4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the development and its component parts which is the subject of a proposed application for planning permission to An Bord Pleanála in accordance with Section 37(e) of the Planning and Development Act 2000, (as amended) ('the proposed development'). The proposed development comprises:

1. *21 No. wind turbines with an overall blade tip height of up to 185 metres and all associated hard-standing areas.*
2. *2 No. permanent Anemometry Masts up to a height of 120 metres.*
3. *Provision of new and upgraded internal site access roads, passing bays, amenity pathways, amenity carpark and associated drainage.*
4. *2 No. permanent underpasses in the townland of Derrinlough. One underpass will be located beneath the N62 and one will be located beneath an existing Bord na Móna rail line.*
5. *1 No. 110 kV electrical substation, which will be constructed in the townland of Cortullagh or Grove. The electrical substation will have 2 No. control buildings, associated electrical plant and equipment and a wastewater holding tank.*
6. *5 No. temporary construction compounds, in the townlands of Clongawny More, Derrinlough, Derrinlough/Crancreagh, Drinagh and Cortullagh or Grove.*
7. *All associated underground electrical and communications cabling connecting the turbines to the proposed electrical substation.*
8. *2 No. temporary security cabins at the main construction site entrances in the townland of Derrinlough.*
9. *All works associated with the connection of the proposed wind farm to the national electricity grid, which will be to the existing Dallow/Portlaoise/Shannonbridge 110 kV line.*
10. *Removal of existing meteorological mast.*
11. *Upgrade of existing access and temporary improvements and modifications to existing public road infrastructure to facilitate delivery of abnormal loads including locations on the N52 and N62; construction access for delivery of construction materials at locations on the N62 and R357; operational access onto L7009 in the townland of Cortullagh or Grove and amenity access off R357 and L7005.*
12. *All associated site works and ancillary development including signage.*
13. *A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.*

The planning application for the proposed wind farm includes connection to the national electricity grid. All elements of the proposed project, including grid connection and any works required on public roads to accommodate turbine delivery, have been assessed as part of this EIAR.

This application seeks a ten-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.

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 3.3.5.1 of Chapter 3: Consideration of

Reasonable Alternatives, has been carried out to ensure that turbines and ancillary infrastructure are located in the most appropriate areas of the site.

The overall layout of the proposed development is shown on Figure 4.1. This drawing shows the proposed locations of the wind turbines, electricity substation, construction compounds, internal roads layout and the site entrances. Detailed site layout drawings of the proposed development are included in Appendix 4-1 to this EIAR.

4.3 Development Components

4.3.1 Wind Turbines

4.3.1.1 Turbine Locations

The proposed wind turbine layout has been optimised using wind farm design software (a combination of WAsP and WindPro) to maximise the energy yield from the site, while maintaining sufficient distances between the proposed turbines 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.

Table 4.1 Proposed Wind Turbine Locations and Elevations

Turbine	Irish Grid Coordinates		Top of Foundation Elevation (m OD)
	Easting	Northing	
1	207077	215344	52
2	207222	214738	53
3	206717	213317	55
4	206008	213069	52
5	207012	212792	54
6	206503	214841	55
7	205775	214884	55
8	205969	215587	57
9	206005	214306	58
10	205144	214531	54
11	205324	213991	54
12	209713	215226	50
13	209652	214472	50
14	210033	214027	51
15	210859	214353	52
16	210364	214701	51
17	210119	215941	54
18	210010	216585	53
19	209411	215693	51
20	209358	216375	51
21	209813	217056	55

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); and
- Rotor.

Plate 4.1 Wind Turbine Components

The proposed wind turbines will have a tip height of up to 185 metres. Within this size envelope, various configurations of hub height, rotor diameter and blade tip height may be used. The exact make and model of the turbine will be dictated by a competitive tender process, but it will not exceed a tip height of up to 185 metres above top of foundation. 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 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. The turbines will be multi-ply coated to protect against corrosion. It is proposed that the turbines would be of an off-white or light grey colour so as to blend into the sky background. This minimises visual impact as recommended by the following guidelines on wind energy development:

- "Wind Farm Development – Guidelines for Planning Authorities" Department of the Environment, Heritage and Local Government (DoEHLG, 2006);
- "The Influence of Colour on the Aesthetics of Wind Turbine Generators" (ETSU, 1999).

For the purposes of this EIAR, various types and sizes of wind turbines within the 185-metre tip height envelope have been selected and considered in the relevant sections of the EIAR to assess the worst-case scenario. Turbine design parameters have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport and biodiversity (specifically birds), as addressed elsewhere in this EIAR. In each EIAR section that requires the consideration of turbine parameters as part of the impact assessment, the turbine design parameters that have been used in the impact assessment are specified.

At the turbine selection stage of the project, pre-construction, new turbines models or variants may be available that were not on the market at the pre-planning and EIAR preparation stage, which would better suit the site and fit within the proposed size envelope. Should this circumstance arise, the specific parameters of the new turbines will be assessed for their compliance with the criteria set out and considered in this EIAR, the relevant guidance in place at the time and any conditions that may be attached to any grant of planning permission that might issue.

A drawing of the maximum size envelope of the proposed wind turbine is shown in Figure 4.2. Figure 4.2 also shows a typical turbine base layout, including turbine foundation, hard standing area, assembly area, access road and surrounding works area. The individual components of a typical geared wind turbine nacelle and hub are shown in Figure 4.3 below.

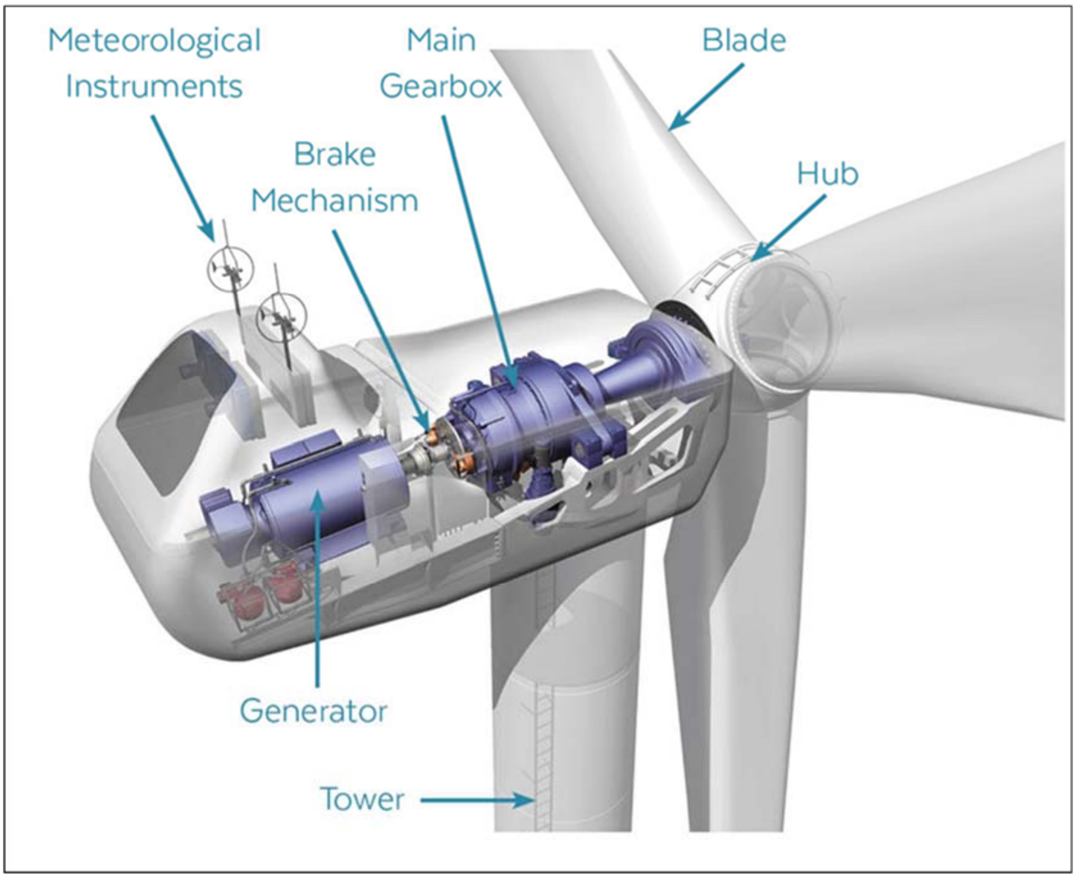

Figure 4.1 Turbine nacelle and hub components

4.3.1.3 Turbine Foundations

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground level on a granular sub-base after the excavation of soil and peat. The size of the foundation will be determined 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. The turbine foundation transmits any load on the wind turbine into the ground. The typical horizontal and vertical extent of a turbine's foundation is shown in Figure 4.2.

