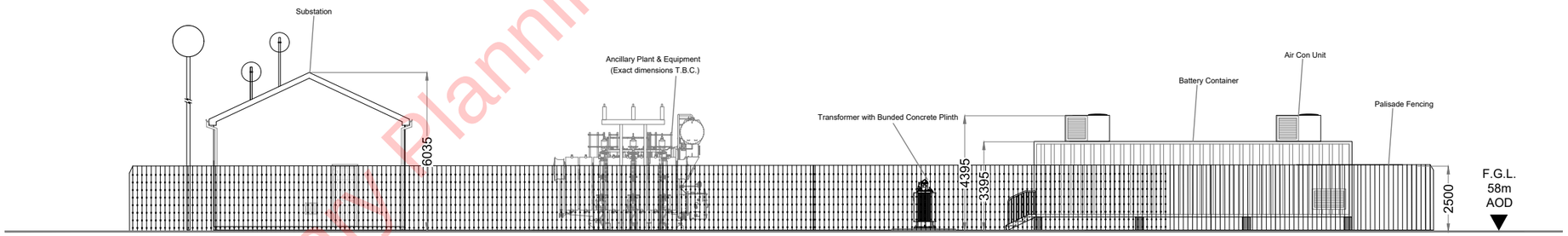
Eastern Elevation



Western Elevation



Northern Elevation



Southern Elevation

DRAWING TITLE:
Proposed Onsite 38kV Substation Elevations

PROJECT TITLE: **Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly**	
DRAWING BY: **KD**	CHECKED BY: **EMC/JW**
PROJECT No.: **211016**	DRAWING No.: **Figure 4-12**
SCALE: **1:200 @ A3**	DATE: **21.09.2023**

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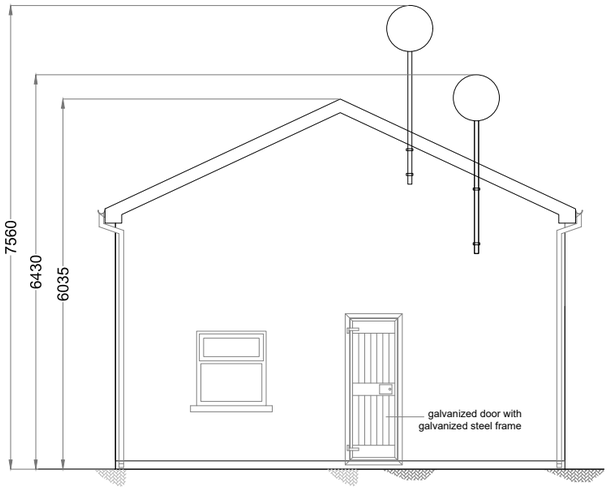

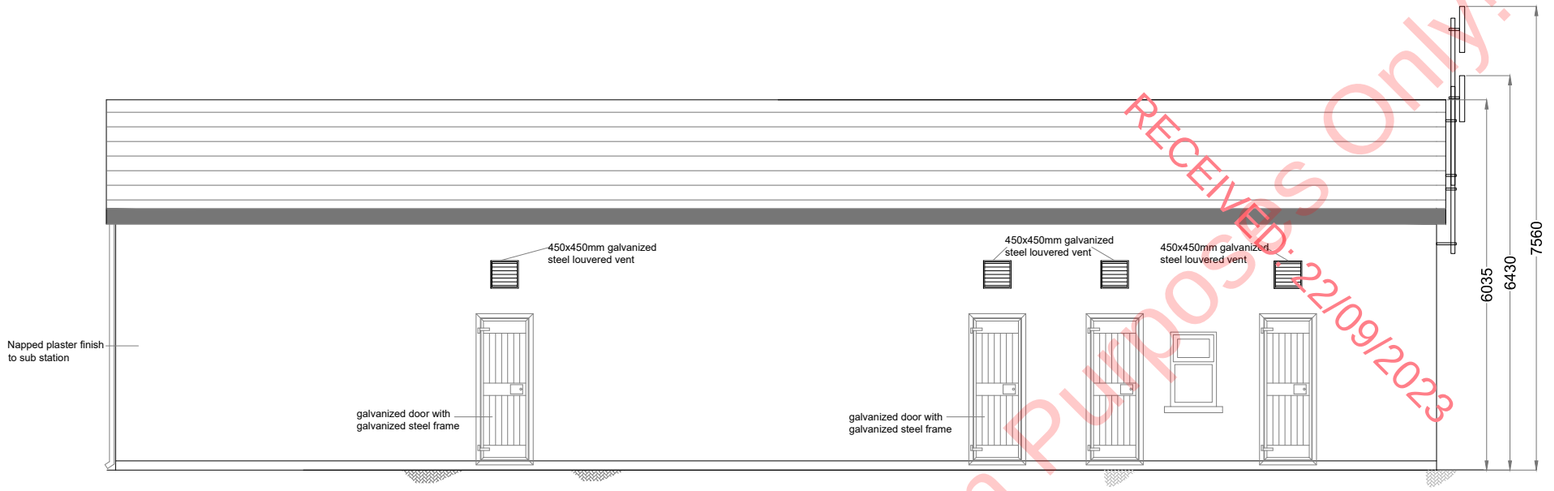

Drawing Notes

1. Layout and arrangements of substation buildings and electrical equipment is shown indicatively and for illustration purposes only as final specifications of buildings and electrical equipment is to be dictated by Eirgrid/ESB networks requirements.

DRAWING TITLE:
Proposed Wind Farm Control Building Layout +Elevations

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-13
SCALE: 1:100 @ A3	DATE: 21.09.2023

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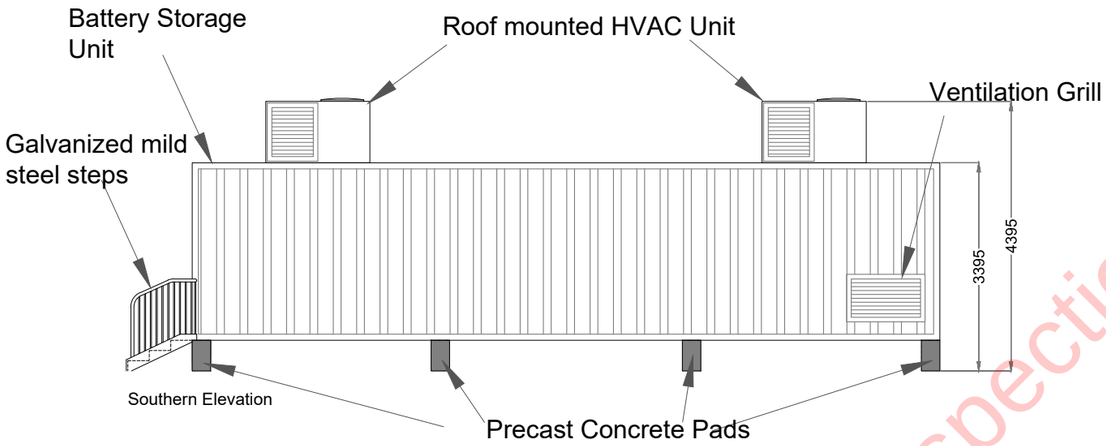
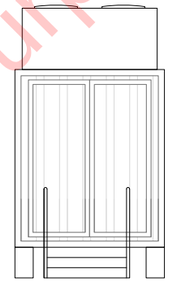
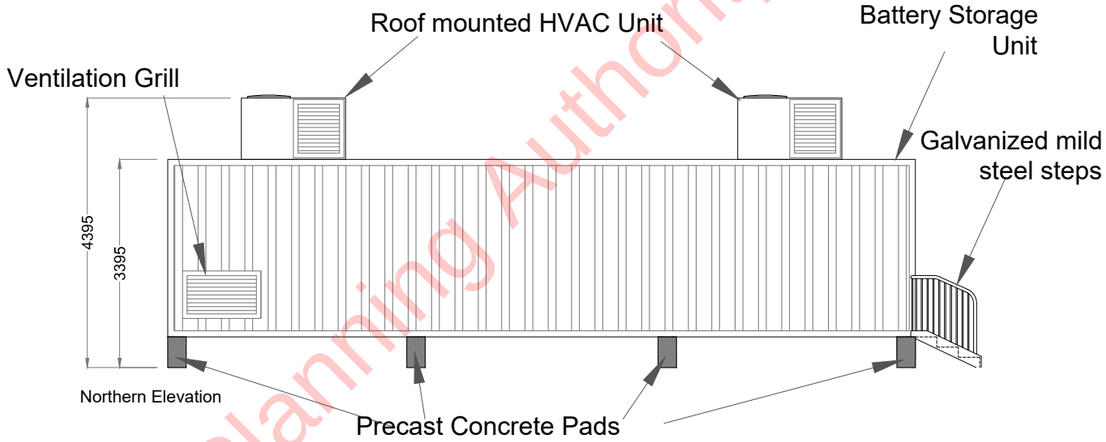


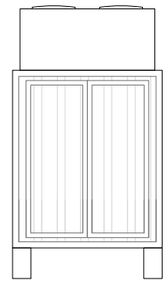
Southern Elevation



Western Elevation



Northern Elevation



Eastern Elevation

DRAWING TITLE:
BESS Containers Layout

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-14
SCALE: 1:100 @ A3	DATE: 21.09.2023

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4.3.6.4 Underground Grid Connection Cabling Route

A 38kV connection between the Proposed Development and the national electricity grid will be necessary to export electricity from the proposed wind farm. It is proposed to connect the Proposed Development to the national electricity grid via a 38kV underground electrical cable connection to the existing 110 kV Dallow substation, in the townland of Clondallow near Birr, Co. Offaly. The underground electrical cabling route is approximately 13.7km in length to Dallow of which approximately 9.3km is located primarily within the curtilage of the public road network. As part of the detailed design process, every effort has been made to locate the grid connection cabling trench off the existing road carriageway and within the hard shoulder or soft margin/grass verges. Approximately 32% of the underground electrical cabling route is proposed to be located in the hard shoulder or soft margin/grass verges within the public road corridor.

The exact location of the grid connection cabling within the curtilage of the public road network may be subject minor modification following confirmatory site investigations, to be undertaken prior to construction of the proposed wind farm development.

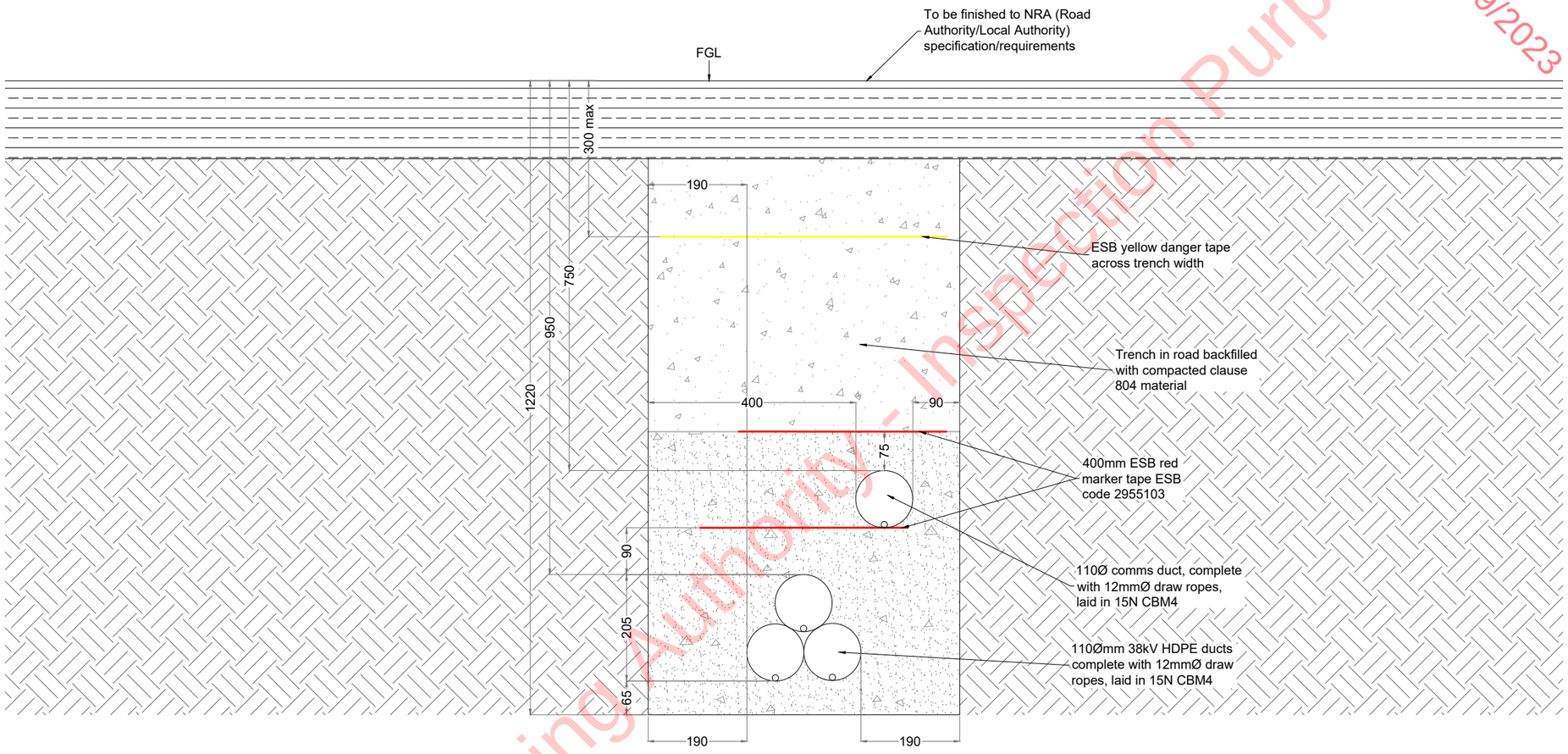
Co. Tipperary

The underground electrical cabling route will originate at the proposed onsite substation and run southeast for 0.2km along the L5041 Local Road. The underground electrical cabling route joins the N52 National road heading northeast through the village of Carrig and continues along the N52 for 2.6km. The cable turns onto the L9520 and runs along this road for approximately 420m. The cable north onto the L1071 and continues northwards for 1.3km where it rejoins the N52. The cable travels along the N52 for 230m before turning northwest and travelling along the R489 Regional Road for approximately 1.2km. At Killeen National School, the cable route heads north on the L5045. At the northern end of the L5045, the route turns east onto the L1077 in the townland of Croghan, where it crosses over the Little Bronsa River and into Co. Offaly. The total length of the grid connection route located in Co. Tipperary measures approximately 10.4km.

Co. Offaly

The cable travels along the L1077, within Co. Offaly, for 360m. At the eastern end of the L1077 in the townland of Townparks, the cable continues north onto the R439 for approximately 2.4km. In the townland of Clondallow, the cable continues west onto the L70152 for approximately 600m where it enters the Dallow substation property and continues onto the access road leading to the 110kV Dallow substation. A planning application will be made to Offaly County Council in respect of this 3.3km section of the grid connection which is located in the county.

The proposed underground grid connection cabling route is shown in Figure 4-1a and a cross section of the grid connection cabling trench is shown in Figure 4-15. The detailed alignment of the grid connection cabling route is shown in Appendix 4-1. It should be noted that any electrical works required within the Dallow substation in order to facilitate the connection go the Proposed Development will occur within the existing substation compound and, therefore, will not lead to any additional environmental effects.



Trench Layout Single Circuit (4-way) Trefoil

DRAWING TITLE:
Cable Trench Cross Section

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-15
SCALE: 1:10 @ A3	DATE: 21.09.2023

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4.3.7 Peat and Spoil Management Plan

4.3.7.1 Quantities

The construction of the Proposed Development will require the excavation of peat and spoil. The quantities of peat and spoil, requiring management on the site of the Proposed Development has been calculated, as presented in Table 4-2 below. These quantities were calculated by GDG as part of the *Peat Management Plan* in Appendix 4-2 of this EIAR.

Table 4-2 Peat and Spoil Volumes requiring management

Development Component	Area (m2) (approx.)	Peat Volume (m^3) (approx.)	Spoil Volume(m^3) (approx.)
New Access Roads (founded)	18,800	21,680	0
Upgraded Access Road (founded)	6,000		
Turbine Foundations	3,500	13,810	8,500
Crane Hardstandings	15,500	33,700	13,160
Substation	3,100	0	1,410
Construction Compounds	2,532	3,520	0
Met Mast	300	0	2,780
Total Volumes to be managed		72,710	25,850

Tree felling is proposed at various locations across the Proposed Development; however this will not involve the excavation of tree stumps, outside of the footprint of the Proposed Development, and as such does not affect the excavation volumes. Where tree stumps are removed along proposed access roads, the excavation volume has been included in the above table.

4.3.7.2 Peat and Spoil Management Areas

It is proposed to manage any excess overburden generated through construction activities within the Proposed Development site, in 4 no. peat repository areas and 3 no. spoil repository, as shown in Figure 4-1b, and in linear berms along access roads where appropriate, as detailed in Section 4.3.2.1. The total capacity of the peat repository areas within the Proposed Development is 61,010m^3 and the total capacity of spoil repository areas within the Proposed Development site is 24,740m^3. As stated in the Peat and Spoil Management Plan (Appendix 4-2), a conservative reinstatement volume of 20% (13,590m^3) of the total peat excavation has been considered available for side casting, reinstatement and re-use across the Proposed Development site. A conservative estimate of 10% (2,120m^3) of the total spoil volumes has been considered as available for re-use in the construction of safety berms across the Proposed Development site. This provides enough capacity for the total volume of peat and spoil requiring management for the Proposed Development as detailed in Table 4-2 above.

The following, outlined in the Peat and Spoil Management Plan in Appendix 4-2, particular recommendations/best practice guidelines for the placement of peat with respect to specific aspects of the wind farm will be considered and taken into account during construction.

Access Roads, Hardstands and Other Infrastructure

- Controlled quantities of peat and spoil shall be side-cast adjacent to access roads and other infrastructure, for the purposes of landscaping/reinstatement only where it can be placed in a stable formation, i.e., where the topography and ground conditions allow.
- Side cast peat material shall consist of the acrotelm (upper layer) only, and it shall be landscaped and shaped to aid in the reinstatement of the construction into the surrounding environment.
- Peat and spoil shall only be cast to safe heights and slope angles, considering the topography and the ground conditions. This height shall be no more than 1m, and the slopes shall be not greater than 1 (V): 3 or 4 (H) unless a site-specific assessment during detailed design indicates a greater height and angle is safe.
- The effect of drainage or water runoff shall be considered when placing landscaping rising adjacent to access roads. Landscaping material shall not interfere with drainage, risk blocking of drainage systems or runoff into drainage systems.