After the foundation level of each turbine has been formed using piling methods or on competent strata, the bottom section of the turbine tower "Anchor Cage" is levelled and reinforcing steel is then built up around and through the anchor cage (Plate 4.2 below). 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 4.3 below).

Plate 4.2 Turbine Base 'Anchor Cage'

Plate 4.3 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 to facilitate access, turbine assembly and turbine erection. The hard-standing areas are typically used to accommodate cranes used in the assembly and erection of the turbine, 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 the turbine foundation is in place. The sizes, arrangement and positioning of hard standing areas are dictated by turbine suppliers. The hard-standing area is intended to accommodate a crane during turbine assembly and erection. The proposed hard standing areas shown on the detailed layout drawings included in Appendix 4-1 to this EIAR are indicative of the sizes required, but the extent of the required areas at each turbine location may vary on-site depending on topography, position of the site access road, the proposed turbine position and 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 4.2. 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 exact location and number of assembly areas will be determined by the selected turbine manufacturer.

4.3.1.6 Power Output

It is anticipated the proposed wind turbines will have a rated electrical power output in the 3 to 5 megawatt (MW) range depending on further wind data analysis and power output modelling. Turbines of the exact same make, model and dimensions can also have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. For the purposes of this EIAR, a rated output of 4.2 MW has been chosen to calculate the power output of the proposed 21-turbine wind farm, which would result in an estimated installed capacity of 88.2 MW.

Assuming an installed capacity of 88.2 MW, the proposed development therefore has the potential to produce up to 244,924 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 31.7%[1] is applied here

C = ... Rated output of the wind farm: 88.2 MW

The 244,924 MWh of electricity produced by the proposed development would be sufficient to supply approximately 58,315 Irish households with electricity per year, based on the average Irish household using 4.2 MWh of electricity (this latest figure is available from the March 2017 CER Review of Typical Consumption Figures Decision).

4.3.2 Site Roads

4.3.2.1 Road Construction Types

To provide access within the site of the proposed development, to connect the wind turbines and associated infrastructure, approximately 29.3 kilometres of access roads will need to be constructed including the upgrade 450m of existing access road. Fehily Timoney & Company Ltd. (FTC) were appointed to assess the extent and condition of the existing site ground conditions and specify the type of road required to access all locations on site. The road construction preliminary design has taken into account the following key factors as stated in the FTC Peat and Spoil Management Plan in Appendix 4-2:

1. *Buildability considerations*
2. *Serviceability requirements for construction and wind turbine delivery and maintenance vehicles*
3. *Minimise excavation arisings*
4. *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 general road construction techniques to be considered are as follows:

- Construction of New Floating Roads over peat
- Construction of New Excavated Roads through peat
- Upgrade of Existing Tracks:
    - Existing Excavated Roads
    - Existing Floating Roads

The construction techniques proposed to be used for certain lengths of new and existing roads across the site are shown in the FTC Peat and Spoil Management Plan and are included in Section 4.9.2 below. Typical cross sections of the road types listed above are shown in Figures 4.4 to 4.7. The construction methodology for each road type is included in Section 4.9.2 below.

[1] *Energy in Ireland 2019 Report (Table 17) (SEAI, December 2019). Report available at: https://www.seai.ie/publications/Energy-in-Ireland-2019-.pdf*

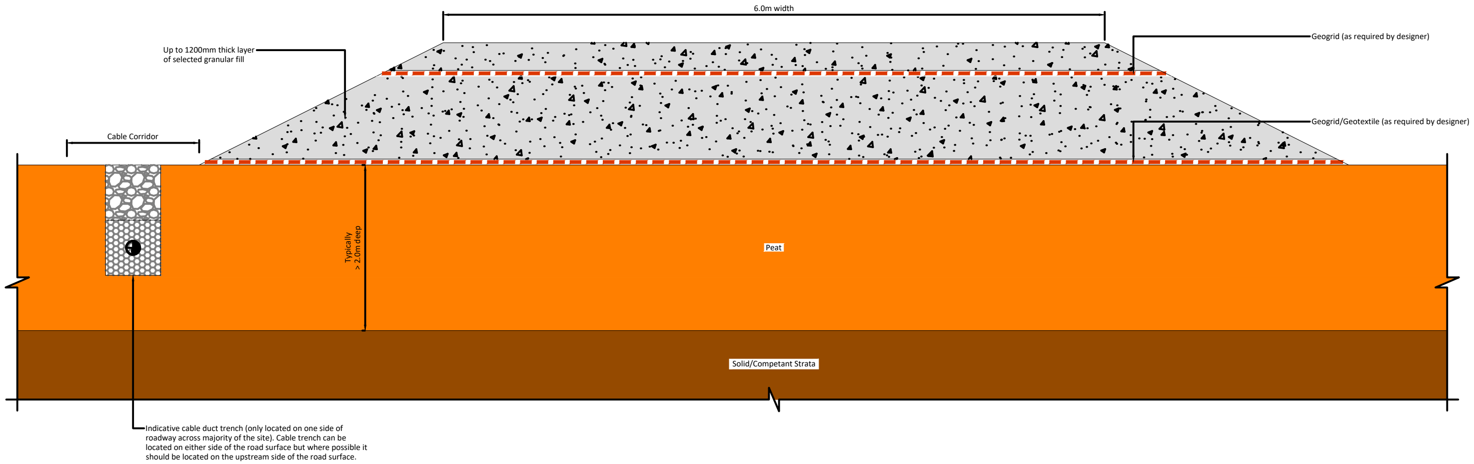

Figure 4.4

DRAWING TITLE:

Type D New Floated Access Road

PROJECT TITLE:

Derrinlough Wind Farm, Co. Offaly

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 171221	DRAWING No.: 171221 - 44
SCALE: 1:50 @ A3	DATE: 18.02.2020

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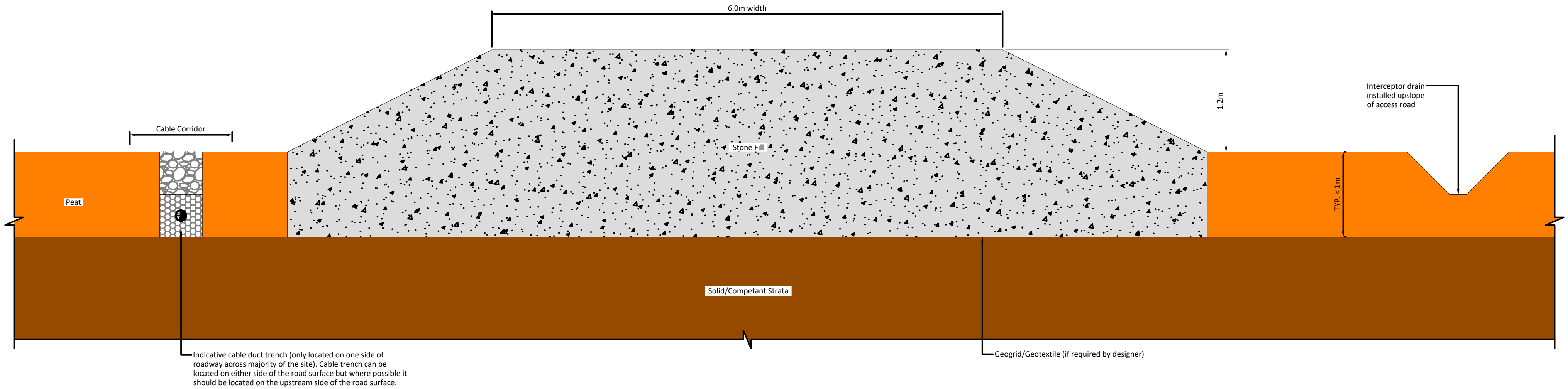

Figure 4.5

DRAWING TITLE: Type C New Excavate and Replace Access Road	
PROJECT TITLE: Derrinlough Wind Farm, Co. Offaly	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 171221	DRAWING No.: 171221 - 43
SCALE: 1:50 @ A3	DATE: 18.02.2020

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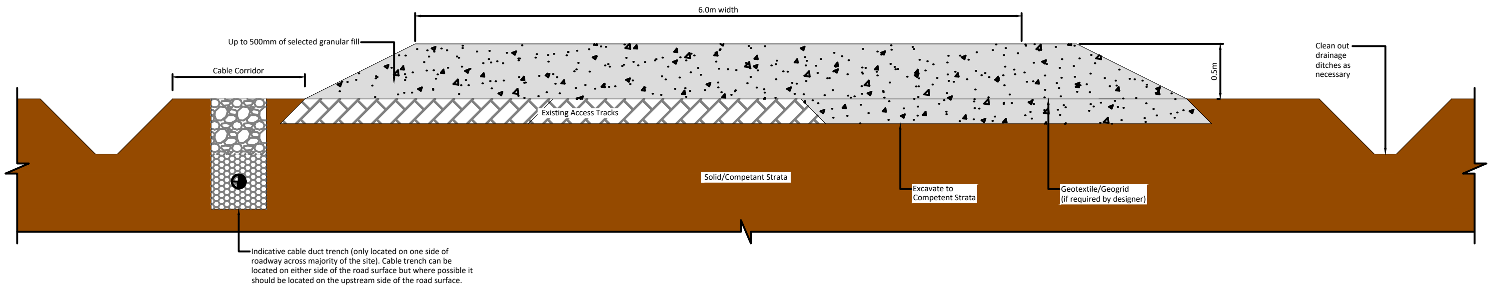

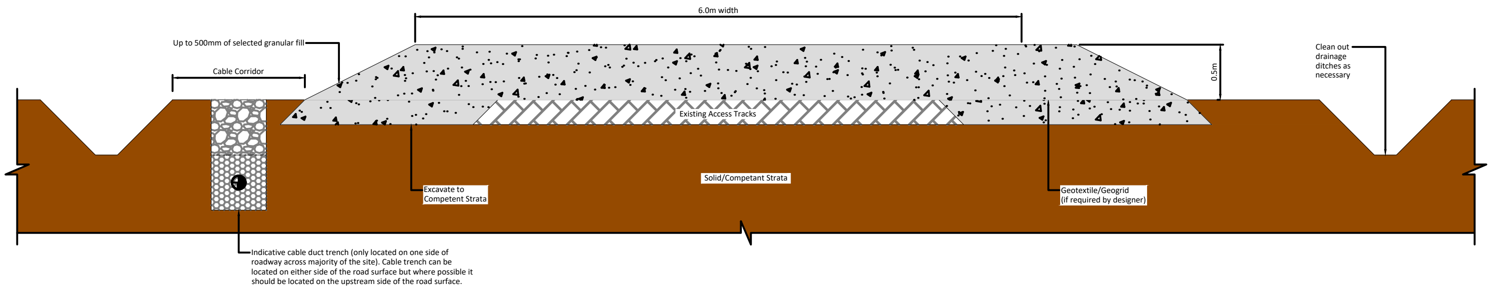

Figure 4.6

DRAWING TITLE:
Type A Upgrade of Existing Excavated Access Tracks

PROJECT TITLE:
Derrinlough Wind Farm, Co. Offaly

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 171221	DRAWING No.: 171221 - 41
SCALE: 1:50 @ A3	DATE: 18.02.2020

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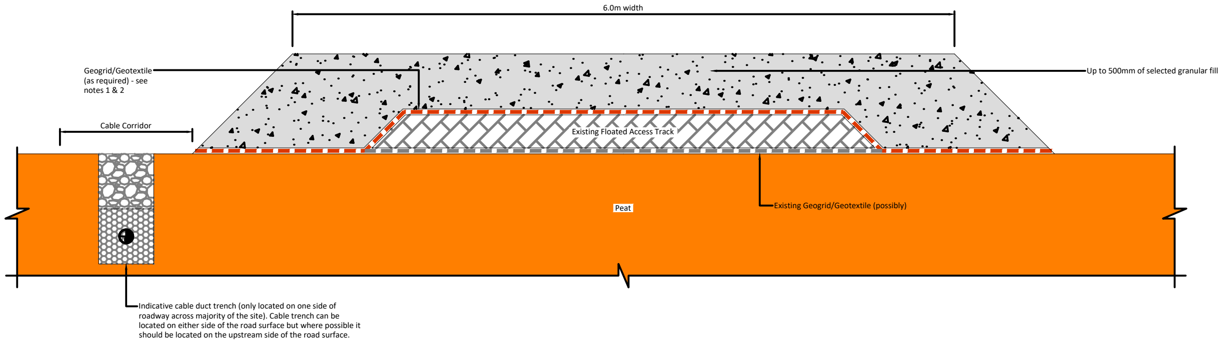
Indicative cable duct trench (only located on one side of roadway across majority of the site). Cable trench can be located on either side of the road surface but where possible it should be located on the upstream side of the road surface.



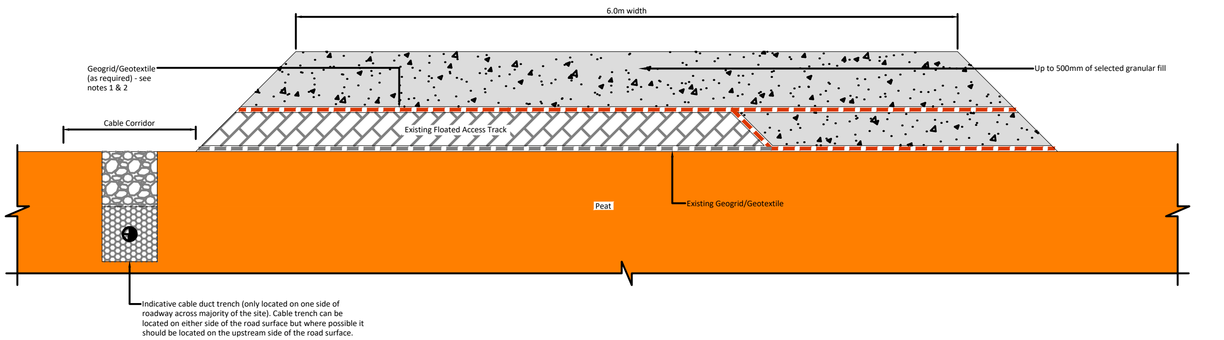


Figure 4.7

DRAWING TITLE: Type B Upgrade of Existing Floated Access Tracks	
PROJECT TITLE: Derrinlough Wind Farm, Co. Offaly	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 171221	DRAWING No.: 171221 - 42
SCALE: 1:50 @ A3	DATE: 18.02.2020

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4.3.3 Underpasses

Two permanent, pre-cast concrete underpasses are proposed as part of the proposed development.