Peat Repository Areas

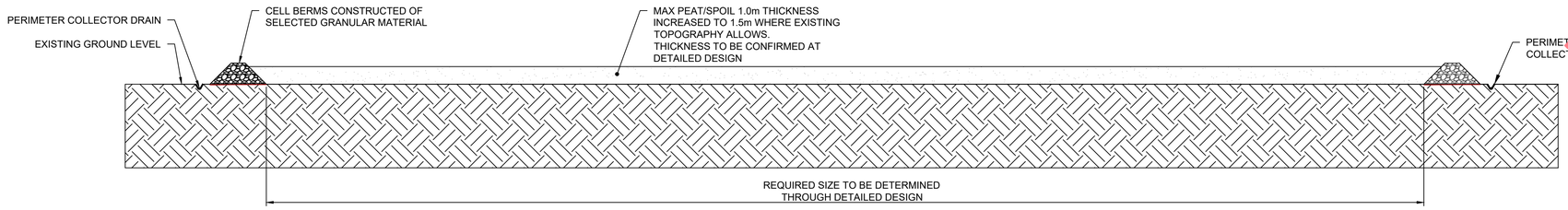
- Peat Repository areas have been identified at locations where the topography (slope angle <5°), peat depth, resulting stability assessment (Factor of Safety of >1.3 for 1.5m peat surcharge, as shown Figure A-4- 1 to Figure A-4- 2 in Appendix A.4) and other environmental constraints (including 50m buffer from all watercourses) have allowed. These areas are designated for the permanent storage of up to 1m of peat material, or where topography allows, up to a maximum of 1.5m.
- A cell berm should be constructed similarly to the peat repository area detail outlined in Appendix C of the Peat and Spoil Management Plan (Appendix 4-2). This cell berm will help to prevent the flow of saturated peat material. The stone berm will be constructed with a sufficiently coarse granular material or rock to enable the drainage of the stored peat material and prevent any instabilities within the storage area.
- The height of the cell berm constructed should be greater than the height of the placed peat & spoil to prevent any surface peat runoff. Berms up to 1.75m in height may likely be required, subject to detailed design.
- The cell berm is subject to the detail designer's specification; however, some peat excavation or installation of a shear key may be required to prevent global instabilities within the stored material.
- Where possible, the surface of the placed peat and spoil should be shaped to allow efficient runoff of surface water from the peat repository areas.
- Silting ponds may be required at the lower side/outfall location of the storage areas.
- Intermediate berms or buttresses of spoil material may be installed within the peat repository area to aid in the placement and stability of the peat material. These berms should be shaped to align with the contours of the storage area.

Spoil Repository Areas

- Spoil Repository areas have been identified at locations where the topography (slope angle <5°), peat depth, resulting stability assessment (Factor of Safety of >1.3 for 1.5m peat surcharge) and other environmental constraints (including 50m buffer from all watercourses) have allowed. These areas are designated for permanently storing up to 1.5m of non-peat spoil material.

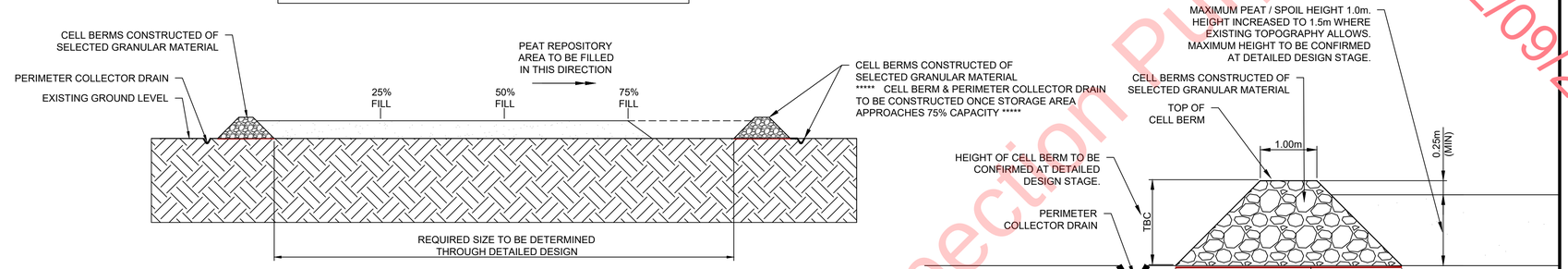
- A cell berm should be constructed similarly to the peat repository area detail outlined in Appendix C of the Peat and Spoil Management Plan (Appendix 4-2). This cell berm will help to prevent the flow of saturated peat material. The stone berm will be constructed with a sufficiently coarse granular material or rock to enable the drainage of the stored peat material and prevent any instabilities within the storage area.
- The height of the cell berm constructed should be greater than the height of the spoil to prevent any surface spoil runoff. Berms up to 1.75m in height may likely be required, subject to detailed design.
- The cell berm is subject to the detail designer's specification; however, some peat excavation or installation of a shear key may be required to prevent global instabilities within the stored material.
- Where possible, the surface of the placed peat and spoil should be shaped to allow efficient runoff of surface water from the peat repository areas.
- Silting ponds may be required at the lower side/outfall location of the storage areas.
- Intermediate berms or buttresses of granular material may be installed within the Spoil Repository area to aid in the placement and stability of the spoil material. These berms should be shaped to align with the contours of the storage area.

The plan view of the peat and spoil repository areas within the Proposed Development site are shown in Figure 4-16.



PEAT/SPOIL REPOSITORY- SECTION A-A

SCALE: 1:200

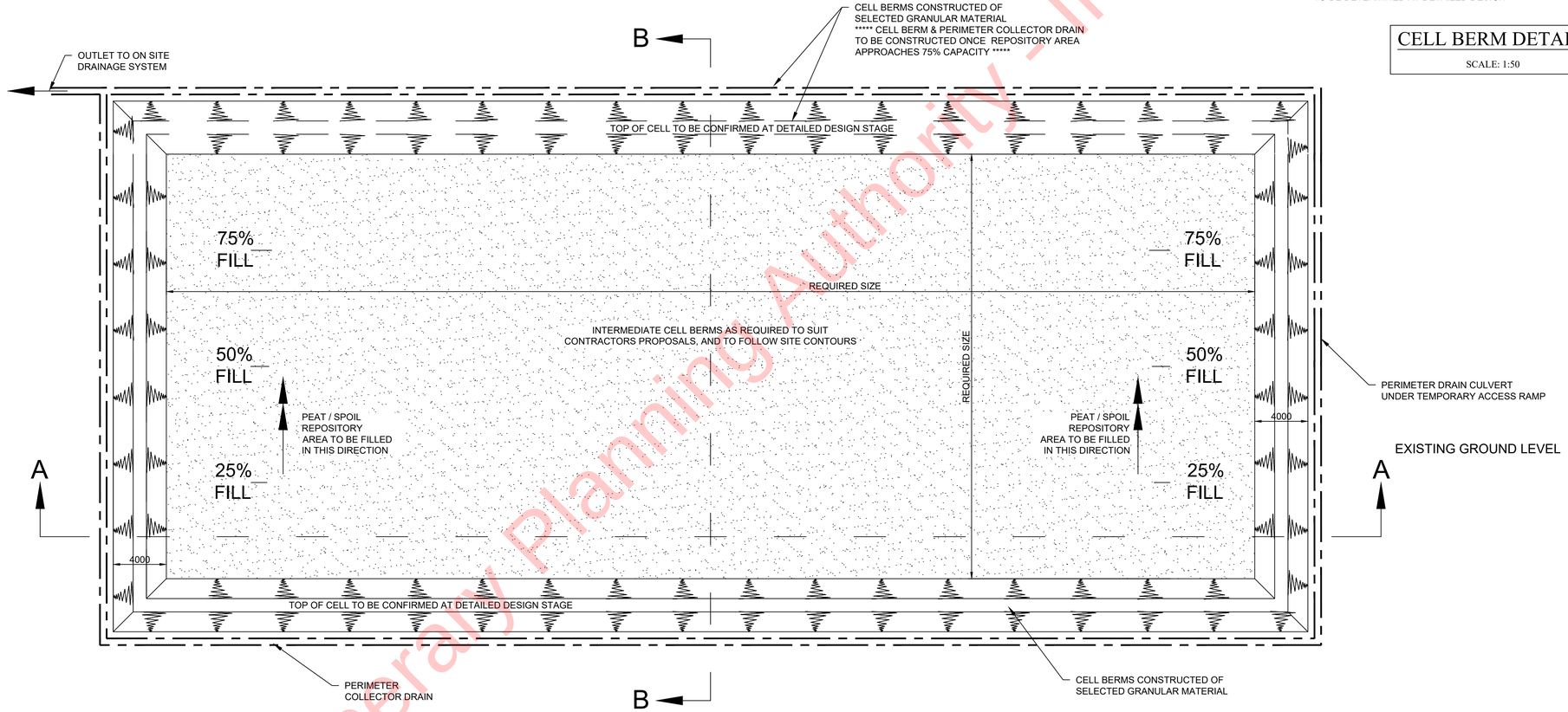


PEAT / SPOIL REPOSITORY - SECTION B-B

SCALE: 1:200

CELL BERM DETAIL

SCALE: 1:50



PEAT / SPOIL REPOSITORY - PLAN

SCALE: 1:200

NOTES:

1. THIS DRAWING IS FOR PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT PURPOSES AND SHOULD NOT BE USED AS DETAILED DESIGN OR FOR CONSTRUCTION.
2. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED.
3. DO NOT SCALE FROM THIS DRAWING.
4. ALL PLACED MATERIAL WILL BE ALLOWED TO REVEGETATE NATURALLY FROM THE EXTENSIVE SEED SOURCE OF THE PLANTS THAT HAVE ALREADY COLONISED IN THE AREA. ALTERNATIVELY AND POSSIBLY IN ADDITION, SEEDING OF THE PLACED SPOIL COULD BE CARRIED OUT WHICH WOULD AID IN STABILISING THE PLACED SPOIL IN THE LONG TERM.
5. WHERE POSSIBLE, THE ACROTELM SHALL BE STORED WITH THE VEGETATION PART OF THE SOD FACING THE RIGHT WAY UP TO ENCOURAGE GROWTH OF PLANTS AND VEGETATION AT THE SURFACE OF THE STORED PEAT WITHIN THE PEAT STORAGE AREAS.
6. BOG MATS TO BE USED WHERE NECESSARY TO FACILITATE PLANT & MACHINERY ACCESS OVER SOFT GROUND.

REV:	S2-P02	DATE:	17/08/23	DRAWN BY:	JMG	CHECKED BY:	CE
DESCRIPTION:	UPDATED TO ADDRESS MKO COMMENTS						
REV:	S2-P01	DATE:	30/05/23	DRAWN BY:	EFC	CHECKED BY:	CE
DESCRIPTION:	ISSUED FOR INFORMATION						

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ISSUED AS: FOR INFORMATION

CLIENT: MKO

PROJECT TITLE: CARRIG RENEWABLES WIND FARM

DRAWING No: 4-16- - - - - -

Revision: -S2-P02

DRAWING TITLE: PEAT AND SPOIL REPOSITORY AREAS STANDARD DETAILS

SCALE:	SHOWN	SHEET SIZE:	A1	DATE:	30/05/2023
DRAWN BY:	EFC	CHECKED BY:	C.E.	APPROVED BY:	J.O'D

4.3.8 Tree Felling and Replanting

4.3.8.1.1 *Tree Felling*

As part of the Proposed Development, tree felling will be required within and around development footprint to allow for the construction of the turbine bases, access roads underground cabling, and the other ancillary infrastructure.

Further details on tree felling required within and around development footprint on the Proposed Development site is detailed in Chapter 6 of this EIAR.

A small portion (3%) of the Proposed Development site comprises commercial forestry. A total of 9.7 hectares of commercial forestry will be permanently felled as part of the Proposed Development along with existing treeline boundaries as detailed in Chapter 6, Section 6.6.3.1.2. Figure 4-17 shows the extent of the commercial forestry to be permanently felled as part of the Proposed Development.

The commercial forestry felling activities required as part of the Proposed Development will be the subject of a Limited Felling Licence (LFL) application to the Forest Service in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments. The policy requires that a copy of the planning permission for the Proposed Development be submitted with the felling licence application; therefore the felling licence cannot be applied for until such time as planning permission is obtained for the Proposed Development.

4.3.8.1.2 *Forestry Replanting*

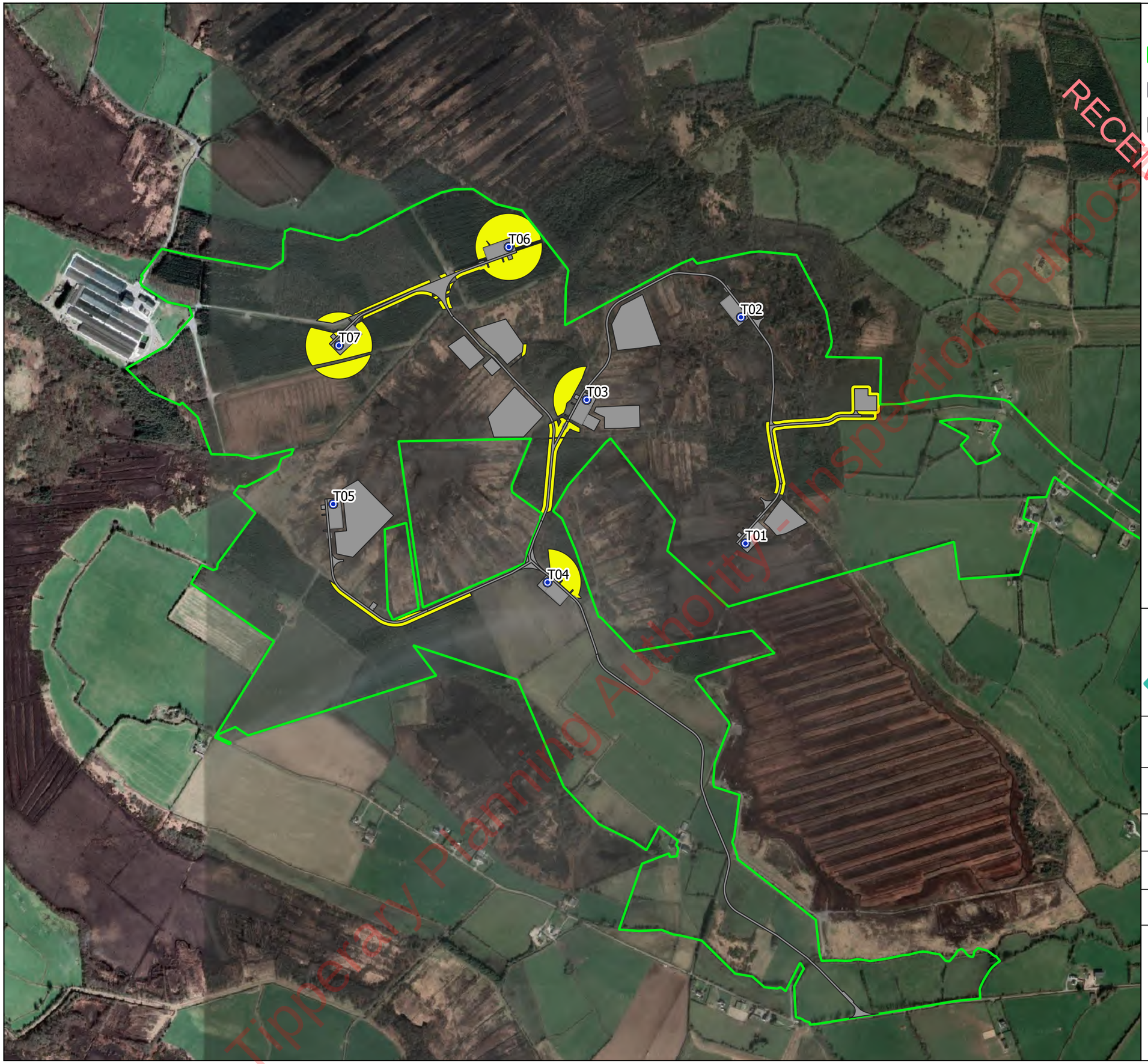
In line with the Forest Service's published policy on granting felling licences for wind farm developments, areas cleared of forestry for access roads, and any other wind farm-related uses will have to be replaced by replanting at an alternative site or sites. The Forest Service policy requires replacement or replanting on a hectare for hectare basis for the footprint of the infrastructure developments.

The estimated 9.7 hectares that will be permanently felled for the footprint of the Proposed Development infrastructure will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that will be issued in respect of the Proposed Development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The replacement of the 9.7 hectares of forestry can occur anywhere in the State subject to licence. The replacement of forestry, felled as part of the Proposed Development, may occur on any lands, within the state, benefitting from Forest Service Technical Approval[2] for afforestation, should the Proposed Development receive planning permission. Under the Forestry Regulations 2017, all applications for licences for afforestation require the prior written approval (technical approval) of the Minister for Agriculture, Food and the Marine. Before the Minister can grant approval, he/she must first determine if the project is likely to have significant effects on the environment (for EIA purposes) and assess if the development, individually or in combination with other plans or projects is likely to have a significant effect on a European site (for Habitats purposes).

Further details in relation to forestry replanting are included in Section 2.8 of Chapter 2 and Appendix 2-4 of this EIAR.

[2] *All proposed forestry developments where the area involved is greater than 0.1 hectare must receive the prior written approval of the Forest Service. The application for approval is known as Pre-Planting Approval – Form 1.*



Map Legend

- EIAR Site Boundary
- Commercial Forestry to be Felled
- Development Footprint
- Turbine Locations

N

Drawing Title
Commercial Forestry to be Felled

Project Title
Carrig Renewables Wind Farm

Drawn By	Checked By
JF	EMC
Project No.	Drawing No.
211016	Fig. 4-17
Scale	Date
1:10,000	2023-09-21

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4.3.9 Site Activities

4.3.9.1 Environmental Management

All proposed activities on the site of the Proposed Development will be provided for in an environmental management plan. A Construction and Environmental Management Plan (CEMP) has been prepared for the Proposed Development and is included in Appendix 4-3 of this EIAR.

The CEMP includes details of drainage, spoil management and waste management, and outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to comply with the environmental commitments outlined in the EIAR. In the event planning permission is granted for the Proposed Development, the CEMP will be updated prior to the commencement of the development, to address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned and will be submitted to the Planning Authority for approval.

Wherever possible, vehicles will be refuelled off-site. This will be the case for regular, road-going vehicles. However, for construction machinery that will be based on-site continuously, a limited amount of fuel will have to be stored on site in appropriately bunded containers.

On-site refuelling of machinery will be carried out at dedicated refuelling locations using a mobile double skinned fuel bowser. The fuel bowser, a double-axle custom-built refuelling trailer will be re-filled off site and will be towed around the Proposed Development site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the Proposed Development. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use.

Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays, spill kits and fuel absorbent mats will be available if necessary, during all refuelling operations.

4.3.9.2 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from a local batching plant in sealed concrete delivery trucks. The quarry that could potentially provide stone and ready mix concrete for the Proposed Development are detailed below in Section 4.4.2.1.

The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching. When concrete is delivered to Site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the Site. Concrete trucks will be washed out fully at the batching plant, where facilities are already in place.

The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area. Where temporary lined impermeable containment areas are used, such containment areas are typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plate 4-3 below.

The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents will be tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

Plate 4-2 Concrete washout area

Alternatively, a Siltbuster-type concrete wash unit or equivalent (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) may be used. This type of Siltbuster unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility.

The risks of pollution arising from concrete deliveries will be further reduced by the following:

- Concrete trucks will not be washed out on the site but will be directed back to their batching plant for washout.
- Proposed Development site roads will initially be constructed with a subgrade and compacted with the use of a roller to allow concrete delivery trucks access all areas where the concrete will be needed. The final wearing course for the Proposed Development site roads will not be provided until all bases have been poured. No concrete will be transported around the Site in open trailers or dumpers so as to avoid spillage while in transport. All concrete used in the construction of turbine bases will be pumped directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be pumped from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.
- The arrangements for concrete deliveries to the Site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.
- Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the Site.

4.3.9.3 Concrete Pouring

Due to the volume of concrete required for each turbine foundation, and the requirement for the concrete pours to be continuous, deliveries are often carried out outside normal working hours in order to limit the traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are normally complete in a single day per turbine. The main pours will be planned days or weeks in advance.

Special procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These may include:

- Using weather forecasting to assist in planning large concrete pours and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete.

- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available for freshly placed concrete to avoid the surface washing away in heavy rain.
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) or equivalent.
- Disposing of surplus concrete after completion of a pour in agreed suitable locations away from any watercourse or sensitive habitats.

4.3.9.4 Dust Suppression

In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling/settlement ponds in the Proposed Development site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and temporary construction compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.

4.3.9.5 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. A wheel wash facility will be provided and a layout of the same is shown in Figure 4-18. The site roads will be well finished with non-friable, compacted hardcore, and so the public road-going vehicles will not be travelling over soft or muddy ground where they might pick up mud or dirt.