The first underpass will traverse beneath the N62, immediately north of Derrinlough Briquette Factory. This underpass will provide amenity connectivity between Clongawny and Drinagh Bogs and will also be used during the operational phase to provide access to facilitate wind farm maintenance.

A second underpass is proposed in Clongawny bog beneath an existing Bord na Móna railway line. This underpass will also be used for amenity purposes and for wind farm maintenance during the operational phase.

The underpasses will be approximately 35m in length, 4.5m wide and 4.5m high and will take the form of precast concrete box culverts which will be founded on an in-situ concrete base slab. As a worst-case, the structures may need to be underpinned by piles which have been assessed in this EIAR.

The locations of the underpasses are shown on the layout drawings in Appendix 4.1 of this EIAR. The typical plan view and sections of the proposed underpasses are shown in Figure 4.8.

4.3.4 Electricity Substation

It is proposed to construct an electricity substation within the site of the proposed development as shown in Figure 4.1. The proposed substation site is located within an area adjacent in the north eastern section of the site off the proposed new site road and just south of the north eastern site entrance off the R357 Regional Road.

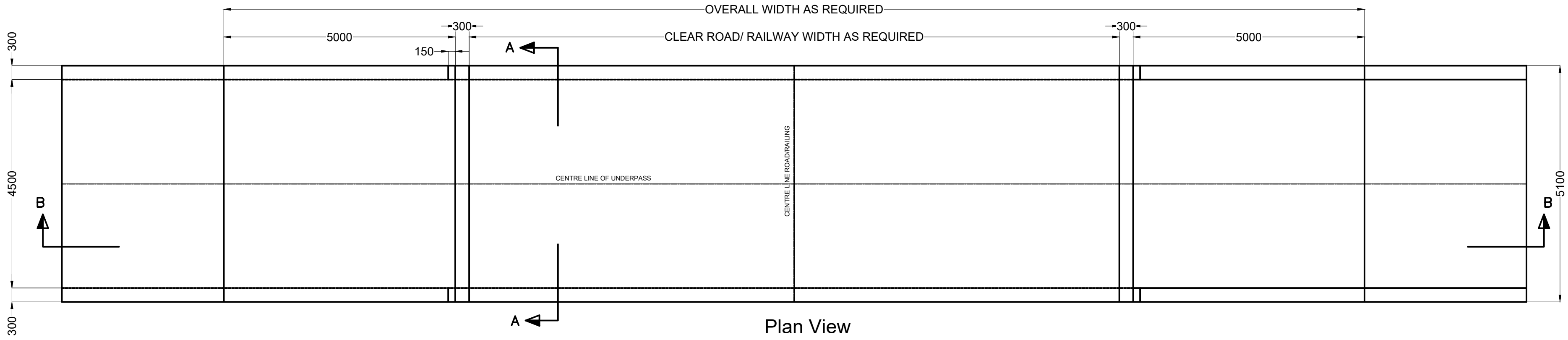
The footprint of the proposed onsite electricity substation compound measures approximately 17,500m^2. It will include two control buildings and the electrical components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the wind farm to the national grid. Further details regarding the connection of the onsite substation to the national electricity grid are provided in Section 4.3.8 below.

The layout of the proposed onsite substation is shown on Figure 4.9. Sections and elevations of the proposed substation are shown in Figure 4.10. The substation compound will be surrounded by an approximately 2.6 metre high steel palisade fence as shown in Figure 4.9 (or as otherwise required by Eirgrid), and internal fences will also segregate different areas within the main substation. The construction and exact layout of electrical equipment in the onsite electricity substation will be to Eirgrid networks specifications.

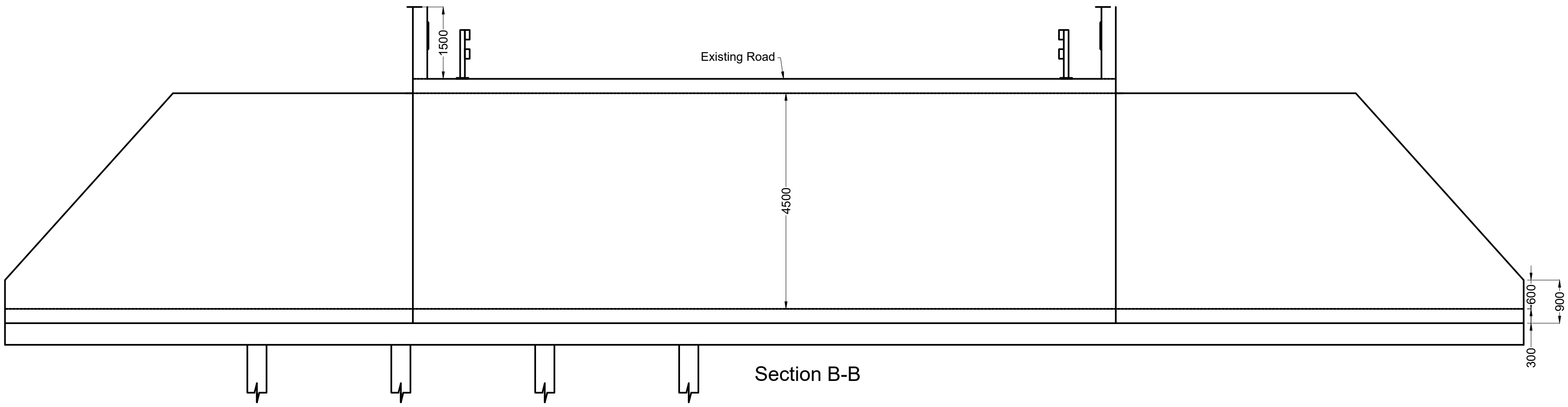
4.3.4.1 Wind Farm Control Buildings

Two substation control buildings will be located within the substation compound. The Transmission Asset Owner (TSO) Control Building will measure approximately 25 metres by 18 metres and approximately 9.6 metres in height. The Independent Power Provider (IPP) Control Building will measure approximately 19 metres by 12 metres and approximately 7 metres in height. The layouts of the control buildings are shown on Figure 4.11 and Figure 4.12.

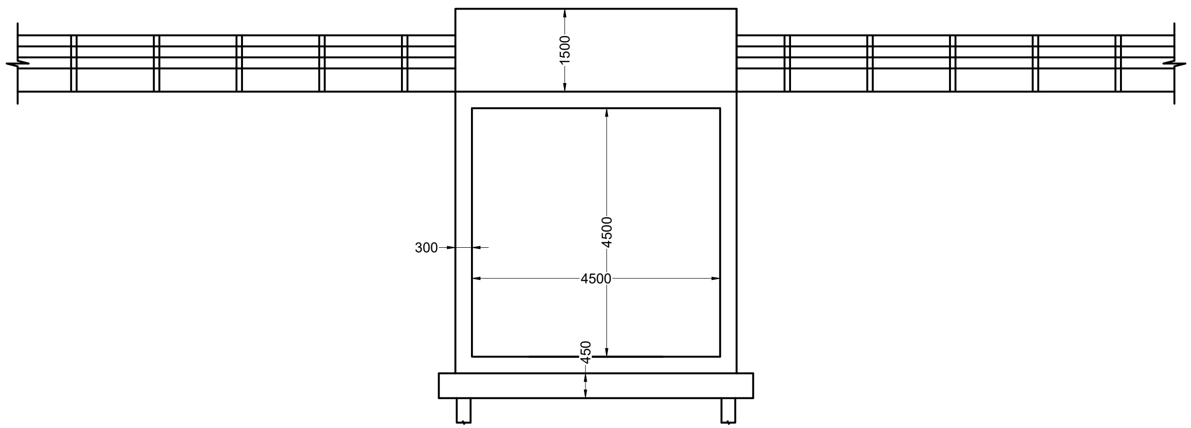
The wind farm control buildings will include staff welfare facilities for the staff that will work on the proposed development during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the proposed 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 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 currently envisaged as