A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the Proposed Development.

4.3.9.6 Waste Management

The CEMP, Appendix 4-3 of this EIAR, provides a waste management plan (WMP) which outlines the best practice procedures during the construction phase of the project. The WMP outlines the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of the Proposed Development. Disposal of waste will be a last resort.

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any waste related activity must have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the Proposed Development to ensure that all contractors hired to remove waste from the Site have valid Waste Collection Permits to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

Prior to the commencement of the development, a Construction Waste Manager will be appointed by the Contractor. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient

authority so that they can ensure everyone working on the development adheres to the management plan.

The WMP will provide systems that will enable all arisings, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It will highlight the areas from which most waste occurs and allows the measurement of arisings against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

4.4 Access and Transportation

4.4.1 Site Entrances

During the construction phase, the proposed development site will be accessed via a proposed new entrance off the local road (L5040) which runs along the southern boundary of the Proposed Development site in the townland of Clohaskin. The local access road is, in turn, accessed via the N52 national secondary road. This entrance will be used as the primary site entrance for HGVs, turbine component deliveries and other abnormal loads during the construction phase of the proposed development. Once the proposed Carrig Renewables Wind Farm is operational this entrance will remain in place, however, it will only be used in the unlikely event of the delivery of a replacement turbine component or other abnormal load required for the operational maintenance of the wind farm.

From the main site entrance, construction traffic will access the turbines via 7 no. internal junctions that provide access through the site during the construction and operational stages of the Proposed Development. These access and egress points are shown on the site layout drawings in Appendix 4-1. These junctions are described in detail in Chapter 15, Section 15.1.1.10 of this EIAR.

It is proposed to access the proposed onsite 38kV substation, during both the construction and operational phases of the Proposed Development, via a new entrance off the L5041 local road in the townland of Faddan More.

During the operational phase of the proposed development, operation and maintenance staff will access the wind farm site via the existing junction north of Turbine No. 4, the exiting junction southwest of Turbine No. 3, the new junction south of Turbine No. 2 and the existing junction north of Turbine No. 1. The remaining junctions will remain in place but will be closed off using a steel barrier or stock proof fencing. These junctions used in the unlikely event of the delivery of a replacement turbine component or other abnormal load required for the operational maintenance of the wind farm.

The location of Proposed Development access is shown in Figure 4-19 and Appendix 4-1 of this EIAR.

4.4.2 Deliveries of Stone and Ready-Mix Concrete from Quarries

In order to facilitate the construction of the Proposed Development, all crushed stone, hardcore materials and ready-mix concrete that will be required during the construction phase will be sourced from local, appropriately authorised quarries. For the purposes of assessment within the EIAR, an existing, authorised quarry, located 13.5km northeast of the Proposed Development has been selected and is shown in Figure 4-20.

The proposed route for HGVs originates from the quarry in the townland of Ballindown and travels southwest along the N52 for approximately 4.4km to the town of Birr. In Birr town centre, the vehicles will continue for 810m along the N52 travelling south before turning west, remaining on the N52, in the townland of Townparks. The vehicles will continue to travel southwest along the N52 for 6.8km. In the

townland of Clohaskin, the vehicles will turn west onto the L5040 and travel for 1.2km where it enters the site entrance of the Proposed Development.

Deliveries of stone and ready-mix concrete for use in construction of the Proposed Development, are discussed in further detail in Chapter 15 of this EIAR.

4.4.3 Turbine Component Delivery Route

It is envisaged that large wind turbine components will be delivered to the Proposed Development site, from Shannon Foynes Port (other ports such as Galway Port could also be used, via the N69 national road, N18 national road, M7 Motorway, R435 Regional Road, R445 Regional Road, N62 National Secondary Road, N52 National Secondary Road, and the L5040 local road. The proposed turbine delivery route (TDR) from the M7 to the Proposed Development is shown on Figure 4-21.

From Shannon Foynes Port in Co. Limerick, the turbines component delivery vehicles will travel east via the N69 and N18 National Primary Roads as far as the western outskirts of Limerick City before merging onto the M7 Motorway. At Junction 21 (Borris-in-Ossory), the vehicles will exit the M7, travelling north on the R435 regional road for approximately 2.2km. In the townland of Townparks (west of Borris-in-Ossory), the vehicles will join the R445 regional road and travel northwest along this road for approximately 9.4km. The vehicle joins the N62 national secondary road in the townland of Benamore and progresses west towards the town of Roscrea. The vehicles will follow the N62 through Roscrea and travel northwards to Birr. In the townland of Townparks (Birr), the vehicle turns west off the N62 and on to the N52. The vehicle will then continue southwest, through the villages of Riverstown and Carrig in Co. Tipperary before turning west onto the L5040 local road in the townland of Clohaskin. The vehicle travels west on the L5040 for approximately 1.2km to the Proposed Development entrance that is located on the northern side of the L5040.

It is also envisaged that general construction traffic (including materials and staff) will travel to the site via the public road network to the east of the site. Traffic movements generated by the proposed development are discussed in Section 15.1 of Chapter 15, Material Assets.

4.4.3.1 Turbine Delivery Route Accommodation Areas

Road and junction widening are sometimes required along proposed turbine delivery routes to accommodate the large vehicles used to transport turbine components to Proposed Development sites. The proposed transport route for the Proposed Development has been the subject of a route assessment to determine if any works are required along its length. Full details of the assessment are included as part of the traffic impact assessment set out in Section 15.1.9 of this EIAR and summarised below. There are sections on the route where the vertical alignment may require specialist transport vehicles. These sections will be further considered by the appointed transport company following turbine procurement process. Accommodation areas will be required at three locations on the N52 National Road between the Birr, Co. Offaly, and the main Proposed Development site entrance in the townland of Clohaskin, Co. Tipperary. These areas will be temporary in nature and only used for the purposes of abnormal load delivery.

The locations of the accommodation areas are shown in Figures 4-22 to 4-24.

Location 1 – Townparks, Co. Offaly

Heavy duty ground protection mats such as Tufftrak mats (https://www.buyjustrite.eu/en/checkers-tufftrak/content/tufftrak/) will be installed along a section of grass verge in the townland of Townparks, Birr, Co. Offaly. The ground protection mats will provide a temporary track over the grass verge to facilitate the movement of large turbine component delivery vehicles through the right turn from the N62 to the N52.

The section of the turbine delivery route will also require the temporary removal of road signage, shop signage and other roadside infrastructure. Upon completion of the turbine delivery phase, the ground mats will be removed, and all signage and roadside infrastructure will be reinstated.

The area covered by the ground protection mats is shown on Figure 4-22.

Location 2– Ballyloughnane, Co. Tipperary

In the townland of Ballyloughnane, Co. Tipperary, it is proposed to construct an accommodation area, measuring approximately 130m in length, within agricultural land on the northern side of a sharp bend on the N52 National Secondary Road. This accommodation area will allow large turbine component and other abnormal load delivery vehicles to bypass this sharp corner.

As the existing boundary between the agricultural land and the public road corridor will need to be removed at either end of the accommodation area, it is proposed to install, temporary gates will be at the entry and exit points off and on to the N52. These gates will be locked between scheduled turbine deliveries.

Upon the completion of the construction phase, the accommodation area will be covered with a layer of topsoil and reseeded. It will only be used again in the unlikely event that an oversized delivery was required for wind turbine maintenance purposes. The boundary between the agricultural land and the public road corridor, at either end of the accommodation area will be reinstated to its current condition.

This accommodation area is shown in Figure 4-23 and it forms part of this planning application.

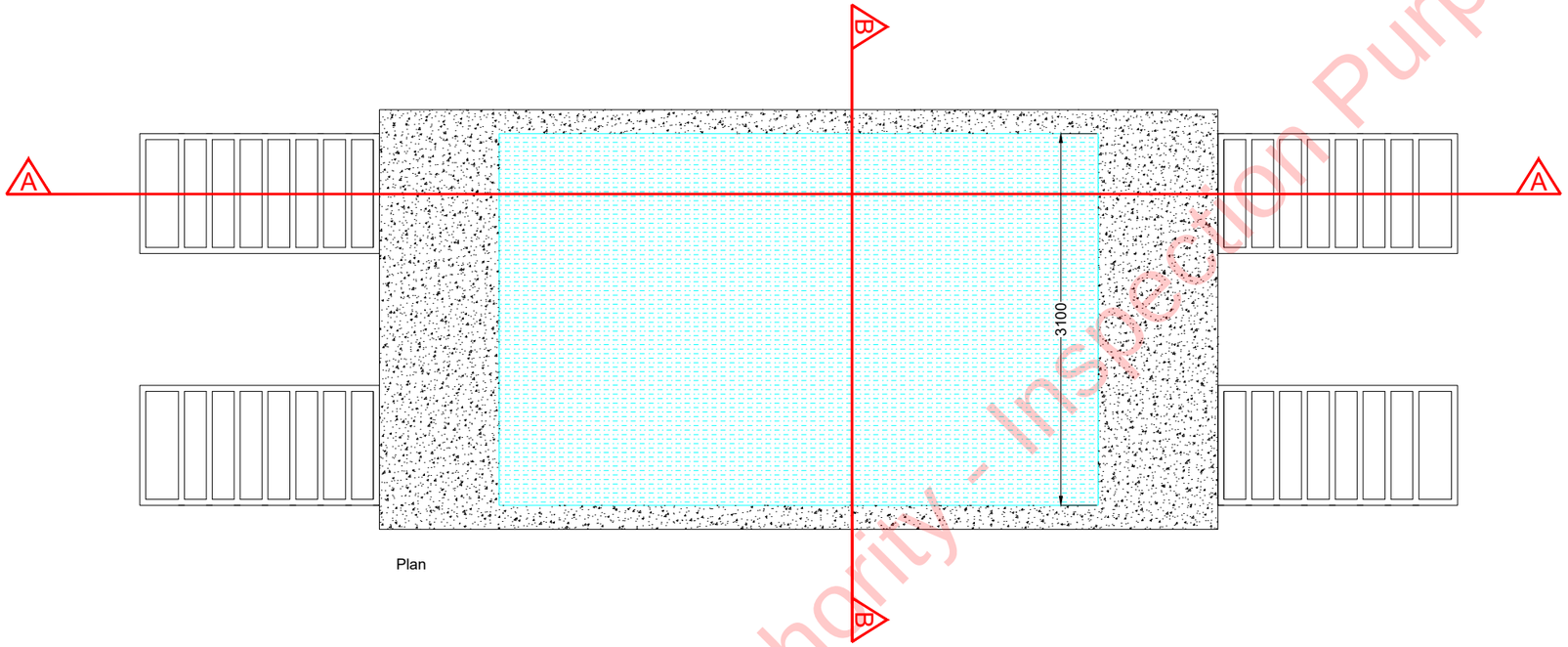
Location 3 -Clohaskin, Co. Tipperary

Temporary junction widening works will be required on the southern side of the N52/L5040 junction in order to facilitate the delivery of turbine components and other abnormal loads. This area is currently under the control and being maintained by Tipperary County Council. It will also be used for the purposes of traffic management during the construction phase of the Proposed Development (refer to Appendix 15-2 of the EIAR).

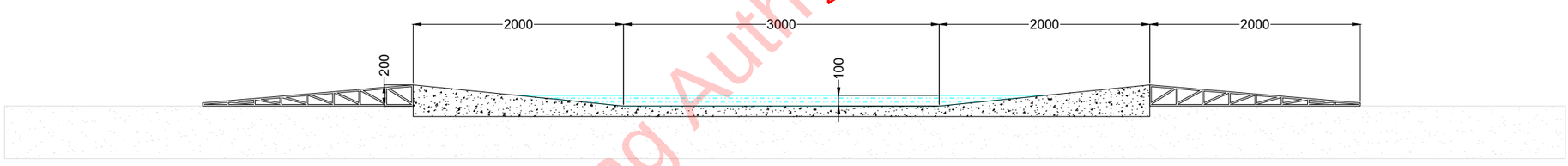
Upon the completion of the turbine component delivery phase, this area will be reinstated to its current condition.

It should be noted that these junction widening works do not form part of this planning application, however, they are assessed as part of the EIAR. This works area is shown in Figure 4-24.

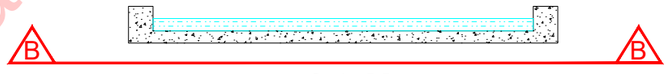
Note
Wheel washes will be appropriately located at all entrances used during construction of the wind farm



Plan



Section A-A



Section B-B

DRAWING TITLE:
Wheel Wash Detail

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-18
SCALE: 1:50 @ A3	DATE: 21.09.2023

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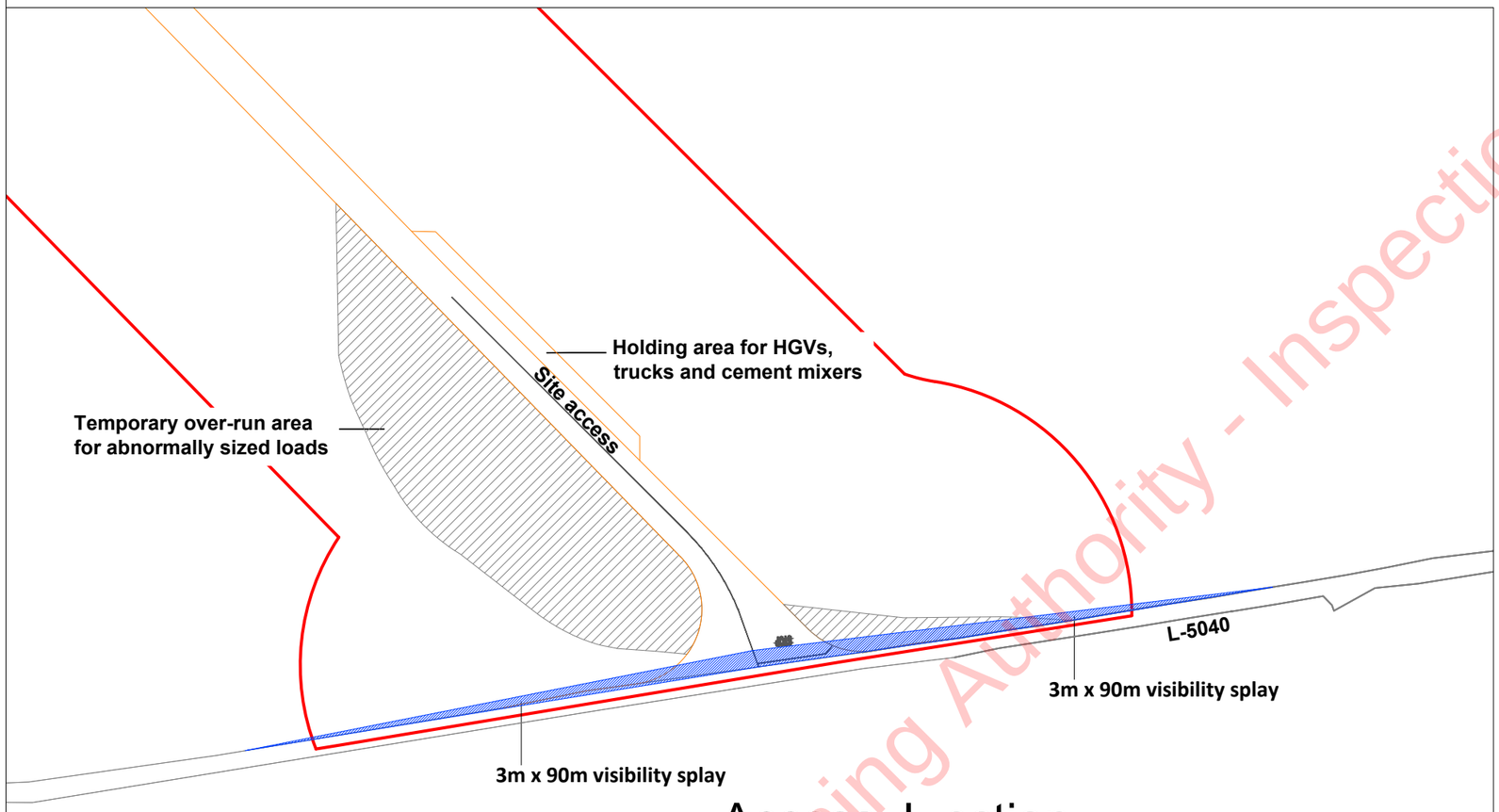
Drawing Legend

- Application Boundary
- Proposed Site Road
- Existing Road
- Transport Runover Area
- Sight Line



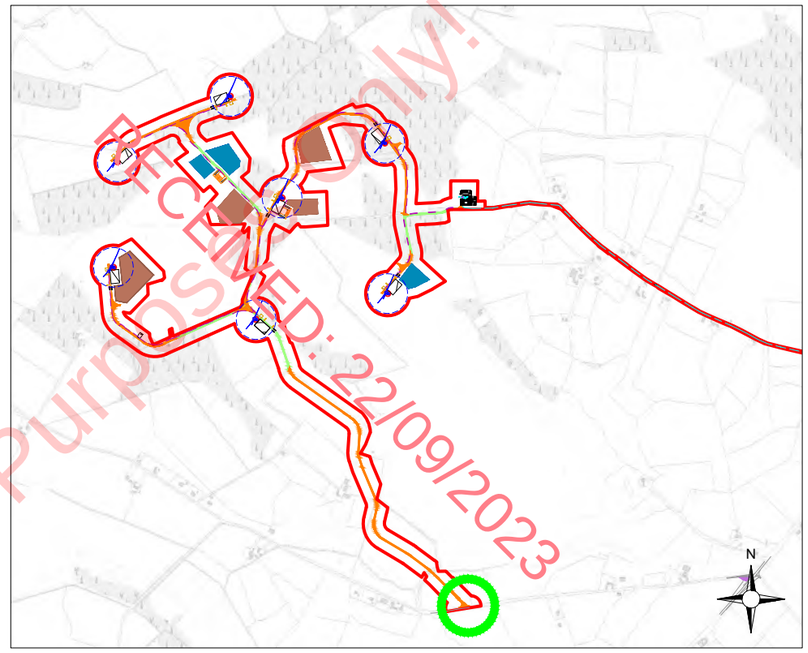
Access Junction

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

N



1:25,000 Location on Context Map

DRAWING TITLE:
proposed site new entrance

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EM/JW
PROJECT No.:	DRAWING No.:
211016	Figure 4-19
SCALE:	DATE:
1:1,000 @ A3	21.09.2023