Plan View



Section B-B



Section A-A

Figure 4.8

DRAWING TITLE:

Typical Underpass Detail

PROJECT TITLE:

Derrinlough Wind Farm, Co. Offaly

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **171221**	DRAWING No.: **171221 - 45**
SCALE: **1:100 @ A3**	DATE: **18.02.2020**

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+353 (0) 91 735611
email: info@www.mkoireland.ie
Website: www.mkoireland.ie

Project Design Drawing Notes

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2. Drawings not to be used for construction/contract conditions.
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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 typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

SUBSTATION COMPONENT LEGEND:

ID	DESCRIPTION
BBPI	BUSBAR POST INSULATOR
BW	BORED WELL
CB	CIRCUIT BREAKER
CC	CABLE CHAIR
CCTV	CLOSED CIRCUIT TELEVISION
CT	CURRENT TRANSFORMER
CT/VT	COMBINED CURRENT & VOLTAGE TRANSFORMER
DA	BUSBAR DISCONNECTOR
DB	BUSBAR DISCONNECTOR
DE	EARTH SWITCH
DEM	TRANSFORMER EARTH SWITCH
DG	DIESEL GENERATOR
DL	LINE DISCONNECTOR
DT	TRANSFORMER DISCONNECTOR
FHT	FOUL HOLDING TANK
HOT	HOUSE TRANSFORMER
IFK	INTERFACE KIOSK
LM	LIGHTNING MAST
LP	LAMP POST
LT	LAMP TRAP
NER	NETURAL EARTHING RESISTOR
NER CSE	NER CABLE SEALING END
OLG	OVERHEAD LINE GANTRY
PI	POST INSULATOR
RS	RURAL SUPPLY
SA	SURGE ARRESTER
TP	TELECOMMUNICATIONS POLE
VT	VOLTAGE TRANSFORMER

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Works Area for Internal Cabling
- Amenity Pathway

N

Figure 4.9

DRAWING TITLE:

Substation Layout

PROJECT TITLE:

Derrinlough Wind Farm, Co. Offaly

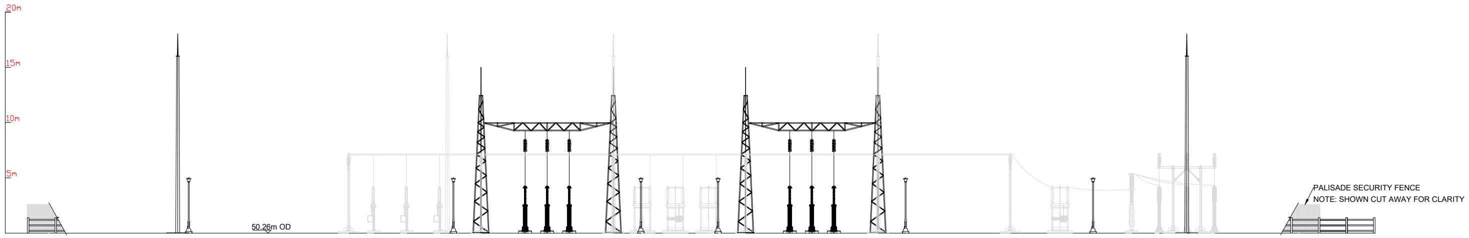
DRAWING BY: Joseph O Brien	CHECKED BY: Eoin McCarthy
PROJECT No.: 171221	DRAWING No.: 171221 - 28
SCALE: 1:500 @ A1	DATE: 18.02.2020

OS SHEET No.: 3487, 3488, 3489, 3490, 3491, 3537, 3538, 3539, 3540, 3541, 3586, 3587, 3588, 3589, 3590, 3643, 3644, 3645, 3646, 3700, 3701, 3702, 3703, 3704, 3758, 3759, 3760, 3761, 3762

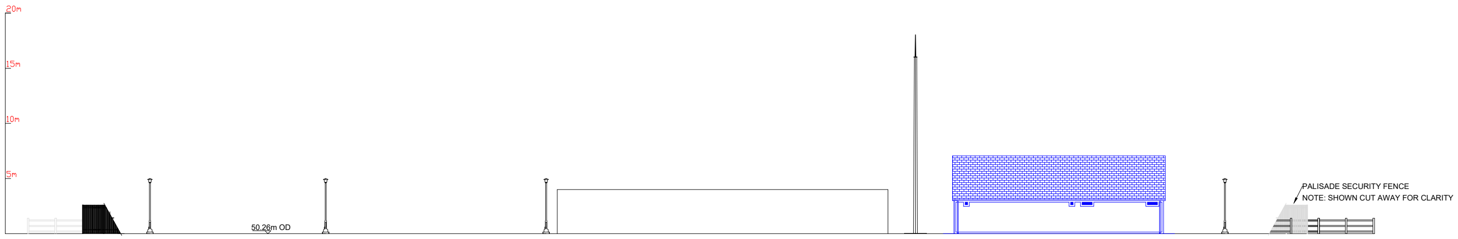
BORD NA MÓNA
Naturally Driven

Drawing Notes

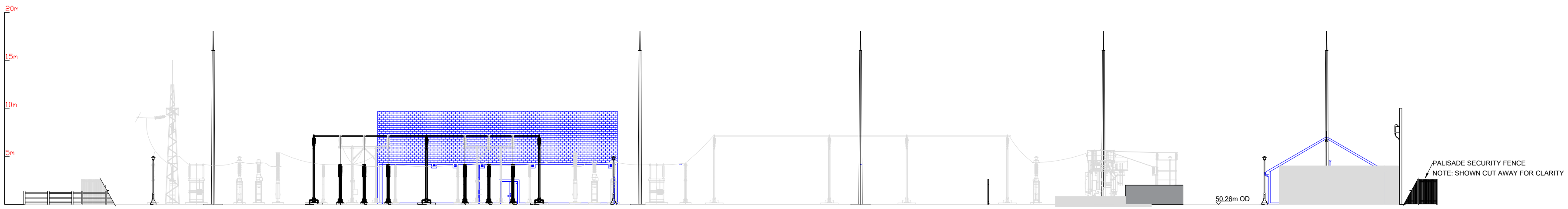
1. Layout and arrangements of substation buildings and electrical equipment is shown indicatively and for illustration purposes only as final specifications of buildings and electrical equipment is to be dictated by Eirgrid/ESB networks requirements.