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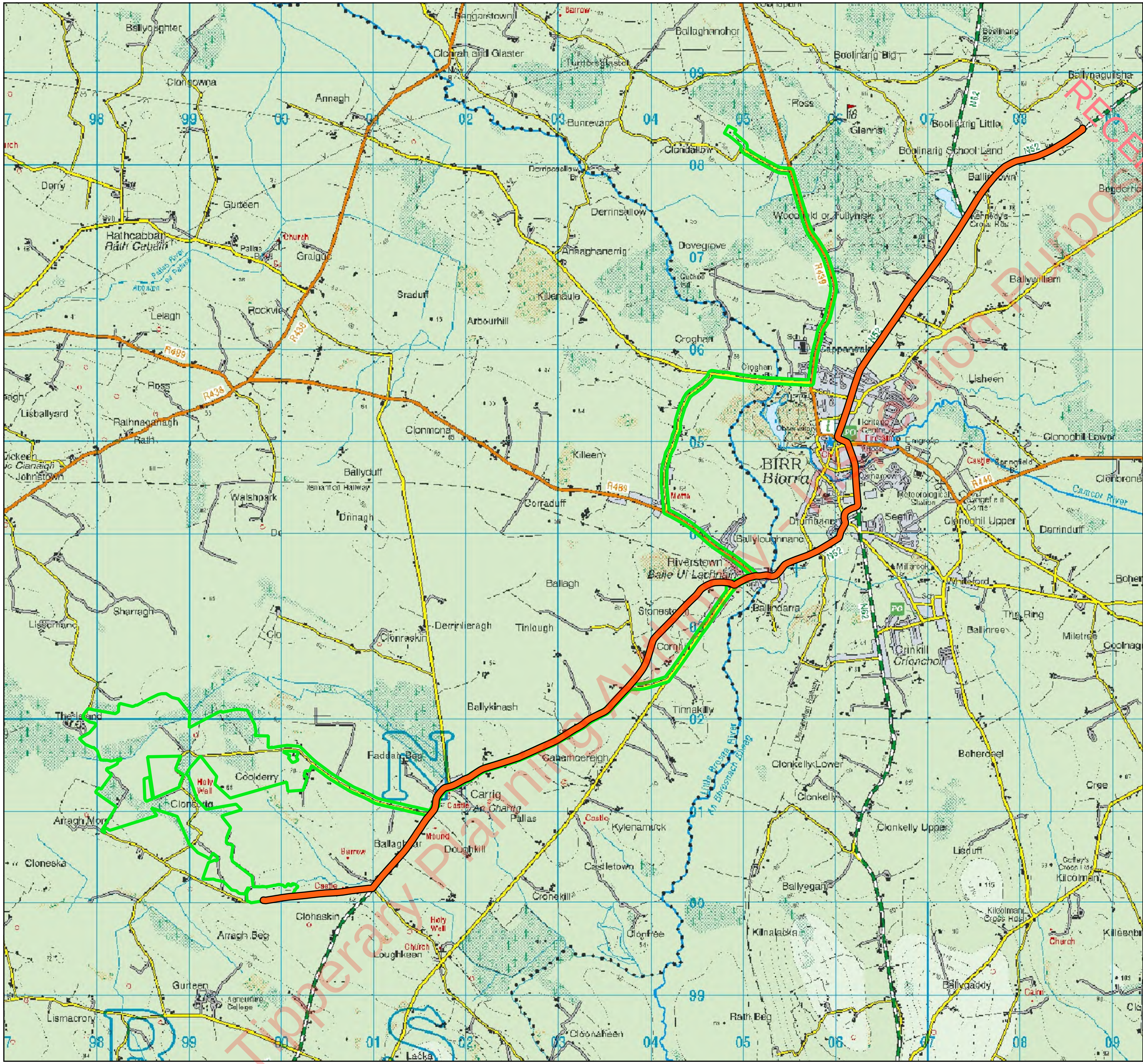

Map Legend

EIAR Site Boundary

Proposed Delivery Route for Stone and Ready-mix Concrete

N

Drawing Title	
Proposed Delivery Route of Stone and Ready-mix Concrete	
Project Title	
Carrig Renewables Wind Farm	
Drawn By JF	**Checked By** EM
Project No. 211016	**Drawing No.** Fig. 4-20
Scale 1:40,000	**Date** 2023-09-21

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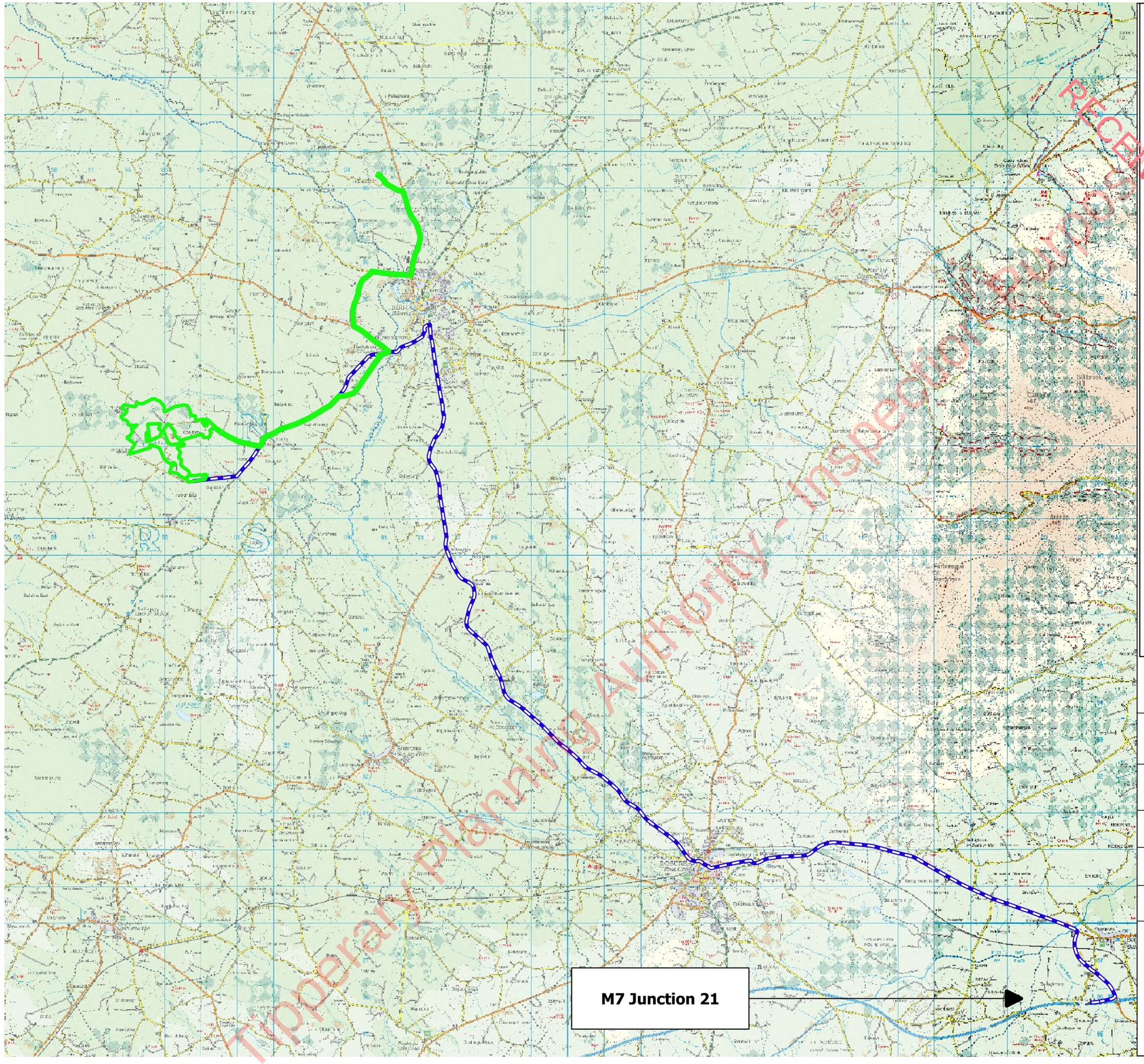

Map Legend

EIAR Site Boundary

Proposed Turbine Delivery Route

Drawing Title

Proposed Turbine Delivery Route

Project Title

Carrig Renewables Wind Farm Development

Drawn By	Checked By
JF	EM
Project No.	Drawing No.
211016	Fig. 4-21
Scale	Date
1:100,000	2023-09-21

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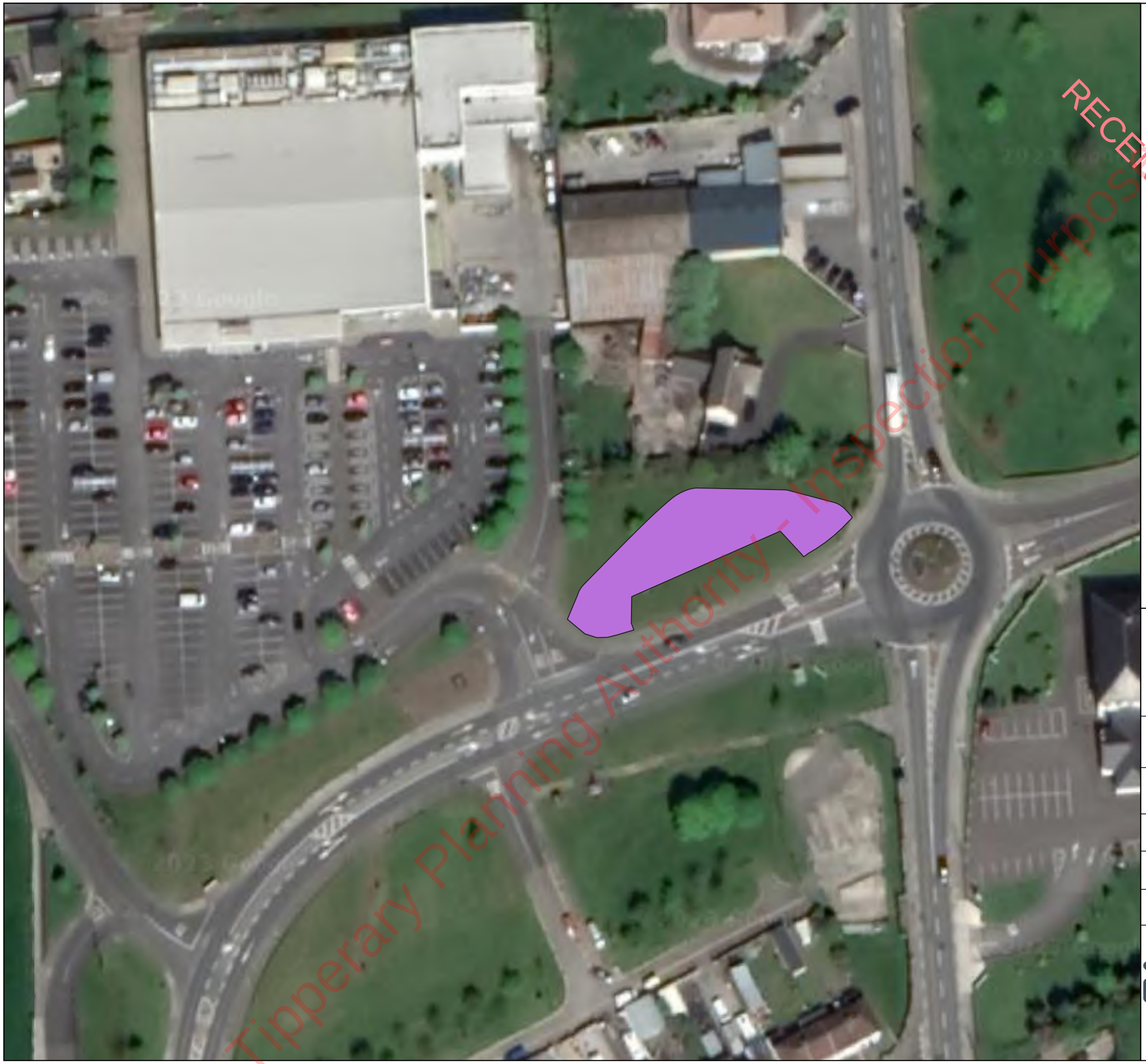

Map Legend

Location of Proposed Turbine Delivery Accomodation Area

Drawing Title

Proposed Turbine Delivery Accomodation Area 1

Project Title

Carrig Renewables Wind Farm

Drawn By	Checked By
JF	EM
Project No.	Drawing No.
211016	Fig. 4-22
Scale	Date
1:750	2023-09-21

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Map Legend

- EIAR Site Boundary
- Location of Proposed Turbine Delivery Accomodation Area

Drawing Title
Proposed Turbine Delivery Accomodation Area 2

Project Title
Carrig Renewables Wind Farm

Drawn By	Checked By
JF	EM
Project No.	Drawing No.
211016	Fig. 4-23
Scale	Date
1:1,500	2023-09-21

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Map Legend

Location of Proposed Turbine Delivery Accomodation Area

Drawing Title

Proposed Turbine Delivery Accomodation Area 3

Project Title

Carrig Renewables Wind Farm

Drawn By	Checked By
JF	EM
Project No.	Drawing No.
211016	Fig. 4-24
Scale	Date
1:750	2023-09-21

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4.4.4 Traffic Management

A turbine with the maximum blade length of 81.5 metres has been used in assessing the traffic impact of the Proposed Development. The blade transporter for such a turbine blade would have a total vehicle length of 87.5 metres, including the blade which overhangs the back of the vehicle. The total length of the tower transporter is 46.7 metres with the axles located at the front and rear of the load with no overhang.

The vehicles used to transport the nacelles will be similar to the tower transporter. All other vehicles requiring access to the site of the Proposed Development will be smaller than the design test vehicles. The turbine delivery vehicles have been modelled accurately in the Autotrack assessments for the Proposed Development site access junctions, as detailed in Section 15.1.9 of this EIAR.

The need to transport turbine components on the public roads is not an everyday occurrence in the vicinity of the site of the Proposed Development. However, the procedures for transporting abnormal size loads on the country's roads are well established. While every operation to transport abnormal loads is different and requires careful consideration and planning, escort vehicles, traffic management plans, drive tests, road marshals and convoy escorts from the Garda Traffic Corps are all measures that are regularly employed to deliver oversized loads from origin to destination. With just under 400 No. wind farms already built and operating in Ireland (Republic and Northern Ireland combined, as per latest available figures on www.windenergyireland.com), transport challenges are something the wind energy industry and specialist transport sector has become particularly adept in finding solutions to.

As an alternative solution for transport of turbine blades, alternative delivery systems are available. For example, delivery vehicles fitted with blade adapters may be used in order to navigate the existing roads along the turbine delivery route. Blade adaptors allow the turbine blade to be transported at a suitable angle in order to navigate tight bends or obstacles along the delivery route. Plate 4-4 below shows an example of a blade adapter.

Plate 4-3 Blade adaptor transport system

A detailed traffic management plan has been prepared as part of the traffic impact assessment set out in Chapter 15 of this EIAR. The deliveries of turbine components to the Proposed Development site may be made in convoys of three to four vehicles at a time, and at night when roads are quietest. Convoys will be accompanied by escorts at the front and rear operating a "stop and go" system. Although the turbine delivery vehicles are large, they will not prevent other road users or emergency vehicles

passing, should the need arise. The delivery escort vehicles will ensure the turbine transport is carried out in a safe and efficient manner with minimal delay or inconvenience for other road users.

It is not anticipated that any section of the public road network will be closed during transport of turbines, although there will be some delays to local traffic at pinch points. During these periods it may be necessary to operate local diversions for through traffic. All deliveries comprising abnormally large loads where required will be made outside the normal peak traffic periods, usually at night, to avoid disruption to work and school-related traffic.

Prior to the Traffic Management Plan being finalised, a full dry run of the transport operation along the potential routes will be completed using vehicles with attachments to simulate the dimensions of the wind turbine transportation vehicles. This dry run will inform the Traffic Management Plan for agreement with the relevant Authorities. All turbine deliveries will be provided for in a Traffic Management Plan which will be finalised in advance of oversized load deliveries, when the exact transport arrangements are known, delivery dates confirmed and escort proposals in place. Such a traffic management plan is typically submitted to the relevant Authorities for agreement in advance of any abnormal loads using the local roads, and will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

4.4.4.1 Traffic Management of Other Construction Materials

Aside from the delivery of the large turbine components and other abnormal loads, the construction of the Proposed Development will require the delivery of a large volume of other construction materials (including all crushed stone and cement required) mainly by HGVs. A detailed traffic management plan (TMP) has been prepared as part of the traffic and transport impact assessment and is included as Appendix 15-2 of this EIAR. The purpose of the TMP is to set out the various traffic management measures that will be implemented during the construction stage of the Proposed Development. The successful completion of the Proposed Development will require significant coordination and planning and a comprehensive set of mitigation measures will be put in place before and during the construction phase of the Proposed Development in order to minimise the effects of the additional traffic generated on the surrounding road network.

All traffic management measures that are to be implemented during the construction phase of the Proposed Development will be agreed with Tipperary County Council and the Roads and Traffic Section will be consulted throughout the construction phase.

4.5 Community Gain Proposal

4.5.1 Background

4.6 Community Gain Proposal

Carrig Renewables Wind Farm has the potential to bring significant positive benefit to the local community. The project will create sustainable local employment, it will contribute annual rates to the local authority, and it will provide opportunity for local community investment in the project. A community benefit fund will be put in place for the lifetime of the project to provide direct funding to those areas surrounding the project. Renewable Energy Support Scheme

The Renewable Energy Support Scheme (RESS) Terms and Conditions, published by the Department of Communications, Climate Action and Environment on the 29th October 2021, make some high level provisions for how this type of benefit fund will work. Any project which wants to export electricity to the national grid must abide by these broad principles. These include the following:

1. *a minimum of €1,000 shall be paid to each household located within a distance of a 1-2kilometre radius from the Project;*
2. *a minimum of 40% of the funds shall be paid to not-for-profit community enterprises whose primary focus or aim is the promotion of initiatives towards the delivery of the UN Sustainable Development Goals, in particular Goals 4, 7, 11 and 13, including education, energy efficiency, sustainable energy and climate action initiatives.*
3. *a maximum of 10% of the funds may be spent on administration. This is to ensure successful outcomes and good governance of the Community Benefit Fund.*
4. *the balance of the funds shall be spent on initiatives successful in the annual application process, as proposed by clubs and societies and similar not-for-profit entities, and in respect of Onshore Wind RESS 1 Projects, on "near neighbour payments" for households located outside a distance of 1 kilometre from the Project but within a distance of 2 kilometres from such Project.*

4.6.1 Community Benefit Fund

Carrig Renewables Wind Farm Ltd. expects that for each megawatt hour (MWh) of electricity produced by the wind farm, the project will contribute €2 into a community fund for the RESS period or the first 15 years of operation. If this commitment is improved upon in upcoming Government Policy, we will adjust accordingly.

If this project is constructed as currently designed, we estimate that a total of approximately €4 million will be available in the local area for community funding over the lifetime of the project. The above figure is indicative only and will be dependent on the generation capacity of the wind farm which is influenced by a number of factors including:

1. *Number of wind turbines.*
2. *Capacity and availability of energy production of those turbines.*
3. *Quantity of wind.*

4.6.2 Community Investment Opportunity

The Renewable Energy Support Scheme (RESS) sets out that future renewable energy project proposals enable the possibility for local communities to invest in projects in a meaningful way as a means to directly gain from the financial dividends that a project can provide should it be consented, built and operated. In response to this, the applicant has been working hard with external agencies to develop workable models of Community Investment. As with the benefit fund, the applicant aims to take this work into the community during 2023/2024, to continue to explore this exciting possibility and see how best to embed its design within the community.

4.7 Site Drainage

4.7.1 Introduction

The drainage design for the Proposed Development has been prepared by Hydro Environmental Services Ltd. (HES). The drainage design has been prepared based on experience of the project team of other Proposed Development sites, and the number of best practice guidance documents referred to in the Bibliography section of the EIAR.

The protection of the watercourses within and surrounding the site of the Proposed Development, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. The Proposed Development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream

catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the Proposed Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones around the existing natural drainage features have been used to inform the layout of the Proposed Development.

4.7.2 Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the Proposed Development. Turbine locations have been selected to avoid natural watercourses. It is proposed that 3 no. new watercourse crossing will be required to facilitate the renewable energy development infrastructure.

There will be no direct discharges to natural watercourses. All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at an appropriate distance from natural watercourse and lakes. Buffer zones around the existing natural drainage features have informed the layout of the Proposed Development and are indicated on the drainage design drawings.

Where artificial drains are currently in place in the vicinity of proposed works areas, these drains may have to be diverted around the proposed works areas to minimise the amount of water in the vicinity of works areas. Where it may not be possible to divert artificial drains around proposed work areas, the drains will be blocked to ensure sediment laden water from the works areas has no direct route to other watercourses. Where drains have to be blocked, the blocking will only take place after an alternative drainage system to handle the same water has been put in place.

Existing artificial drains in the vicinity of existing Proposed Development site roads will be maintained in their present location where possible. If it is expected that these artificial drains will receive drainage water from works areas, check dams will be added (as specified below) to control flows and sediment loads in these existing artificial drains. If road widening or improvement works are necessary along the existing roads, where possible, the works will take place on the opposite side of the road to the drain.

4.7.3 Drainage Design Principles

Drainage water from any works areas of the site of the Proposed Development will not be directed to any natural watercourses within the Proposed Development site. Two distinct methods will be employed to manage drainage water within the Proposed Development site. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the Site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage design is intended to maximise erosion control, which is more effective than having to control sediment during high rainfall. Such a system also requires less maintenance. The area of exposed ground will be minimised. The drainage measures will prevent runoff from entering the works areas of the Proposed Development site from adjacent ground, to minimise the volume of sediment-laden water that has to be managed. Discoloured run-off from any construction area will be isolated from natural clean run-off.

A schematic line drawing of the proposed drainage design is presented in Figure 4-25 below.

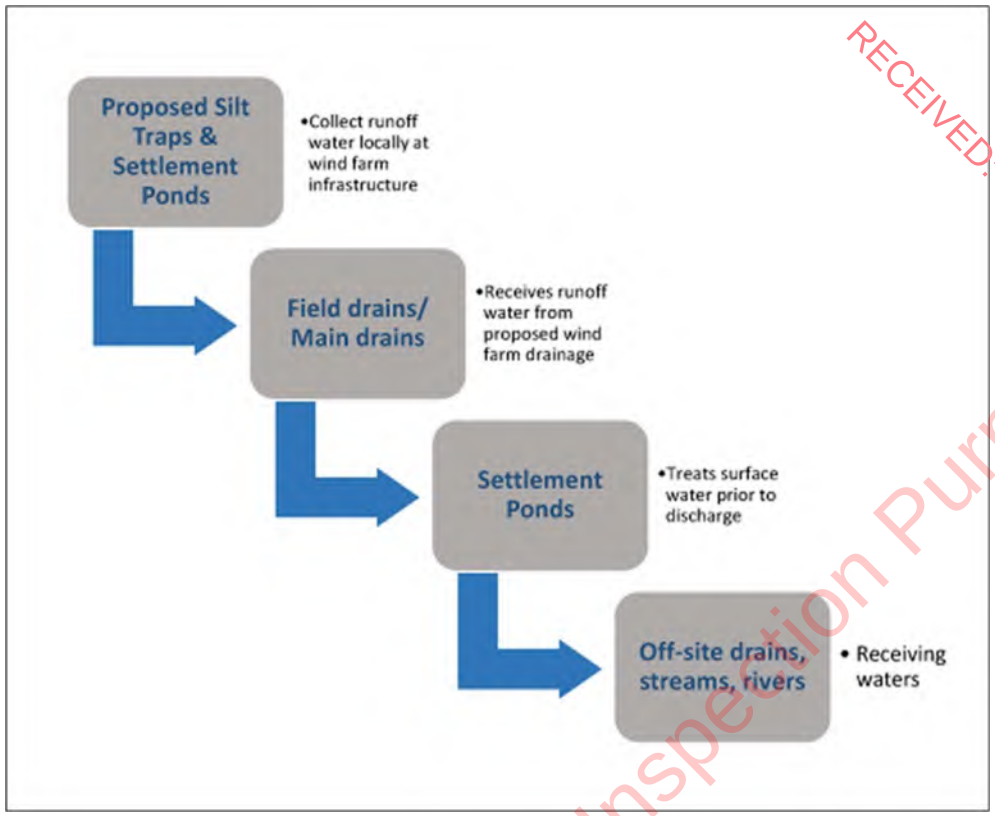


Figure 4-25 Proposed Development Drainage Process Flow

4.7.4 Drainage Design

A drainage design for the Proposed Development, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 4-4 (Surface Water Management Plan) to this EIAR. The drainage design employs the various measures further described below and is cognisant of the following guidance documents:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- Forest Service, (2000): Code of Best Forest Practice – Ireland. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the design, construction and management of forest roads;
- MacCulloch (2006): Guidelines for risk management of peat slips on the construction of low volume low cost roads over peat (Frank MacCulloch Forestry Civil Engineering Forestry Commission, Scotland);
- National Roads Authority (2005): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (September 1996);
- Eastern Regional Fisheries Board: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works Adjacent to Waters;

- Scottish Natural Heritage, 2010: Good Practice During Wind Farm Construction;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA Report No. C648 (2006): CIRIA (Construction Industry Research and Information Association) guidance on 'Control of Water Pollution from Linear Construction Projects';
- CIRIA Report Number C532 (2001): Control of water pollution from construction sites - Guidance for consultants and contractors.; and,
- Control of water pollution from linear construction projects -Technical guidance. CIRIA C648 London, 2006.

4.7.4.1 Interceptor Drains

Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the Site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is envisaged that the majority of the interceptor drains could be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed Site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting of conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction. Figure 4-26 below shows an illustrative drawing of an interceptor drain.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.7.4.3 below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel.

Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader (see Section 4.7.4.4 below). Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

4.7.4.2 Swales

Drainage swales are shallow drains that will be used to intercept and collect run off from construction areas of the Site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the Proposed Development during the operational phase. A

swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above. Figure 4-26 below, shows an illustrative example of a drainage swale.

Drainage swales will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the Site and prevent it reaching natural watercourses.

Drainage swales will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike.

4.7.4.3 Check Dams

The velocity of flow in the interceptor drains and drainage swales, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the swale is non-erosive.

Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the Site, downstream of where drainage swales connect in.

The proposed check dams will be made up of straw bales or stone, or a combination of both depending on the size of the drainage swale it is being installed in. Where straw bales are to be used, they will be secured to the bottom of the drainage swale with stakes. Clean 4-6 inch stone will be built up on either side and over the straw bale to a maximum height of 600mm over the bottom of the interceptor drain. In smaller channels, a stone check dam will be installed and pressed down into place in the bottom of the drainage swale with the bucket of an excavator. Figure 4-26, below, shows illustrative examples of check dams.

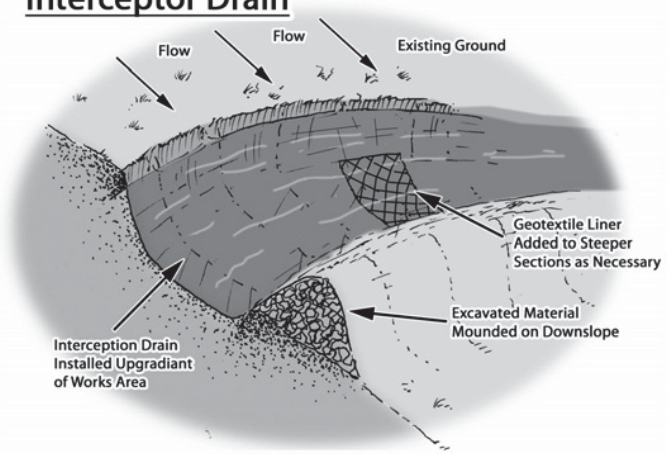
The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

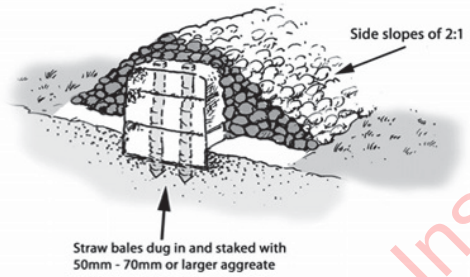
Drainage Design Measures

Interceptor Drain

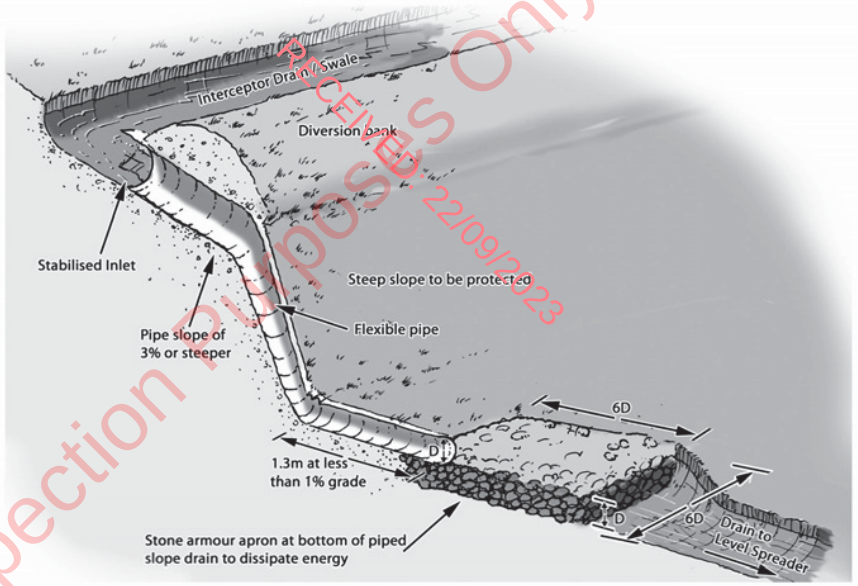


Check Dam (Stone Dam in Drain)

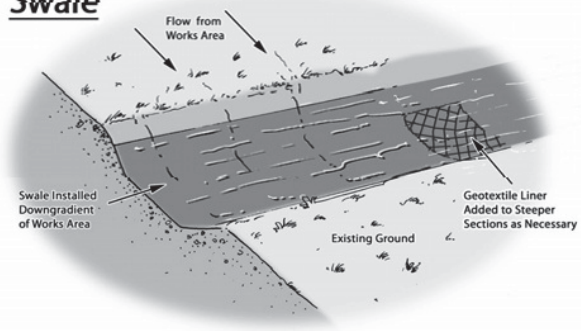
Check Dam
(Straw Bale & Stone Dam - Cross Section)



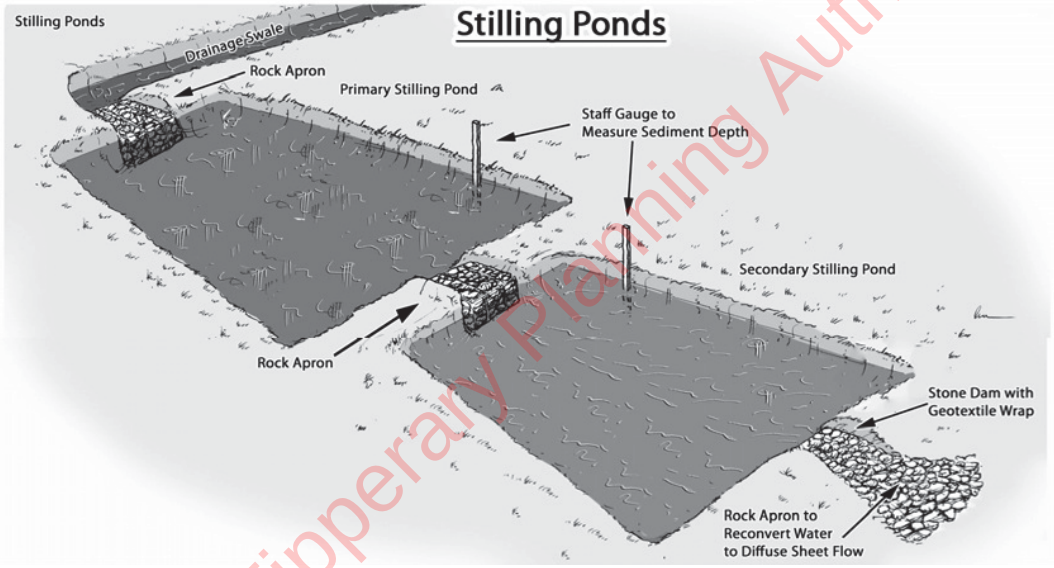
Slope Pipe Drain



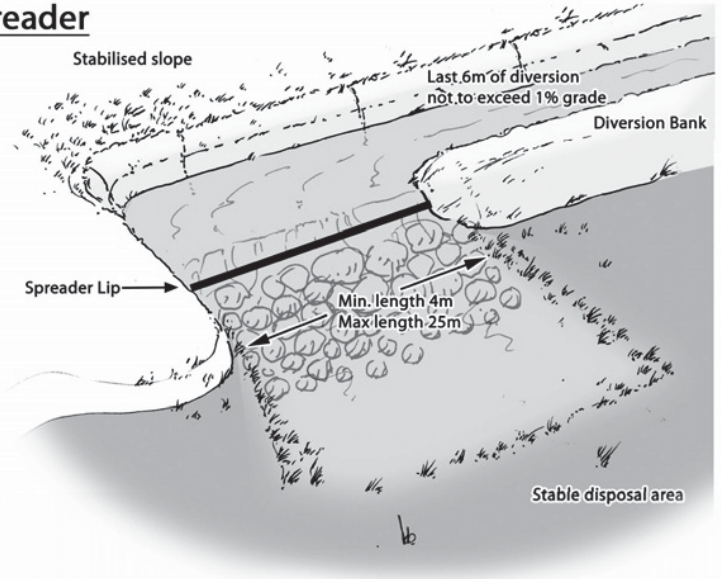
Swale



Stilling Ponds



Level Spreader



Drawing Title: Drainage Design Measures	Drawing No.: Figure 2-2	Scale: NTS	
Project Title: Carrig Renewables Wind Farm		Date: 12.09.2022	
Drawn By: Jonny Fearon	Checked By: Michael Watson	Project No.: 211016	

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4.7.4.4 Level Spreaders

A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the Site.

The water carried in interceptor drains will not have come in contact with works areas of the Site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be reconcentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. Figure 4-26, above, shows an illustrative example of a level spreader.

The slope in the channel leading into the spreader will be less than or equal to 1%.

The spreader lip over which the water will spill will be made of a concrete kerb, wooden board, pipe, or other similar piece of material that can create a level edge similar in effect to a weir. The spreader will be level across the top and bottom to prevent channelised flow leaving the spreader or ponding occurring behind the spreader. The top of the spreader lip will be 150mm above the ground behind it. The length of the spreader will be a minimum of four metres and a maximum length of 25 metres, with the actual length of each spreader to be determined by the size of the contributing catchment, slope and ground conditions.

Clean four-inch stone can be placed on the outside of the spreader lip and pressed into the ground mechanically to further dissipate the flow leaving the level spreader over a larger area.

4.7.4.5 Piped Slope Drains

Piped slope drains will be used to convey surface runoff from diversion drains safely down slopes to flat areas without causing erosion. Once the runoff reaches the flat areas it will be reconverted to diffuse sheet flow. Level spreaders will only be established on slopes of less than 6% in grade. Piped slope drains will be used to transfer water away from areas where slopes are too steep to use level spreaders.

The piped slope drains will be semi-rigid corrugated pipes with a stabilised entrance and a rock apron at the outlet to trap sediment and dissipate the energy of the water. The base of drains leading into the top of the piped slope drain will be compacted and concavely formed to channel the water into the corrugated pipe. The entrance at the top of the pipe will be stabilised with sandbags if necessary. The pipe will be anchored in place by staking at approximately 3-4 metre intervals or by weighing down with compacted soil. The bottom of the pipe will be placed on a slope with a grade of less than 1% for a length of 1.5 metres, before outflowing onto a rock apron.

The rock apron at the outlet will consist of 6-inch stone to a depth equal to the diameter of the pipe, a length six times the diameter of the pipe. The width of the rock apron will be three times the diameter of the pipe where the pipe opens onto the apron and will fan out to six times the diameter of the pipe over its length. Figure 4-26, above, shows a diagrammatic example of a piped slope drain and rock apron.

Piped slope drains will only remain in place for the duration of the construction phase of the Proposed Development. on completion of the works, the pipes and rock aprons will be removed and all channels backfilled with the material that was originally excavated from them.

Piped slope drains will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and blockages. Stake anchors or fill over the pipe will be checked

for settlement, cracking and stability. Any seepage holes where pipe emerges from drain at the top of the pipe will be repaired promptly.

4.7.4.6 Vegetation Filters

Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.

Vegetation filters will carry outflow from the level spreaders as overland sheet flow, removing any suspended solids and discharging to the groundwater system by diffuse infiltration.

Vegetation filters will not be used in isolation for waters that are likely to have higher silt loadings. In such cases, silt-bearing water will already have passed through stilling ponds prior to diffuse discharge to the vegetation filters via a level spreader.

4.7.4.7 Stilling Ponds (Settlement Ponds)

Stilling or settlement ponds will be used to attenuate runoff from works areas of the site of the Proposed Development during the construction phase and will remain in place to handle runoff from roads and hardstanding areas of the Proposed Development during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

Stilling ponds will be excavated/constructed to the appropriate size at each required location as shown on the drainage design drawings included in Appendix 4-4 (Appendix A) of this EIAR. The points at which water enters and exits the stilling ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the stilling pond system, and prevent erosion. The stilling ponds will reduce the velocity of flows in order to allow settlement of silt to occur. Water will flow out of the stilling pond through a stone dam, partially wrapped in geo-textile membrane, which will control flow velocities and trap any sediment that has not settled out.

Water will flow by gravity through the stilling pond system. The stilling ponds have been sized according to the size of the area they will be receiving water from and are large enough to accommodate a 10-year return rainfall event. The settlement ponds are designed for 11hr and 24hr retention times used to settle out medium silt (0.006mm) and fine silt (0.004mm) respectively (EPA, 2006)[3]. The stilling ponds will be dimensioned so that the length to width ratio will be greater than 2:1, where the length is the distance between the inlet and the outlet. Where ground conditions allow, stilling ponds will be constructed in a wedge shape, with the inlet located at the narrow end of the wedge. Each stilling pond will be a minimum of 1-1.5 metres in depth. Deeper ponds will be used to minimise the excavation area needed for the required volume.

The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area.

Stilling ponds will be located towards the end of swales, close to where the water will be reconverted to diffuse sheet flow. Upon exiting the stilling pond system, water will be immediately reconverted to diffuse flow via a fan-shaped rock apron if there is adequate space and ground conditions allow. Otherwise, a swale will be used to carry water exiting the stilling pond system to a level spreader to reconvert the flow to diffuse sheet flow.

[3] Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (EPA, 2006)

A water level indicator such as a staff gauge will be installed in each stilling pond with marks to identify when sediment is at 10% of the stilling pond capacity. Sediment will be cleaned out of the still pond when it exceeds 10% of pond capacity. Stilling ponds will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows. An illustration of a stilling pond is shown in Figure 4-26.

4.7.4.8 Siltbuster

A "siltbuster" or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.

Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction sites.

The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile. Figure 4-27 below shows an illustrative diagram of the Siltbuster.

The Siltbuster units are now considered best practice for the management of dirty water pumped from construction sites. The UK Environment Agency and the Scottish Environmental Protection Agency have all recommended/specified the use of Siltbuster units on construction projects.

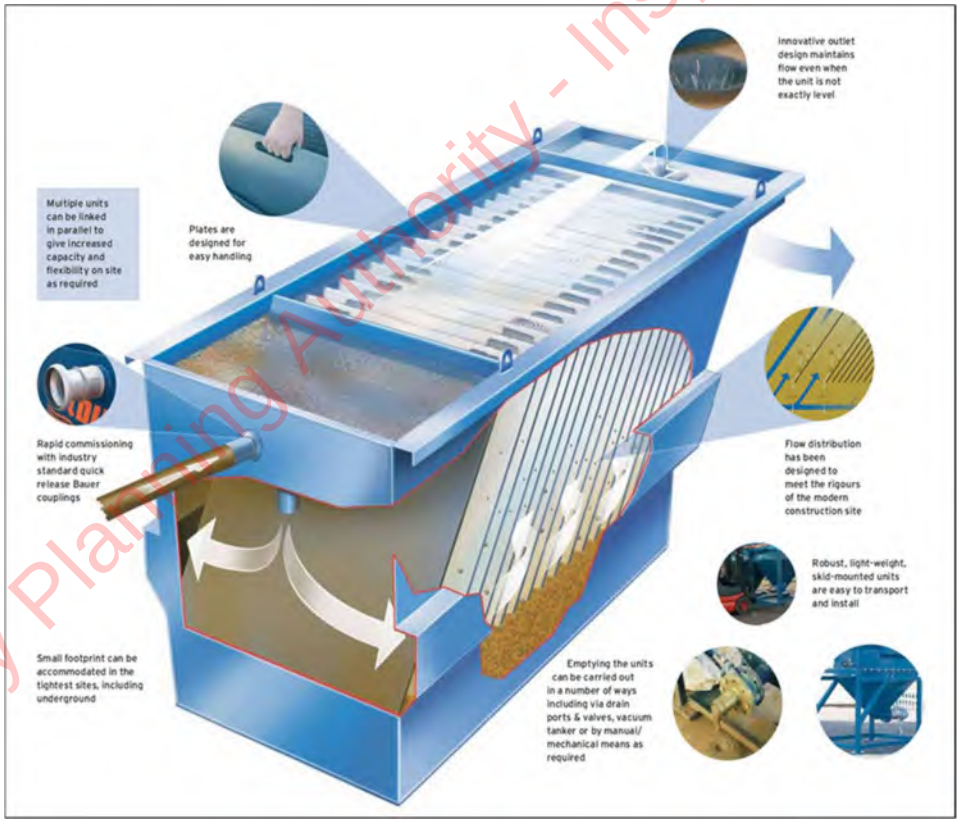


Figure 4-27 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

4.7.4.9 Silt Bags

Dewatering silt bags allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the Site.