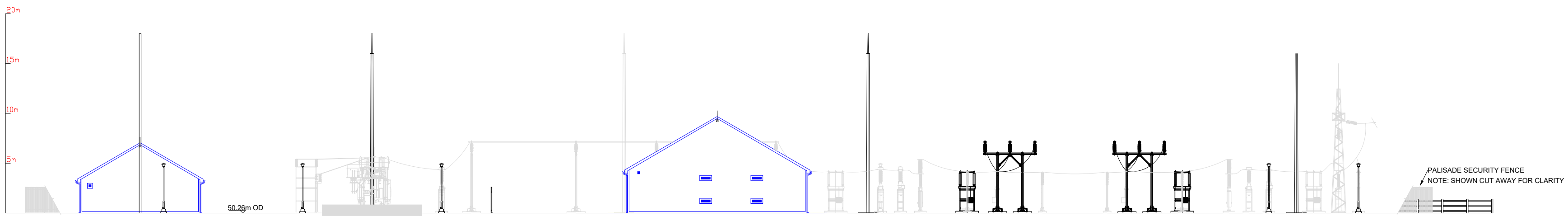
SECTION VIEW A - A



SECTION VIEW B - B



SECTION VIEW C - C



SECTION VIEW D - D

Figure 4.10

DRAWING TITLE: **Substation Sections**	
PROJECT TITLE: **Derrinlough Wind Farm, Co. Offaly**	
DRAWING BY: JMcD	CHECKED BY: NM
PROJECT No.: 1712221	DRAWING No.: 171221 - 29
SCALE: 1:500 @ A3	DATE: 18.02.2020

BORD NA MÓNA
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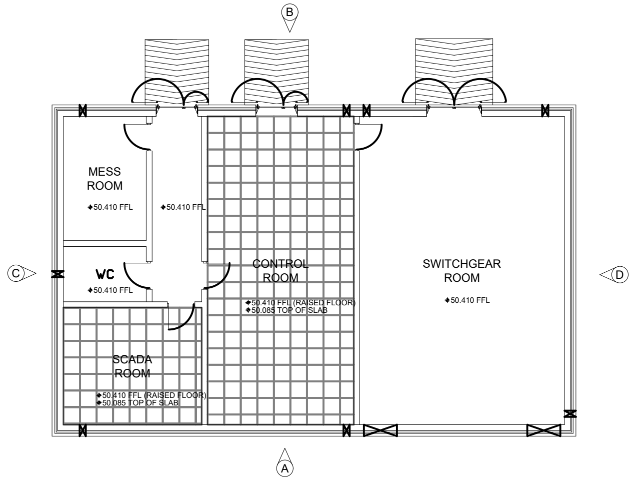
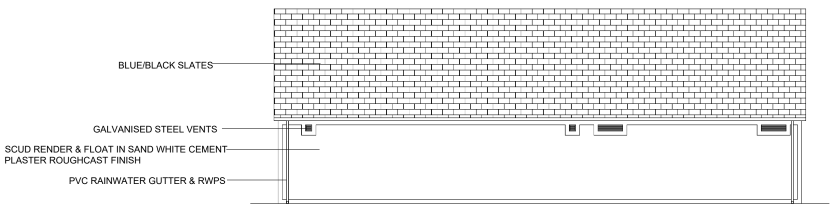
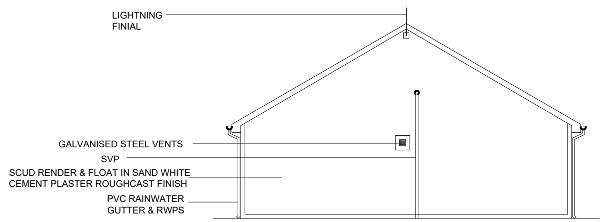
Drawing Notes

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.

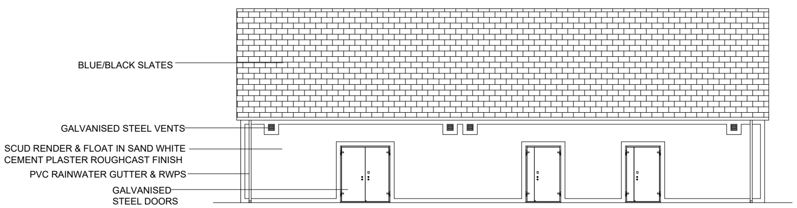




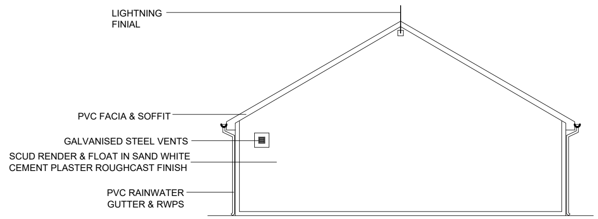
Elevation A



Elevation C



Elevation B



Elevation D

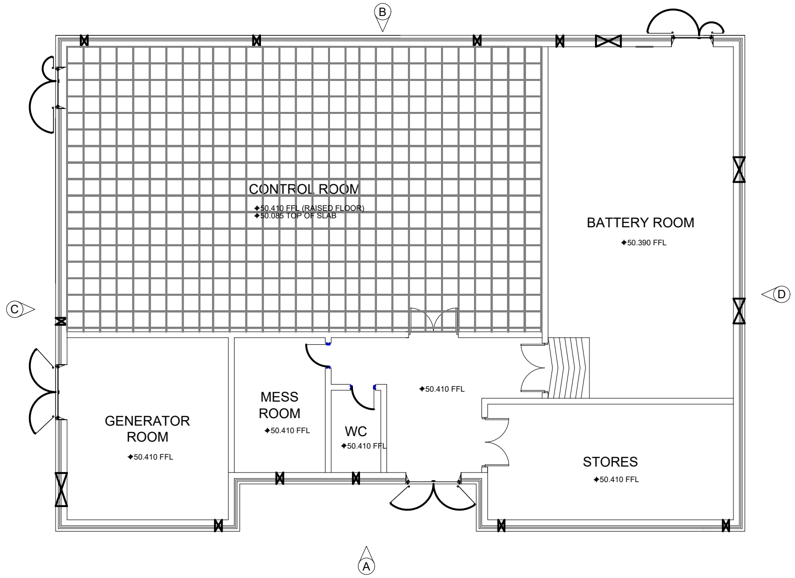
Figure 4.11

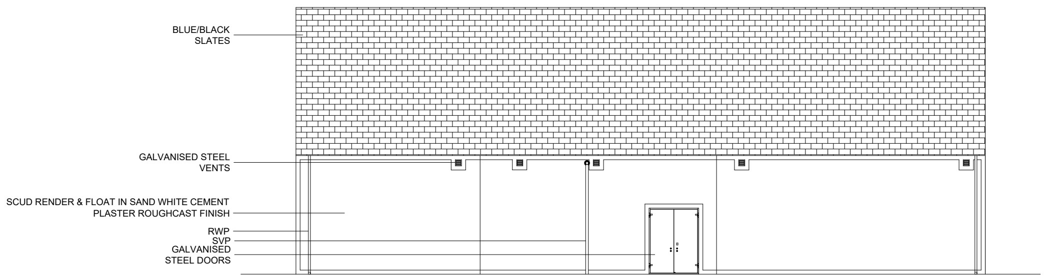
DRAWING TITLE: **IPP Control Building**	
PROJECT TITLE: **Derrinlough Wind Farm, Co. Offaly**	
DRAWING BY: JMcD	CHECKED BY: NM
PROJECT No.: 1712221	DRAWING No.: 171221 - 30
SCALE: 1:200 @ A3	DATE: 18.02.2020

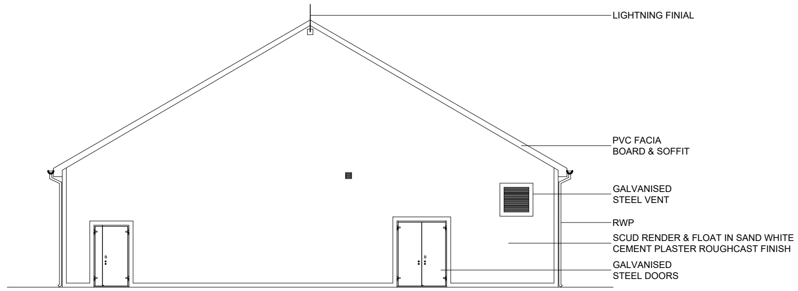
BORD NA MÓNA
Naturally Driven

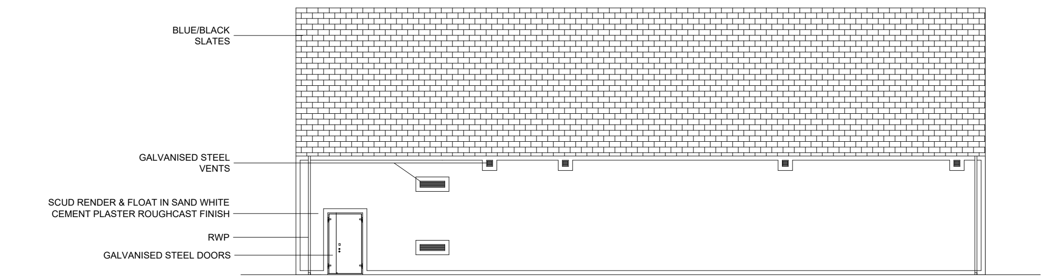
Drawing Notes

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.