Dewatering silt bags are an additional drainage measure that can be used downgradient of the stilling ponds at the end of the drainage swale channels and will be located, wherever it is deemed appropriate, throughout the Site. The water will flow, via a pipe, from the stilling ponds into the silt bag. The silt bag will allow the water to flow through the geotextile fabric and will trap any of the finer silt and sediment remaining in the water after it has gone through the previous drainage measures. The dewatering silt bags will ensure that there will be no loss of silt into the stream.

The dewatering silt bag that will be used will be approximately 3 metres in width by 4.5 metres (see Plate 4-5 and Plate 4-6 below) in length and will be capable of trapping approximately four tonnes of silt. The dewatering silt bag, when full, will be removed from Site by a waste contractor with the necessary waste collection permit, who will then transport the silt bag to an appropriate, fully licensed waste facility.

Plate 4-4 Silt Bag with water being pumped through

Plate 4-5 Silt bag under inspection

4.7.4.10 Sedimats

Sediment entrapment mats, consisting of coir or jute matting, will be placed at the outlet of the silt bag to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

Plate 4-7 Typical Sedimat Details (Source: https://www.hy-tex.co.uk/)

4.7.4.11 Culverts

All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse.

Some culverts may be installed to manage drainage waters from works areas of the Proposed Development, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In some cases, two or more smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling does not occur above or below the culvert and water can continue to flow as necessary.

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

4.7.4.12 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone of a stream or 100m buffer zone of a lake, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the Proposed Development. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the drainage design drawings included in Appendix 4-4 (Appendix A) of this EIAR.

Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document '*Control of Water Pollution from Linear Construction Projects'* published by Construction Industry Research and Information Association (CIRIA, No. C648, 1996). Up to three silt fences may be deployed in series.

All silt fencing will be formed using Terrastop Premium or equivalent silt fence product.

Silt fences will be inspected regularly to ensure water is continuing to flow through the fabric, and the fence is not coming under strain from water backing up behind it.

4.7.4.13 Hydrocarbon Interceptors

A hydrocarbon (or petrol) interceptor is a trap used to filter out hydrocarbons from surface water runoff. A suitably sized hydrocarbon interceptor will be installed wherever it is intended to store hydrocarbons and oils (i.e., construction compounds and substation compound) or where it is proposed to park vehicles during the construction and operational phases of the proposed development (i.e., construction compounds and substation compound).

4.7.5 Drainage Management and Maintenance

A Surface Water Management Plan (SWMP) has been prepared for the proposed development. It is intended, as an accompanying document to the Construction and Environmental Management Plan

(CEMP). It compiles the proposed surface water drainage control and treatment measures, set out in the EIAR, the drainage management and maintenance measures and the proposed surface water monitoring programme, set out in the CEMP, in a single document. The SWMP is included as Appendix 4-4 of this EIAR.

The SWMP also provides details in relation to the activity specific drainage control and mitigation measures including those measures to be implemented for the following:

- Keyhole Felling
- Peat and Spoil Repository Areas Drainage
- Floating Road Drainage
- Cabling Trench Drainage
- Refuelling, Fuel and Hazardous Material Storage
- Cement Based Product Handling

4.8 Construction Phasing and Timing

It is estimated that the construction phase of the Proposed Development will take approximately 12-18 months from starting on Site to the commissioning of the electrical system. In the interest of breeding birds, construction will not commence during the bird breeding season which runs from the 1st of March to the 31st of August inclusive. Construction may commence at any stage from September onwards to the end of February, so that construction activities are ongoing by the time the next breeding bird season comes around and can continue throughout the next breeding season.

4.8.1 Construction Sequencing

The construction phase can be broken down into three main phases, which overlap partially and will take approximately 12-18 months to complete 1) civil engineering works - 9 months, 2) electrical works including grid connection works - 8 months, and 3) turbine erection and commissioning - 6 months. The main task items under each of the three phases are outlined below.

Civil Engineering Works

- Construct new Site roads to temporary compound.
- Clear and hardcore area for temporary Site offices. Install same.
- Construct bunded area for oil storage.
- Construct new Site roads and hard-standings and crane pads.
- Construct drainage ditches, culverts etc. integral to road construction.
- Excavate for turbine bases. Place blinding concrete to turbine bases. Fix reinforcing steel and anchorage system for tower section. Construct shuttering. Fix any ducts etc. to be cast in. Pour concrete bases. Cure concrete. Remove shutters after 1-2 days.
- Excavate trenches for Site cables, lay cables and backfill. Provide ducts at road crossings.
- Backfill tower foundations and landscape with previously stored topsoil.
- Complete Site works, reinstate Site.
- Remove temporary Site offices. Provide any gates, landscaping, signs etc. which may be required.

Electrical Works

- Construct bases/plinths for substation building.
- Install external electrical equipment at substation.
- Install transformer at compound.
- Erect stock proof and palisade fencing around substation area.
- Install internal collector network and communication cabling.

- Construct grid connection cabling.

Turbine and Meteorological Mast Erection

- Erect towers, nacelles and blades.
- Complete electrical installation.
- Grid connection.
- Install meteorological mast.
- Commission and test turbines.
- Complete Site works, reinstate Site.
- Remove temporary Site offices. Provide any gates, landscaping, signs etc. which may be required.

The phasing and scheduling of the main construction task items are outlined in Figure 4-28 below, where the 1st January has been selected as an arbitrary start date for construction activities.

			Year 1				Year 2			
ID	Task Description	Duration (months)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Mobilisation	1								
2	Set-up Construction Compound	1								
3	Construct Roads	6								
4	Turbine Foundations	4								
5	Site Ducting	4								
6	Site Cabling	4								
7	Turbine Delivery	2								
8	Turbine Erection	3								
9	Turbine Commissioning	3								
10	Site Substation Civils	4								
11	Grid Connection Cable Civils	3								
12	Substation electrical fit-out	4								
13	Grid Connection cable and jointing	3								
14	Substation Commissioning	3								
15	Power on	1								
16	Commissioning	3								
17	Operational	0								

Figure 4-28 Indicative Construction Schedule

4.8.2 Construction Phase Monitoring and Oversight

The requirement for a Construction and Environmental Management Plan (CEMP) to be prepared in advance of any construction works commencing on any development site and submitted for agreement to the Planning Authority is now well-established. The proposed procedures for the implementation of the mitigation measures outlined in such a CEMP and their effectiveness and completion is typically audited by the Ecological Clerk of Works (ECoW) on behalf of the Project Developer, in an and objective manner. The basis for auditing is presented in Section 6 of the CEMP which effectively lists all mitigation measures prescribed in any of the planning documentation. The first assessment is a simply Yes/No question, has the mitigation measure been employed on-site or not? Following confirmation that the mitigation measure has been implemented, the effectiveness of the mitigation measures has to be the subject of regular review and audit during the full construction stage of the project. If some remedial actions are needed to improve the effectiveness of the mitigation measure, then these are notified to the site staff immediately during the audit site visit, and in writing by way of the circulation

of the findings of the audit. Depending on the importance and urgency of rectifying the issue, the construction site manager is given a timeframe by when the remedial works need to be completed.

A CEMP has been prepared for the Proposed Development and is included in Appendix 4-3 of this EIAR. The CEMP includes details of drainage, spoil management, waste management etc, and describes how the above-mentioned audit will function and how the findings are presented.

In the event planning permission is granted for the Proposed Development, the CEMP will be updated prior to the commencement of the development, to address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned and will be submitted to the Planning Authority for written approval.

The on-site construction staff will be responsible for implementing the mitigation measures specified in the EIAR and compiled in Section 6 of the CEMP. Their implementation will be overseen by the ECoW or supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation. The system of auditing referred to above ensures that the mitigation measures are maintained for the duration of the construction phase, and into the operational phase where necessary.

4.9 Construction Methodologies

4.9.1 Keyhole Forestry Felling

As part of the proposed development, keyhole felling of forestry will be required within and around the development footprint to enable the construction of turbine bases, access roads and the other ancillary infrastructure. Felling is also required around turbine bases for the reduction of potential effects on bats (refer to Appendix 6-2 of this EIAR). A total of 9.7 hectares of forestry will be permanently felled within and around the footprint of the Proposed Development in order to facilitate infrastructure construction and turbine erection.

The proposed methodology for the forestry felling activities is as follows:

Felling works will conform to current best practice Forest Service policies and strategic guidance documents as well as Coillte produced guidance documents, including the specific guidelines listed below, to ensure that the felling works provides minimal potential impacts to the receiving environment.

- 'Standards for Felling and Reforestation' (Department of Agriculture, Food and the Marine, 2019)
- 'Forest Operations & Water Protection Guidelines' (Coillte, 2009)
- 'Methodology for Clear Felling Harvesting Operations' (Coillte, 2009)
- 'Forestry and Water Quality Guidelines' (Forest Service, 2000)
- 'Forestry Biodiversity Guidelines' (Forest Service, 2000)
- 'Forestry Protection Guidelines' (Forest Service, 2002)
- 'Forestry Harvesting and Environmental Guidelines' (Forest Service, 2000)

The proposed methodology for the forestry felling activities is as follows:

- The extent of all necessary forestry felling areas will be identified and demarcated with markings on the ground in advance of any felling commencing.
- All roads and culverts will be inspected by the ECoW and contractor prior to any machinery being brought on site to commence the felling operation.
- Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt/sediment traps (ie. check dam / silt fence) will be constructed to ensure collection of all silt within felling areas. These temporary silt traps will be cleaned out and backfilled once felling works are complete. This ensures

there is no residual collected silt remaining in blocked drains after felling works are completed.

- New collector drains and sediment traps will be installed during ground preparation to intercept water upgradient of felling areas and divert it away. Collector drains will be excavated at an acute angle to the contour (0.3%-3% gradient), to minimise flow velocities.
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated.
- Sediment removed from traps will be carefully disposed of in the peat repository areas.
- Machine combinations (i.e. hand-held or mechanical) will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance; however, the general proposed machine combination will comprise a harvester and a low-ground pressure harvester with a 14-tonne bunk capacity.
- Trees will be cut manually inside the 50m construction watercourse buffer and using machinery to extract whole trees only;
- Brash mats will be put in place to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur.
- Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.
- No tracking of vehicles through watercourses will occur. Vehicles will only use existing road infrastructure and established watercourse crossings.
- Brash which has not been pushed into the soil may be moved to facilitate the creation of mats elsewhere within the site.
- Extraction routes, and hence brash mats, will be aligned parallel to the ground contours where possible.
- Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone prior to removal off site to authorised saw mills.

4.9.2 Turbine Foundations

Each of the turbines to be erected on the Proposed Development site will have a reinforced concrete base that is installed below the finished ground level. The turbine foundation may be formed using piling methods or on competent strata (i.e bedrock or subsoil of sufficient load bearing capacity). Where the ground conditions do not have a competent stratum of sufficient load bearing capacity, piling methods will be utilised. Overburden will be stripped off the foundation area to a suitable formation using a 360º excavator and will be stored locally for later reuse in backfilling around the turbine foundation. A two-metre-wide working area will be required around each turbine base, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be sealed using the back of the excavator bucket and surrounded by silt fences to ensure sediment-laden run-off does not occur.

The formation material will have to be approved by an engineer as meeting the turbine manufacturer's requirements. If the formation level is reached at a depth greater than the depth of the foundation, the ground level will have to be raised with clause 804 or similar hardcore material, compacted in 250 millimetres (mm) layers, with sufficient compacted effort (i.e. compacted with seven passes using 12 tonne roller). Drainage measures will be installed to protect the formation by forming an interceptor drain around the perimeter of the base which will outfall out at the lowest point level spreader or settlement pond.

An embankment approximately 600 mm high will be constructed around the perimeter of each turbine base and a fence will be erected to prevent construction traffic from driving into the excavated hole and

to demarcate the working area. All necessary health and safety signage will be erected to warn of deep excavations etc. Access to and from excavated bases will be formed by excavating a pedestrian walkway to 1:12 grade.

There will be a minimum of 100 mm of blinding concrete laid on the formation material positioned using concrete skip and 360° excavator to protect ground formation and to give a safe working platform.

The anchor cage is delivered to the Proposed Development site in 2 or more parts depending on the turbine type. A 360° excavator or crane with suitable approved lifting equipment will be used to unload sections of the anchor cage and reinforcing steel. The anchor cage is positioned in the middle of the turbine base and is assembled accordingly. When the anchor cage is in final position it is checked and levelled by using an appropriate instrument. The anchor cage is positioned 250mm – 300mm from formation level by use of adjustable legs. Reinforcement bars are then placed around the anchor cage, first radial bars, then concentric bars, shear bars and finally the superior group of bars. Earthing material is attached during the steel foundation build up. The level of the anchor cage will be checked again prior to the concrete pour and during the concrete pour.

Formwork to concrete bases will be propped/supported sufficiently so as to prevent failure. Concrete for bases will be poured using a concrete pump. Each base will be poured in three stages. Stage 1 will see the concrete being poured and vibrated in the centre of the anchor cage to bring the concrete up to the required level inside the cage. Stage 2 will see the centre of the steel foundation being poured and vibrated to the required level. Stage 3 will see the remaining concrete being poured around the steel foundation to bring it up to the required finished level. After a period of time when the concrete has set sufficiently the top surface of the concrete surface is to be finished with a power float.

Once the base has sufficient curing time it will be backfilled with suitable fill up to existing ground level and finished with the original material that was excavated.

4.9.3 Site Roads and Hardstand Areas

4.9.3.1 Construction Methodology for New Roads

The construction methodology for the proposed new access roads is outlined, as stated in the Peat Management Plan in Appendix 4-2, as follows:

1. Excavation of the new access road to competent strata (see Section 6 of the Peat and Spoil Management Plan for guidance on correctly handling and storing the different peat layers). Maximum excavation side slopes will be 1:1.5.
    a. Drainage shall be installed to divert surface and groundwater from the construction areas.
2. A layer of geogrid/geotextile may be required at the base of the excavation. To be confirmed at detailed design stage.
3. Placement of granular fill-in layers following the designer's specification. The fill thickness is 200mm above the existing ground level, in addition to the fill thickness required to backfill the excavation to a suitable competent strata below the existing ground level.
4. Access roads are to be finished with a granular running surface across the full width of the road.

The general methodology to construct new floating roads (i.e. See Detail B of the road construction detail drawings presented in Appendix B of the Peat and Spoil Management Plan) is presented below.

1. Placement of a geotextile or geogrid directly onto the peat surface following the designer's specification.

2. Placement of granular fill up to 800mm and reinforcing geogrids in layers following the designer's specification, with due regard to any settlement and deformation of peat anticipated at the access track.
    a. Cross-drains shall be installed within the road to divert surface and groundwater from upslope to downslope.
    b. Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road in a manner that will avoid excessive impact loading on the peat due to concentrated end-tipping. Direct tipping of stone onto the peat shall not be carried out.
    c. Stone will be spread and placed from the constructed floating road onto the peat surface using a bulldozer.
3. Access roads are to be finished with a granular running surface across the full width of the road.

No excavations (e.g. drainage, peat cuttings) shall be carried out within 5m of a completed floated access road edge or at a distance determined following a site inspection by the Project Geotechnical Engineer.

The presence of excavations can destabilise the road. Where required, for example for the installation of internal cabling offset from the footprint of the floated road, temporary excavations will be excavated in short lengths and backfilled as soon as practicable. These works will be designed and supervised by Project Geotechnical Engineer.

Spoil materials can be used for landscaping along the edge of access road sections to aid with the restoration of the peatland areas and embed the access roads into the surrounding environment where slope and ground conditions allow, limiting their ecological and environmental impact. Consideration needs to be given to the placement of excavated materials in areas of potential instability or additional mitigation requirements, as highlighted in the PSRA (GDG, 2023). Where permissible, excavated materials will be placed to a maximum height of 1m and stockpile widths of a minimum of 2 to 3m unless site-specific detail designs allow larger volumes to be placed. Large stockpiles of materials shall not be placed on or adjacent to floated access roads to avoid bearing failure of the underlying peat.

Peat placement or landscaping will be carried out only in areas where it is topographically contained and does not create a propagated landslide risk – see PSRA (GDG, 2023).

For this development, particular buffer areas including construction buffers have been highlighted in the PSRA (GDG, 2023) and are presented in Appendix A of the Peat and Spoil Management Plan.

4.9.3.2 Construction Methodology to Upgrade Existing Roads

The general methodology to upgrade existing founded roads (i.e. See Detail C of the road construction detail drawings presented in Appendix B of the PMP) is presented below.

1. Excavation on one or both sides of the existing access road to competent strata.
2. Placement of granular fill up to 800mm and reinforcing geogrids in layers following the designer's specification, with due regard to any settlement and deformation of peat anticipated at the access track.
3. Overlay of the existing access road with selected granular fill following the designer's specification.
    a. Where coarse granular fill has been used in the existing floated access road makeup, a layer of geogrid should be placed on top of the existing floated access road.
4. Access roads are to be finished with a granular running surface across the full width of the road.
    a. A layer of geogrid/geotextile may be required at the surface of the existing access road following the designer's specification.

The general methodology to upgrade existing floating roads (i.e. See Detail D of the road construction detail drawings presented in Appendix B of the Peat and Spoil Management Plan) is presented below.

1. Tree brash and/or a geotextile is placed on one or both sides of the existing access road directly onto the peat surface, following the designer's specification.
2. Benching of existing road and placement of granular fill and reinforcing geogrids in layers following the designer's specification, with due regard to any settlement of peat anticipated for the widened area.
    a. It may be necessary to stage the widening to maintain peat stability – i.e. to reduce the rate of placement of fill to allow the peat layers to consolidate and increase in strength.
    b. It may be necessary to anchor the geogrids into the existing roads, requiring significant benching of existing roads.
3. Overlay of the existing access road with selected granular fill following the designer's specification.
    a. Where coarse granular fill has been used in the existing floated access road makeup, a layer of geogrid should be placed on top of the existing floated access road.
    b. The surface of the existing access road should be graded/levelled before the placement of any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).
4. Access roads are to be finished with a layer of capping across the full width of the road.
    a. A layer of geogrid/geotextile may be required at the surface of the existing access road following the designer's specification.

Where there are cross slopes, any road widening works required should be carried out on the upslope side of the existing access road, where possible. Particular design details will be required at detailed design at the transitions between floating and founded roads to reduce differential settlements between the two construction types.

4.9.4 Proposed Clear-Span Watercourse Crossing

It is proposed to construct a clear-span watercourse crossing along the Proposed Development site access roads at 3 no. location using a clear-span bridge. The location of this crossings is shown on the layout drawings included in Appendix 4-1 of this EIAR. The clear-span watercourse crossing methodologies presented below will ensure that no instream works are necessary.

The standard construction methodology for the installation of a clear-span bridge watercourse crossing is as follows:

- The access road on the approach either side of the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- A foundation base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the opposite side of the watercourse for excavation and foundation installation will require the installation of a temporary pre-cast concrete or metal bridge across the watercourse to provide temporary access for the excavator. Plant and equipment will not be permitted to track across the watercourse.
- Once the foundation base has been completed, the pre-cast concrete box culvert will be installed using a crane which will be set up on the bank of the watercourse and will be lifted into place from the bank with no contact with the watercourse.

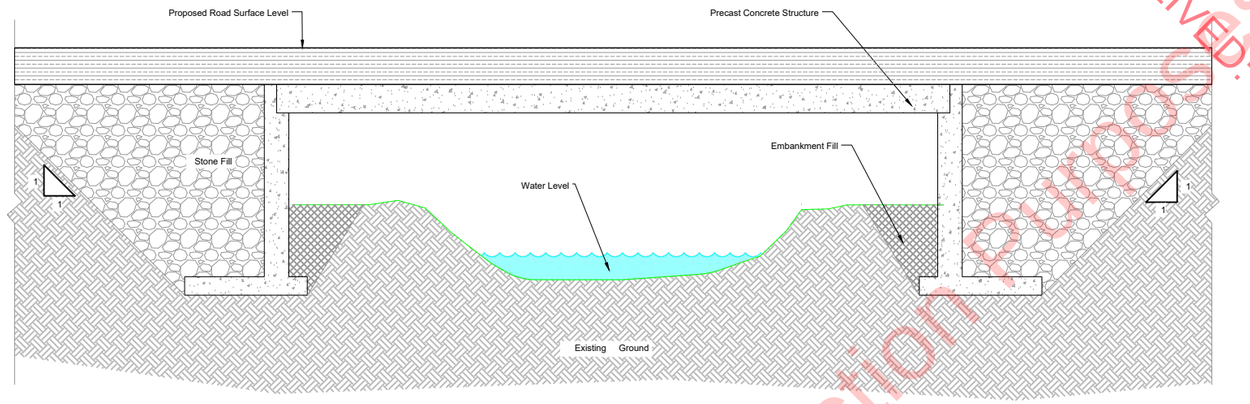
- Where the box culvert is installed in sections, the joints will be sealed to prevent granular material entering the watercourse,
- Once the crossing is in position stone backfill will be placed and compacted against the structure up to the required level above the foundations.

A standard design drawing of a pre-cast concrete, clear span crossing is shown in Figure 4-29.

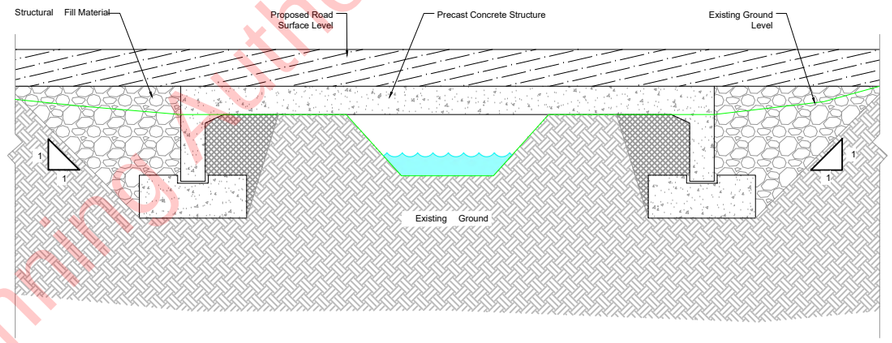
The watercourse crossing will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

Confirmatory inspections of the proposed new watercourse crossing location will be carried out by the Project Civil/Structural Engineer and the Project Hydrologist prior to the construction of the crossing.

Pre-Cast Concrete Clearspan Watercousre Crossing



Pre-Cast Concrete Bottomless Box Watercousre Crossing



DRAWING TITLE:
Clearspan Watercourse Crossing

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-29
SCALE: 1:100 @ A3	DATE: 21.09.2023

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4.9.4.1 Site Cable Trenching

The transformer in each turbine is connected to the onsite substation through a network of buried electrical cables. The ground is trenched using a mechanical excavator. The top layer of soil (or road surface) is removed and saved so that it is replaced on completion. The cables will be bedded with suitable material. The cables will be laid at a depth of approximately 1.2m below ground level; a suitable marking tape is installed between the cables and the surface (see Plate 4-7 below illustrating an example of a single cable trench). On completion, the ground will be reinstated as previously described above. The route of the cable ducts will follow the access tracks as illustrated on the site layout drawings included as Appendix 4-1 of the EIAR. The cabling may be located on either side of the road and/or within the road footprint.

Plate 4-6 Standard Cable Trench View

4.9.5 Onsite Electricity Substation and Control Buildings

The proposed onsite substation will be constructed by the following methodology:

- The area of the onsite substation will be marked out using ranging rods or wooden posts and the soil and overburden stripped and removed to a nearby spoil repository area for later use in landscaping. Any excess material will be sent to one of the on-site spoil repository areas.
- The dimensions of the onsite substation area have been designed to meet the requirements of the Eirgrid and the necessary equipment to safely and efficiently operate the Proposed Development;
- 1 no. control buildings will be built within the onsite substation compound;
- The foundations will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concrete will be laid over it. An anti-bleeding admixture will be included in the concrete mix;
- The block work walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;

- The roof slabs will be lifted into position using an adequately sized mobile crane;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.
- The electrical equipment will be installed and commissioned.
- Perimeter fencing will be erected.
- The construction and components of the substation are to Eirgrid specifications.

4.9.6 Temporary Construction Compounds

The temporary construction compounds will be constructed as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts. Drainage runs and associated settlement ponds will be installed around the perimeter;
- The compound platform will be established using a similar technique as the construction of the substation platform as discussed in Section 4.7.5 above;
- A layer of geo-grid will be installed where deemed necessary by the designer and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for Site offices and storage containers;
- A limited amount of fuel will have to be stored on the Proposed Development site and for the Grid connection in appropriately bunded containers and a bunded area for oil storage will be constructed within the compound.
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- A bunded containment area will be provided within the compound for the storage of lubricants, oils and site generators etc;
- A waste storage area will be provided within the compounds;
- The compounds will be fenced and secured with locked gates if necessary; and,
- Upon completion of the Proposed Development the temporary construction compounds will be decommissioned and allowed to vegetate naturally.

4.9.7 Grid Connection Cabling Trench

4.9.7.1 Underground Cabling Trench

The underground cabling works will consist of the installation of ducts in an excavated trench to accommodate power cables, and a fibre communications cables to allow communications between the proposed 38kV onsite substation and the existing 110kV Dallow substation.

The proposed grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from Tipperary County Council and Offaly County Council. A Traffic Management Plan (TMP) (Appendix 15-2 of this EIAR) will be agreed with the local authority prior to the commencement of the development where required. The TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with the local authority in advance of the works commencing.

The UGC will be a single circuit connection consisting of 3 no. 110mm diameter HDPE power cable ducts and 1 no. 110mm diameter HDPE communications duct to be installed in an excavated trench, typically 600mm wide by 1,220mm deep. For trench designs there will be variations on the design to adapt to service crossings and watercourse crossings.

The underground electrical cabling will be laid beneath the surface of the Proposed Development site and the public road using the following methodology:

- Before works commence, updated surveying will take place along the proposed cable route, with all existing culverts identified. All relevant bodies i.e. ESB, Tipperary County Council, Offaly County Council etc. will be contacted and all up to date drawings for all existing services sought.
- When the cable is located on public roads, a traffic management plan will be prepared prior to any works commencing. A road opening licence will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.
- A tracked 360-degree excavator will then proceed to dig out the proposed trench, typically to a depth of 1200mm, within which the ducts will be laid.
- The cable ducts will be concrete surrounded where they pass under the public road and under drains or culverts.
- Trench supports will be installed, or the trench sides will be benched or battered back where appropriate and any ingress of ground water will be removed from the trench using submersible pumps, fitted with appropriate silt filtration systems, to prevent contamination of any watercourse.
- Once the trench has been excavated, a base-layer will be laid and compacted, comprising Clause 804, or 15 Newton CBM4 concrete as required.
- The ducting will be installed as per specification, with couplers fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions, the ends of the ducts will be shimmed up off of the bed of the trench, to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected. Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- As the works progress, the as-built location of the ducting will be recorded using a total station or GPS.
- As per the associated base-layer (Clause 804 material or 15 Newton CBM4 concrete) will be installed and compacted as per approved detail, with care not to displace the ducting.
- Spacers will be used to ensure that the correct cover is achieved at both sides of the ducting.
- The remainder of the trench will be backfilled in two compacted layers with approved engineer's specified material.
- Yellow marker warning tape will be installed across the width of the trench, at 300mm depth,
- The finished surface is to be reinstated, as per original specification. Off-road cabling may be finished with granular fill to facilitate access to the trench for any potential maintenance that is required during the operational phase of the Proposed Development.
- Marker posts will then be placed at regular intervals (generally at joint bays and any change in direction) to denote the location of the underground power cables.

4.9.7.2 Existing Underground Services

In order to facilitate the installation of an underground grid connection, it may be necessary to relocate existing underground services such as water mains or existing cables. In advance of any construction activity, the contractor will undertake additional surveys of the proposed route to confirm the presence or otherwise of any services. If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works.

If existing low voltage underground cables are found be present, a trench will be excavated, and new ducting and cabling will be installed along the new alignment and connected to the network on either end. The trench will be backfilled with suitable material to the required specification. Warning strip and marking tape will be laid at various depths over the cables as required. Marker posts and plates will be

installed at surface level to identify the new alignment of the underground cable, the underground cables will then be re-energised.

In the event that water mains are encountered the water supply will be turned off by the utility so work can commence on diverting the service. The section of existing pipe will be removed and will be replaced with a new pipe along the new alignment of the service. The works will be carried out in accordance with the utility standards.

4.9.7.3 Joint Bays

Joint bays are typically pre-cast concrete chambers where lengths of cable will be joined to form one continuous cable. They will be located at various points along the ducting route generally between 700 to 1100 metres intervals or as otherwise required by ESB/Eirgrid and electrical requirements. Joint Bays are typically 2.5m x 6m x 1.75m pre-cast concrete structures installed below finished ground level.

Where possible, joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. Joint Bays will be located in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this may not always be possible. During construction the joint bay locations will be completely fenced off once they have been constructed they will be backfilled until cables are being installed. Once the cabling is installed the joint bays will be permanently backfilled with the existing surface re-instated and there will be no discernible evidence of the joint bay on the ground.

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between the onsite 38kV substation and the existing 110kV Dallow substation. Earth Sheath Link Chambers are also required approximately every second joint bay along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground power cables, installed in a flat formation, so that the circulating currents and induced voltages are eliminated or reduced. Earth Sheath Link Chambers and Communication Chambers are located in close proximity to Joint Bays. Earth Sheath Link Chambers and Communication Chambers will be pre-cast concrete structures with an access cover at finished surface level. The locations of the joint bays and chambers are shown on the site layout drawings included in Appendix 4-1 of this EIAR.

The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers within the curtilage of the public road is subject to approval by ESBN and Eirgrid.

4.9.7.4 Underground Cable Watercourse/Culvert/Service Crossings

There is a total of 7 no. identified watercourse and existing culvert/drain crossings along the proposed Grid connection underground electrical cabling route, of which 4 no. are EPA/OSI mapped crossings. The remaining crossings are classified as culverts over minor channels or manmade drains.

The construction methodology for the 4 no. EPA/OSI mapped crossings has been designed to eliminate the requirement for in-stream works on these locations requiring a crossing to be constructed to traverse the watercourse with the cabling ducts. A general description of the various construction methods employed at watercourse/ culvert/ drain crossings are described in the following paragraphs below. A list of the mapped crossings along the underground electrical cabling route and the proposed crossing method is provided in Table 4-3 below. The EPA/OSI mapped crossing locations are shown in Figure 4-30.

In the event that an unidentified existing culvert/drain crossing is located during the construction phase, the most appropriate proposed crossing methodology, as outlined below, will be used to traverse the watercourse/culvert/drain.

The crossing methodologies employed at the other culvert and manmade drain crossings along the underground electrical cabling route, will be selected from the suite of watercourse crossing options outlined below, as appropriate, depending on culvert type, depth, size and local ground conditions.

The crossing locations for the culvert and drain crossing locations along the underground electrical cabling route are shown on the site layout drawings included in Appendix 4-1 of this EIAR.

Should an alternative methodology option be required for individual crossings during the construction process this will be agreed with the relevant authorities including Tipperary County Council and Offaly County Council prior to works commencing.

Where culverts require upgrading, the Applicant will commission a survey of culverts, the results of which will inform the exact details of the upgrade works which will be forwarded to the relevant Local Authority. Having regard to the duration of the consent requested (10 years) it is considered best practice that any such surveys be carried out prior to construction to facilitate accuracy and timely reporting of the surveys.

Inland Fisheries Ireland have published guidelines relating to construction works along water bodies entitled "*Requirements for the Protection of Fisheries Habitats during Construction and Development Works at River Sites*", and these guidelines will be adhered to during the construction of the Proposed Development.

4.9.7.4.1 Standard Formation Crossing over Culvert – Option A

Where adequate cover exists above a culvert, the standard aforementioned trench arrangement will be used where the cable ducts pass over a culvert without any conflict with the existing culvert or water course. The cable trench will pass over the culvert in a standard trench as outlined in Figure 4-31.

Where no crossing currently exists, the cable will pass over the watercourse in a bottomless box culvert or pre-cast concrete slab in a standard trefoil arrangement. Where required existing culvert crossings will be extended using appropriately sized corripipe (see Section 4.3.3 above).

4.9.7.4.2 Standard Formation Crossing under Culvert – Option B

Where the culvert consists of a socketed concrete or sealed plastic pipe and sufficient depth is not available over the crossing, a trench will be excavated beneath the culvert and cable ducts will be installed in the standard formation 300mm below the existing pipe, as outlined in Figure 4-32.

4.9.7.4.3 Shallow Formation Crossing over Culvert – Option C

Where cable ducts are to be installed over an existing culvert and sufficient cover cannot be achieved, the ducts will be laid in a much shallower trench, the depth of which will be determined by the cover available at the culvert crossing location. The ducts within the shallow formation trench will be encased in 6mm thick steel galvanized plates and backfilled with 35N concrete.

Where sufficient deck cover is not available to fully accommodate the required ducts, it may be necessary to locally raise the footpath level if present, or to locally raise the pavement level. Should the footpath or pavement level be increased, the parapet wall levels will also increase to facilitate the raise in pavement level if required. Any addition of a new pavement will be tied back into the existing road pavement at grade. This method of duct installation is further detailed in Figure 4-33.

4.9.7.4.4 Directional Drilling – Option D

In the event that none of the above methods are appropriate, directional drilling (DD) will be utilised.

DD is a method of drilling under obstacles such as bridges, culverts, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible.

The DD method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, for the directional drilling at watercourse/culvert crossings listed in Table 4-3 below. The launch and reception pits will be approximately 0.55m wide, 2.5m long and 1.5m deep. The pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water is pumped through the centre of the drill rods to the reamer head and is forced in to void and enables the annulus which has been created to support the surrounding subsoil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any adverse impacts arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the Site in the same manner as other subsoil materials associated with the drilling process to a licensed recovery facility.

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. Sufficient controls and monitoring will be put in place during drilling to prevent frack-out, such as the installation of casing at entry points where reduced cover and bearing pressure exits. The directional drilling methodology is further detailed in Figure 4-34.

4.9.7.5 Other Directional Drilling Locations

A protected limestone, disused railway bridge (RPS Reg No. 22400514), which formed part of the Parsonstown to Portumna Railway Line is located along the proposed underground grid connection route in the townland of Ballyloughnane, Co. Tipperary. The railway line is no longer in use and the bridge underpass has been infilled with earth since the abandonment of the railway line.

It is proposed to cross beneath this structure using the DD method described in Section 4.9.7.4.4 above.

An agricultural underpass used for the movement of livestock beneath the L1077 local road is located along the proposed underground in the townland of Croghan, Co. Tipperary.

It is proposed to cross beneath this structure in a flatbed formation method described in Section 4.9.7.4.3 above.

In the event that a previously unidentified crossing is located during the construction phase, the most appropriate proposed crossing methodology, as outlined above, will be used to traverse the crossing. The proposed crossing methods for both locations are provided in Table 4-4 below and shown in Figure 4-30.

Map Legend

- EIAR Site Boundary
- Watercourse Crossings
- Old Railway Bridge Crossing
- Farm Underpass Crossing
- Dallow 110kV Substation

Drawing Title
Proposed Watercourse and Non-watercourse Crossings

Project Title
Carrig Renewables Wind Farm Development

Drawn By	Checked By
JF	EM
Project No.	Drawing No.
211016	Fig. 4-30
Scale	Date
1:30,000	2023-09-21

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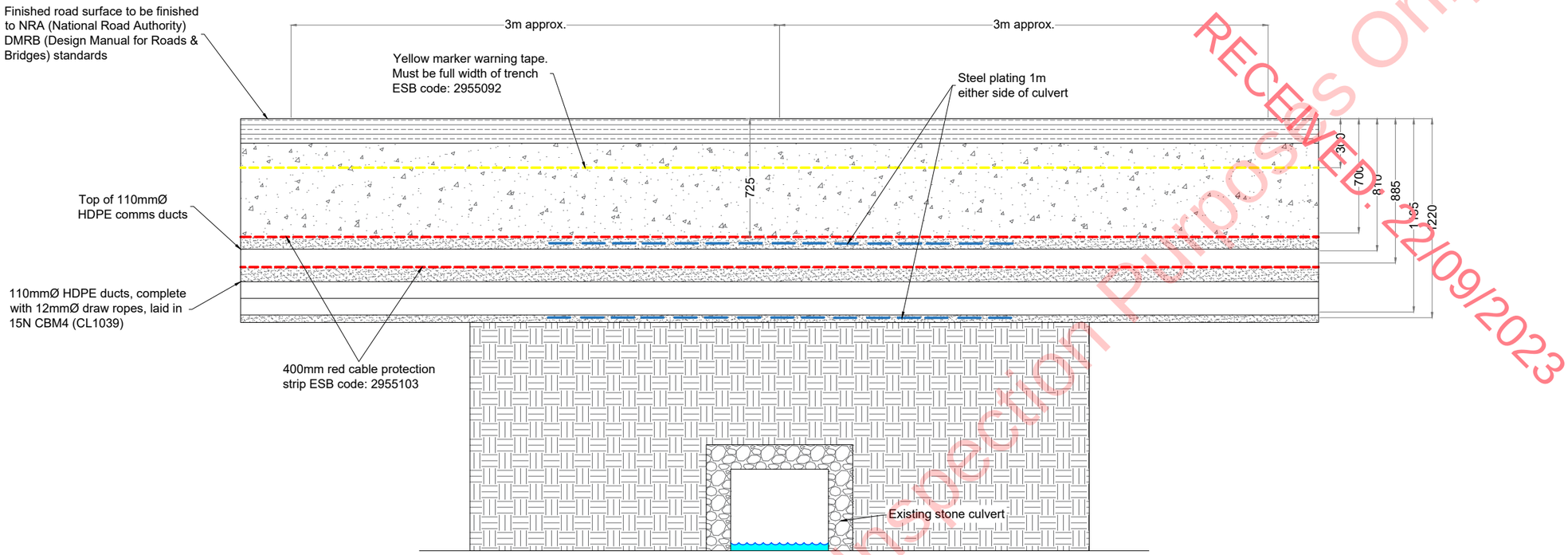
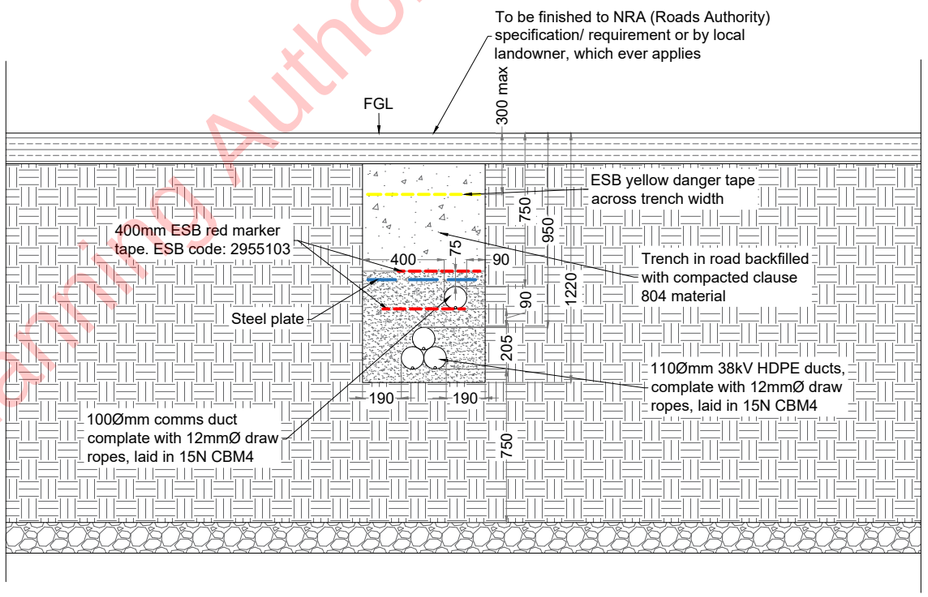