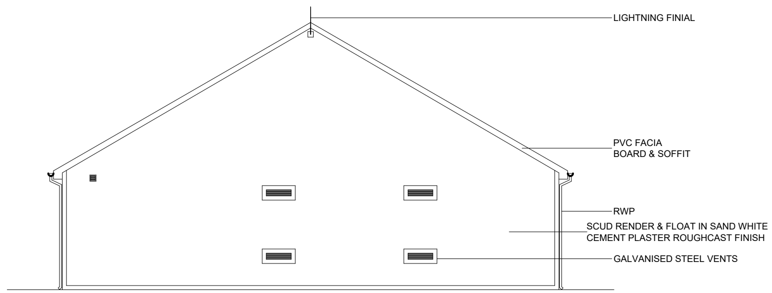


Figure 4.12

DRAWING TITLE: **TSO Control Building**	
PROJECT TITLE: **Derrinlough Wind Farm, Co. Offaly**	
DRAWING BY: JMcD	CHECKED BY: NM
PROJECT No.: 1712221	DRAWING No.: 171221 - 31
SCALE: 1:200 @ A3	DATE: 18.02.2020

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an in-well pump will direct water to a water tank within the roof space of the control building (subject to final design). Bottled water will be supplied for drinking, if required.

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by an appropriately consented waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site, and therefore the EPA's 2009 *'Code of Practice: Wastewater Treatment and Disposal Systems Serving Single Houses'* (EPA, 2009) does not apply. Similarly, the EPA's 1999 manual on *'Treatment Systems for Small Communities, Business, Leisure Centres and Hotels'* also does not apply, as it too deals with scenarios where it is proposed to treat wastewater on-site.

Such a proposal for managing the wastewater arising on site has become almost standard practice on wind farm 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 sites 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 site. When the final destination of the materials is known following the appointment of a permitted contractor, this information can be submitted to the Planning Authority if necessary.

4.3.5 Site Cabling

Each turbine will be connected to the on-site electricity substation via an underground 33 kV (kilovolt) electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building in the onsite substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in cable ducts approximately 1.3 metres below the ground surface, along the sides of or underneath the internal roadways. The route of the cable ducts will follow the access track to each turbine location. The indicative position of the cable trench relative to the roadways is shown in section in Figure 4.4 to Figure 4.7 above. Figure 4.13 below shows numerous variations of a typical cable trench arrangement.

Clay plugs will be installed at regular intervals of not greater than 50 metres along the length of the trenches to prevent the trenches becoming conduits for runoff water. While the majority of the cable trenches will be backfilled with native material, clay subsoils of low permeability will be used to prevent conduit flow in the backfilled trenches. This material will be imported onto the site should sufficient volumes not be encountered during the excavation phase of roadway and turbine foundation construction.

4.3.6 Grid Connection

A connection between the proposed development and the national electricity grid will be necessary to export electricity from the proposed wind farm. This connection will originate at the proposed onsite substation and will be connected to the national grid via either an underground grid connection cable or overhead line which will connect into the existing 110 kV transmission line located approximately 300m north of the substation. This connection route is illustrated in Figure 4.14. Planning permission is being sought for the overhead line and underground cabling options, however, only one option will be used to connect the proposed development to the national electricity grid.

Should the connection option of overhead line be chosen then approximately 530m of new 110kV transmission line and the installation of 6 No. new lattice towers will be required. The proposed lattice towers will all be located within the proposed development site. Each tower can have a footprint of up to approximately 70m^2 and an overall height of up to 20m. They will be lattice steel structures with cross-arms which can extend over the base footprint and internal bracing.

Should the connection be underground cable, approximately 700m of transmission cable will be required to connect from the proposed substation to the existing overhead line.

The cables will be laid in trenches as per Eirgrid and ESB Networks Specifications (Refer to Figure 4.13 which depicts the typical trench bedding details). Further information is also included in Section 4.9.4. Two Line Cable Interface Masts (LCIM) will be used to connect the high voltage underground cable into the existing 110 kV line (Refer to Figure 4.15).

The LCIMs will be within the proposed development site. Each mast has a footprint of approximately 70m^2 and an overall height of up to 20m. The LCIMs will be lattice steel structures with cross-arms which can extend over the base footprint and internal bracing and are very similar in size and character to the masts proposed for the overhead line option.

The exact final detail and specifications of the grid connection route and method for the proposed development will ultimately be decided by ESB/EirGrid.

4.3.7 Rural (Local) Electricity Supply

A rural/local electricity supply will be required as a back-up power supply to the proposed substation for light, heat and power purposes. There is a local MV supply adjacent to the development location which could be utilised, this is the Shannonbridge – Lumcloon MV supply. The rural/local supply will be designed and constructed by ESB Networks. The exact source of supply is to be confirmed by ESB Networks, however, the supply will enter the site by either MV overhead line or MV cable. The rural/local supply will have an associated step-down transformer (i.e. MV to LV) and will enter the substation building by underground cable and terminate onto the control building AC distribution board.

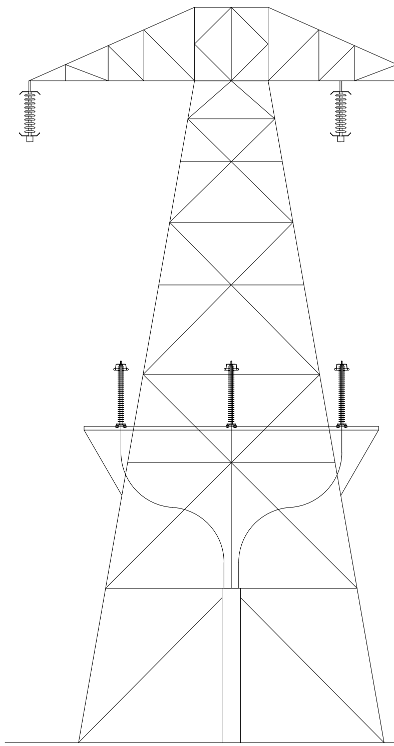
4.3.8 Anemometry Mast

Two permanent anemometry masts are proposed as part of the proposed development. The anemometry masts will be equipped with wind monitoring equipment at various heights. The masts will be located at E114,3322 N234,996 and E114,3322 N234,996 as shown on the site layout in Figure 4.1 and will be slender structures up to 120 metres in height. The masts will be free-standing structures and will be constructed on a hard-standing area sufficiently large to accommodate the crane that will be used to erect the mast, adjacent to an existing track. The typical design of the proposed anemometry masts is shown in Figure 4.16.