Longitudal section at watercourse crossing



Cross section at watercourse crossing

DRAWING TITLE:
Standard Formation Crossing over Culvert - Option A

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-31
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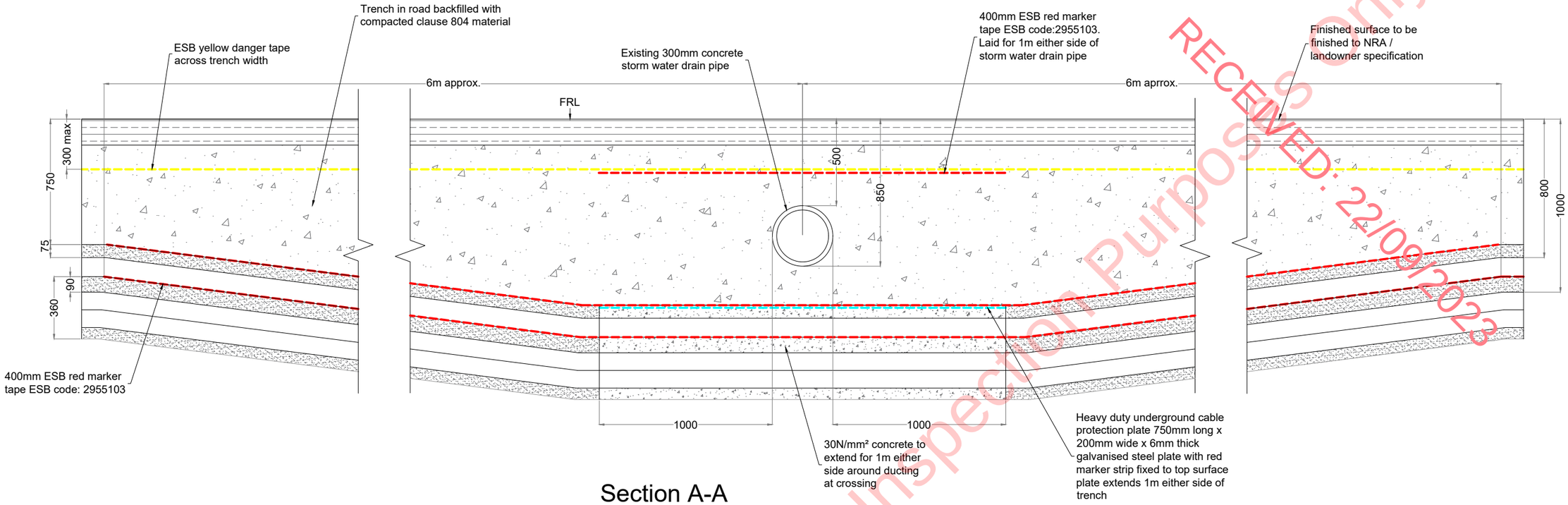

Section A-A

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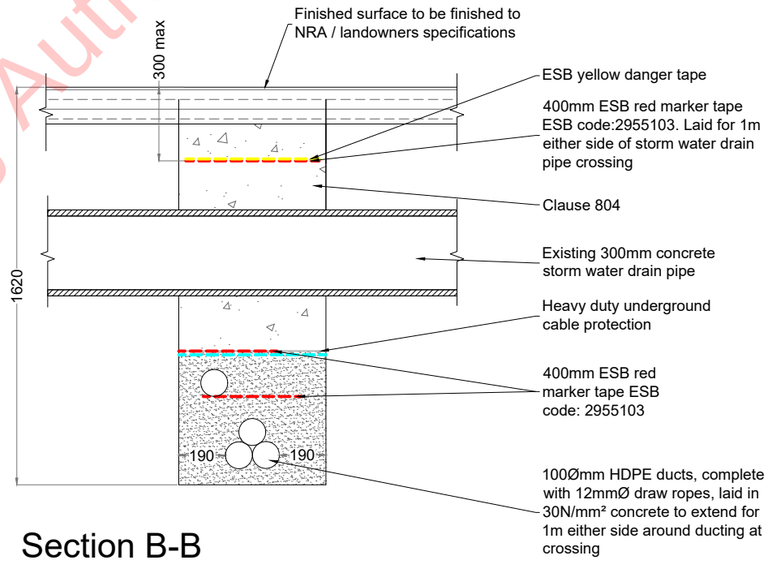

Section B-B

Scale 1:25

DRAWING TITLE:
Standard Formation Crossing over Culvert - Option B

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-32
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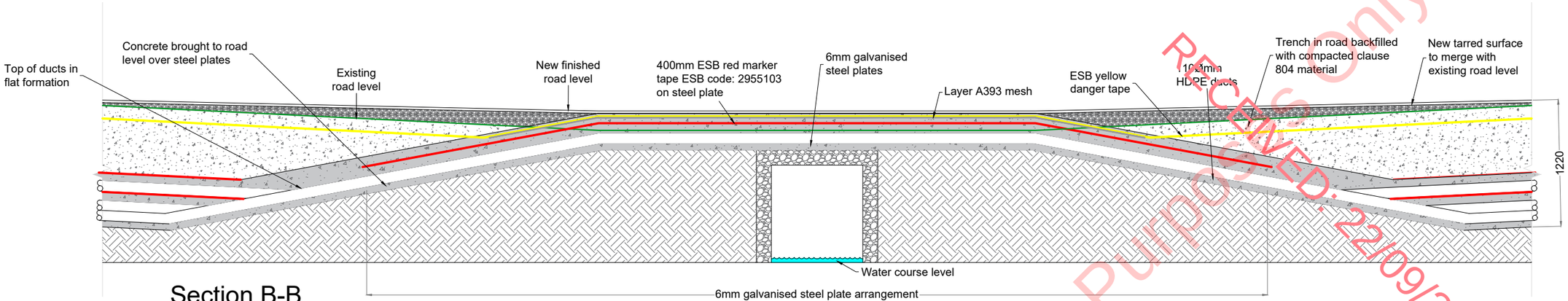

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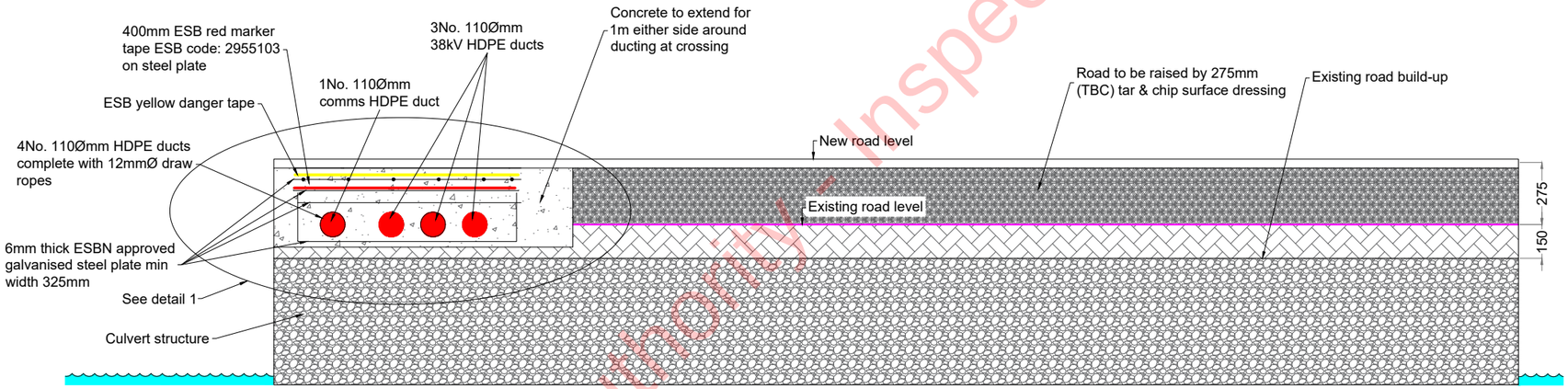

Section A-A

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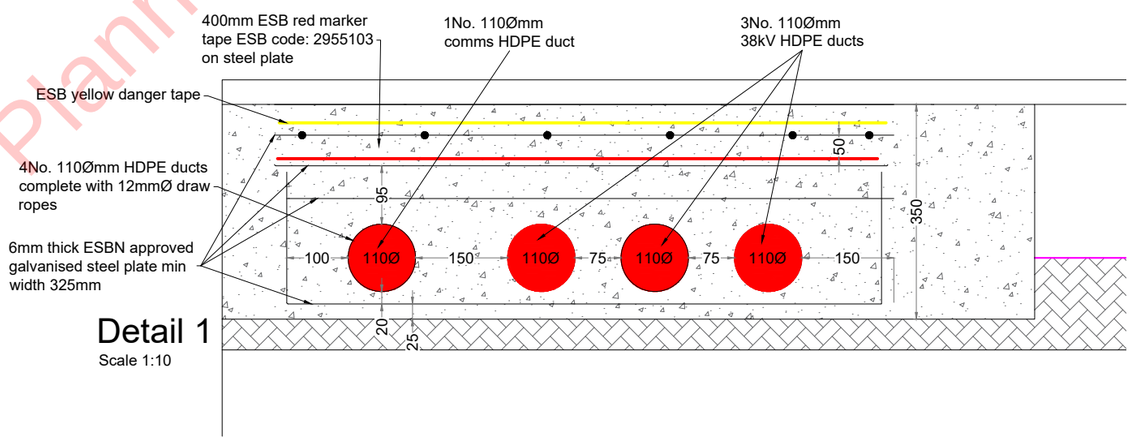

Detail 1

Scale 1:10

DRAWING TITLE:
Standard Formation Crossing over Culvert - Option C

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
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PROJECT No.: 211016	DRAWING No.: Figure 4-33
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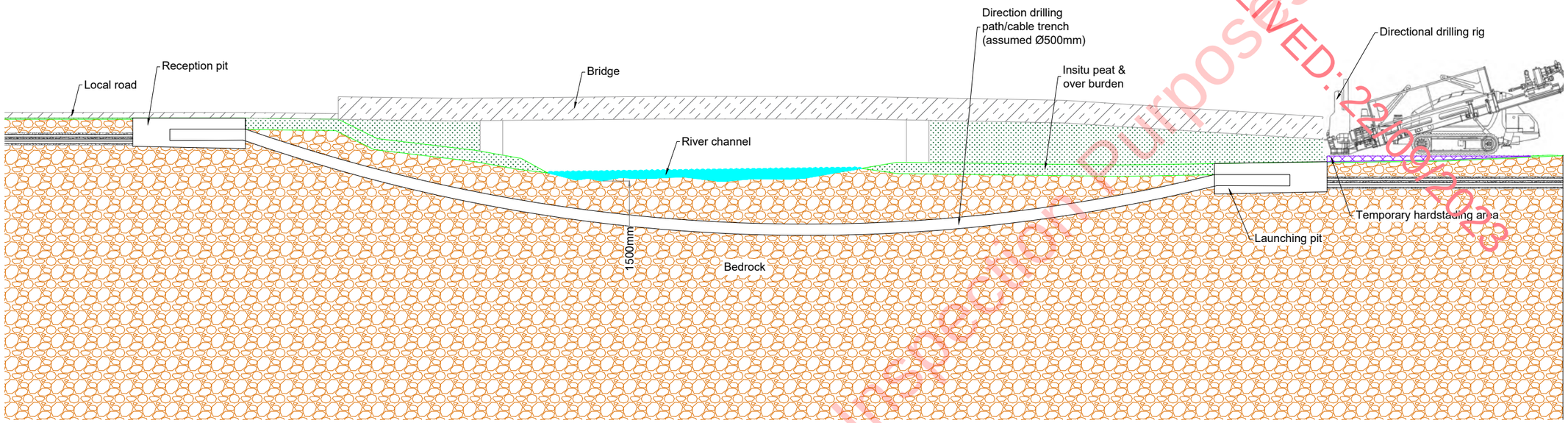

Typical Directional Drilling Rig

Typical Drilling Rig & Launch Pit

DRAWING TITLE:
Horizontal Directional Drilling - Option D

PROJECT TITLE:
Proposed Carrig Renewables Wind Farm, Co.Tipperary / Co. Offaly

DRAWING BY:	CHECKED BY:
KD	EMC/JW
PROJECT No.: 211016	DRAWING No.: Figure 4-34
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Table 4-3 Underground Electrical Cabling Route – Watercourse Crossings Methodology

Watercourse Crossing Reference No.	Watercourse Type	Width of Channel (m)	Cover from Road Level to Top of Culvert (m)	Crossing Option Description	Watercourse Crossing Option	Extent of In-Channel Works
1	Stone Arch Bridge	3m	0.35m	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling. This crossing methodology will ensure that no contact will be made with the watercourse during the works.	Option D	None. No in-stream works required.
2	Concrete Drain	1.8m	0.6m	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling. This crossing methodology will ensure that no contact will be made with the watercourse during the works.	Option D	None. No in-stream works required.
3	Concrete Drain	2.8m	1.8m	Where adequate cover exists above a culvert, the standard aforementioned trench arrangement will be used where the cable ducts pass over a culvert without	Option A	None. No in-stream works required.

				any contact with the existing culvert or water course. The cable trench will pass over the culvert in a standard trench.		
4	Stone Arch Bridge (3 Arches)	15m	0.55m	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling. This crossing methodology will ensure that no contact will be made with the watercourse during the works.	Option D	None. No in-stream works required.
5	Stone Arch Bridge	2.9m	2.15m	Where adequate cover exists above a culvert, the standard aforementioned trench arrangement will be used where the cable ducts pass over a culvert without any contact with the existing culvert or water course. The cable trench will pass over the culvert in a standard trench.	Option A	None. No in-stream works required.
6	Stone Arch Bridge	3m	0.9m	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling.	Option D	None. No in-stream works required.

				This crossing methodology will ensure that no contact will be made with the watercourse during the works.		
7	PVC Pipe	1.2	1.4m	Where adequate cover exists above a culvert, the standard aforementioned trench arrangement will be used where the cable ducts pass over a culvert without any contact with the existing culvert or water course. The cable trench will pass over the culvert in a standard trench.	Option A	None. No in-stream works required.

Table 4-4 – Disused Railway Bridge (1) and Agricultural Underpass (2) – Crossing Methodologies

Crossing Reference No.	Structure Type	Cover from Road Level to Top of Structure (m)	Crossing Option Description	Cable Crossing Option
1	Disused Stone Arch Railway Bridge	N/A	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling. This crossing methodology will ensure that no contact will be made with the watercourse during the works.	Option D
2	Concrete Underpass	1m	Where cable ducts are to be installed over an existing culvert and sufficient cover cannot be achieved, the ducts will be laid in a much shallower trench, the depth of which will be determined by the cover available at the culvert crossing location. The ducts within the shallow formation trench will be encased in 6mm thick steel galvanized plates and backfilled with 35N concrete. Where sufficient deck cover is not available to fully accommodate the required ducts, it may be necessary to locally raise the footpath level if present, or to locally raise the pavement level. Should the footpath or pavement level be increased, the parapet wall levels will also increase to facilitate the raise in pavement level if required. Any addition of a new pavement will be tied back into the existing road pavement at grade.	Option C

4.10 Operation

The Proposed Development is expected to have a lifespan of approximately 35 years. As part of the Proposed Development site planning application, permission is being sought for a 35-year operation period commencing from the date of full operational commissioning of the Proposed Development. During the operational period, on a day-to-day basis the wind turbines will operate automatically, responding by means of meteorological equipment and control systems to changes in wind speed and direction.

The wind turbines will be connected together and data relayed from the wind turbines to a central control unit at the on-site substation which will facilitate off-site remote monitoring of the wind farm. Each turbine will be monitored off-site by the appointed Operations and Maintenance contractor (typically the wind turbine manufacturer) and also a wind farm operations management company. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored off-site by both parties 24-hours per day. Regular on-site visual inspections will also be carried out by the wind farm operations management company.

Certain Proposed Development site components will be subject to routine and periodic maintenance. Each turbine would be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. In addition there is often a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Typically maintenance traffic will consist of four-wheel drive vehicles or vans. The site roads will also require periodic maintenance.

4.11 Decommissioning

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 35 years. Following the end of the operational life of the wind farm, the wind turbines may be retained and the operational life extended or replaced with a new set of turbines, subject to planning permission being obtained. In the event that neither of the above options are implemented, the Proposed Development will be decommissioned fully as agreed with the Planning Authority. The onsite substation will remain in place as it will be under the ownership of the ESB and will form a permanent part of the national electricity grid.

Upon decommissioning of the Carrig Renewables Wind Farm, the wind turbines will be disassembled in reverse order to how they were erected. The turbines will be disassembled with a similar model of crane that was used for their erection. The turbine will likely be removed from site using the same transport methodology adopted for delivery to site initially. The turbine materials will be transferred to a suitable recycling or recovery facility.

The underground electrical cabling connecting the turbines to the on-site substation will be removed from the cable ducts. The cabling will be pulled from the cable ducts using a mechanical winch which will extract the cable and re-roll it on to a cable drum. This will be undertaken at the original cable jointing pits which will be excavated using a mechanical excavator and will be fully re-instated once the cables are removed. The cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance. The cable materials will be transferred to a suitable recycling or recovery facility.

All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in unnecessary environment emissions such as noise, dust and/or vibration.

Site roadways could be in use for purposes other than the operation of the Proposed Development by the time the decommissioning of the Proposed Development is to be considered, and therefore it may be more appropriate to leave the Site roads in situ for future use. It is envisaged that the roads will provide a useful means of extracting the commercial forestry crop which exists on the Site, and as agricultural roads.

The underground grid connection cabling and on-site substation will remain in place as it will be under the ownership and control of the ESB and Eirgrid.

A Decommissioning Plan has been prepared and included as Appendix 4-5 of this EIAR, which will be agreed with the local authority prior to any decommissioning. The plan provides details of the methodologies that will be adopted, throughout decommissioning, the environmental controls that will be implemented, the Emergency Response Procedure to be adopted, methods for reviewing compliance and an indicative programme of decommissioning works.

The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agreed with the competent authority at that time. The potential for effects during the decommissioning phase of the proposed renewable energy development have been assessed in this EIAR.

As noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

> *"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".*