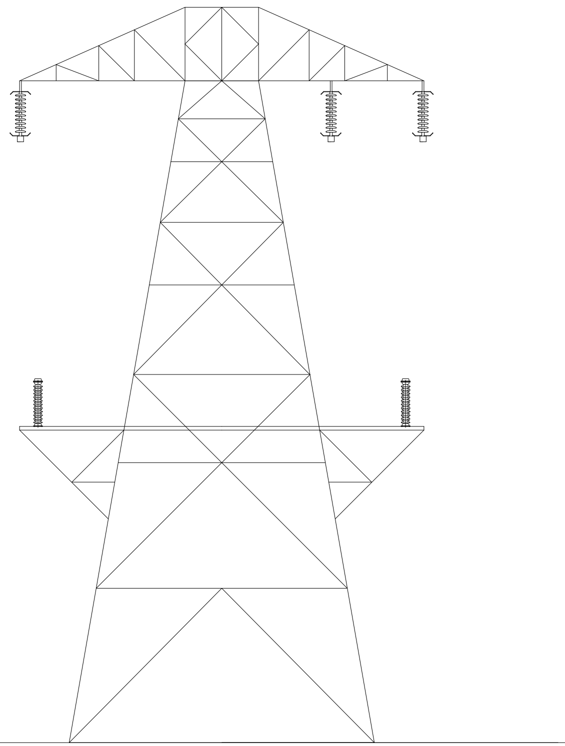
4.3.9 Temporary Construction Compounds

Five temporary construction compounds are proposed as part of the proposed development. They will be located in the townlands of Clongawny More, Derrinlough, Derrinlough/Crancreagh, Drinagh, and Cortullagh or Grove.

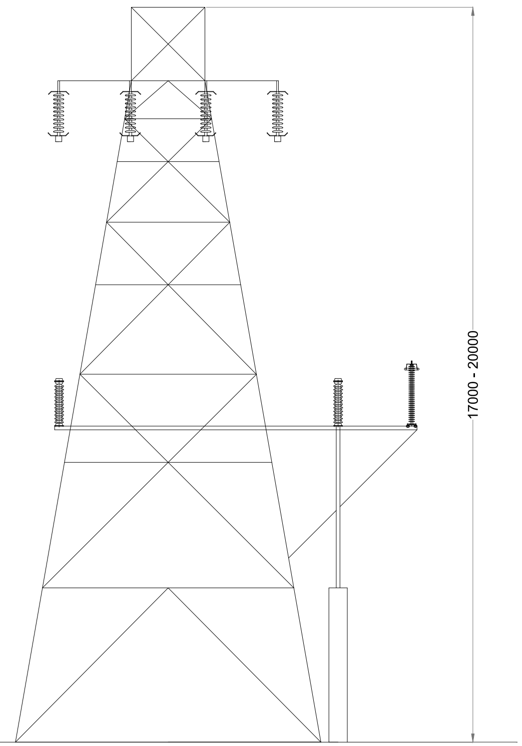
Each compound will measure approximately 50 metres by 100 metres, with a footprint of 5,000m^2 in area. The location of the proposed construction compounds is shown on the site layout drawing in Figure 4.1.



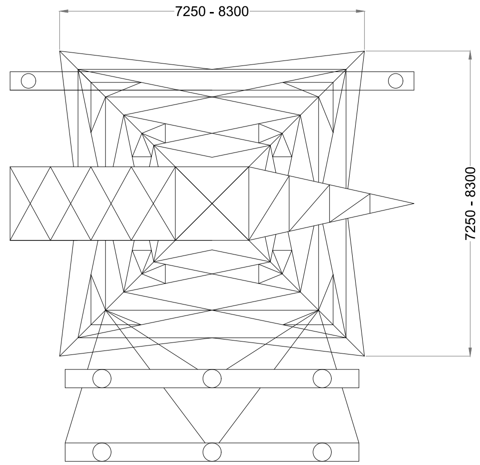
FRONT ELEVATION



REAR ELEVATION



SIDE ELEVATION



PLAN VIEW

Figure 4.15

DRAWING TITLE: **110 kV Overhead Line - Line Cable Interface Tower**	
PROJECT TITLE: **Derrinlough Wind Farm, Co. Offaly**	
DRAWING BY: JMcD	CHECKED BY: NM
PROJECT No.: 1712221	DRAWING No.: 171221 - 33
SCALE: 1:150 @ A3	DATE: 18.02.2020

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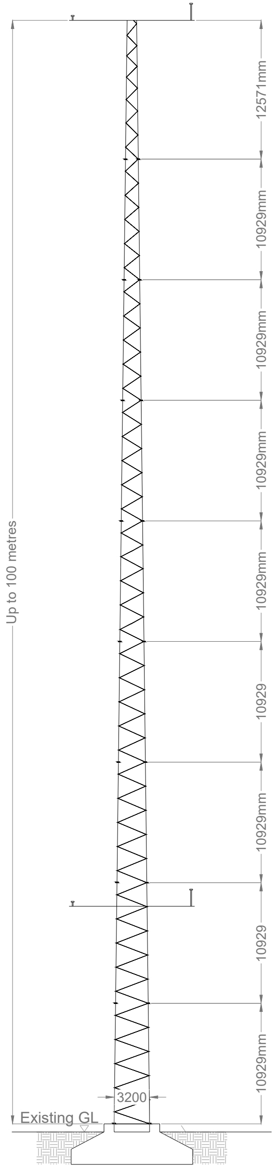

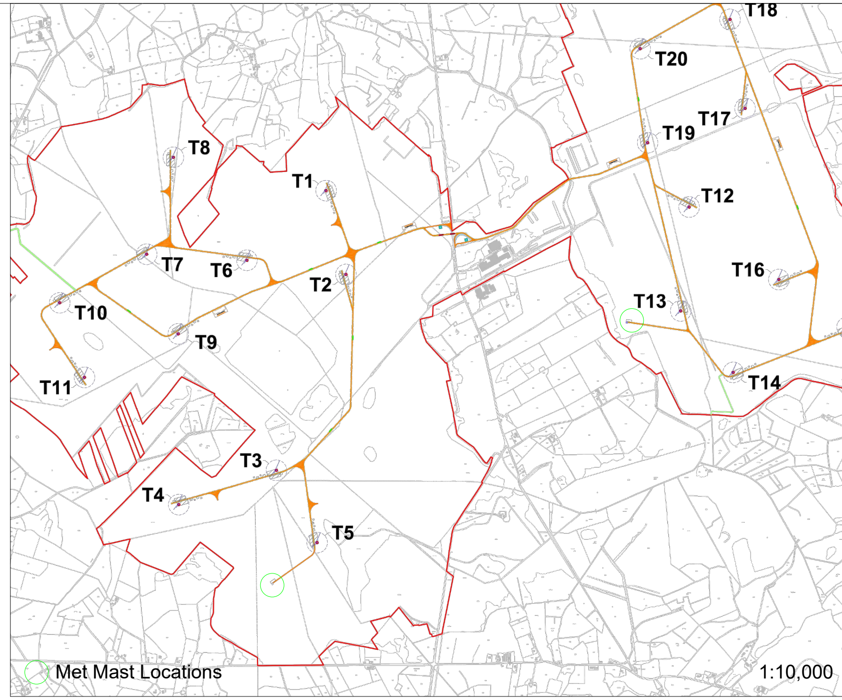

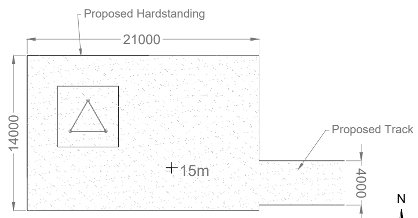

Met Mast Compound Plan

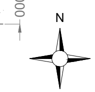

Figure 4.16

DRAWING TITLE:
Typical Free Standing Anemometry Mast

PROJECT TITLE:
Derrinlough Wind Farm, Co. Offaly

DRAWING BY: Joseph O Brien	CHECKED BY: Eoin McCarthy
PROJECT No.: 171221	DRAWING No.: 171221 - 39
SCALE: 1:500 @ A3	DATE: 18.02.2020

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The construction compounds will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors. The layout of the construction compounds is shown on Figures 4.17 to 4.21. Construction materials and turbine components will be brought directly to the proposed turbine locations following their delivery to the site.

Temporary port-a-loo toilets located within a staff portacabin 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 an appropriately consented waste collector to wastewater treatment plants.

4.3.10 Temporary Security Cabins

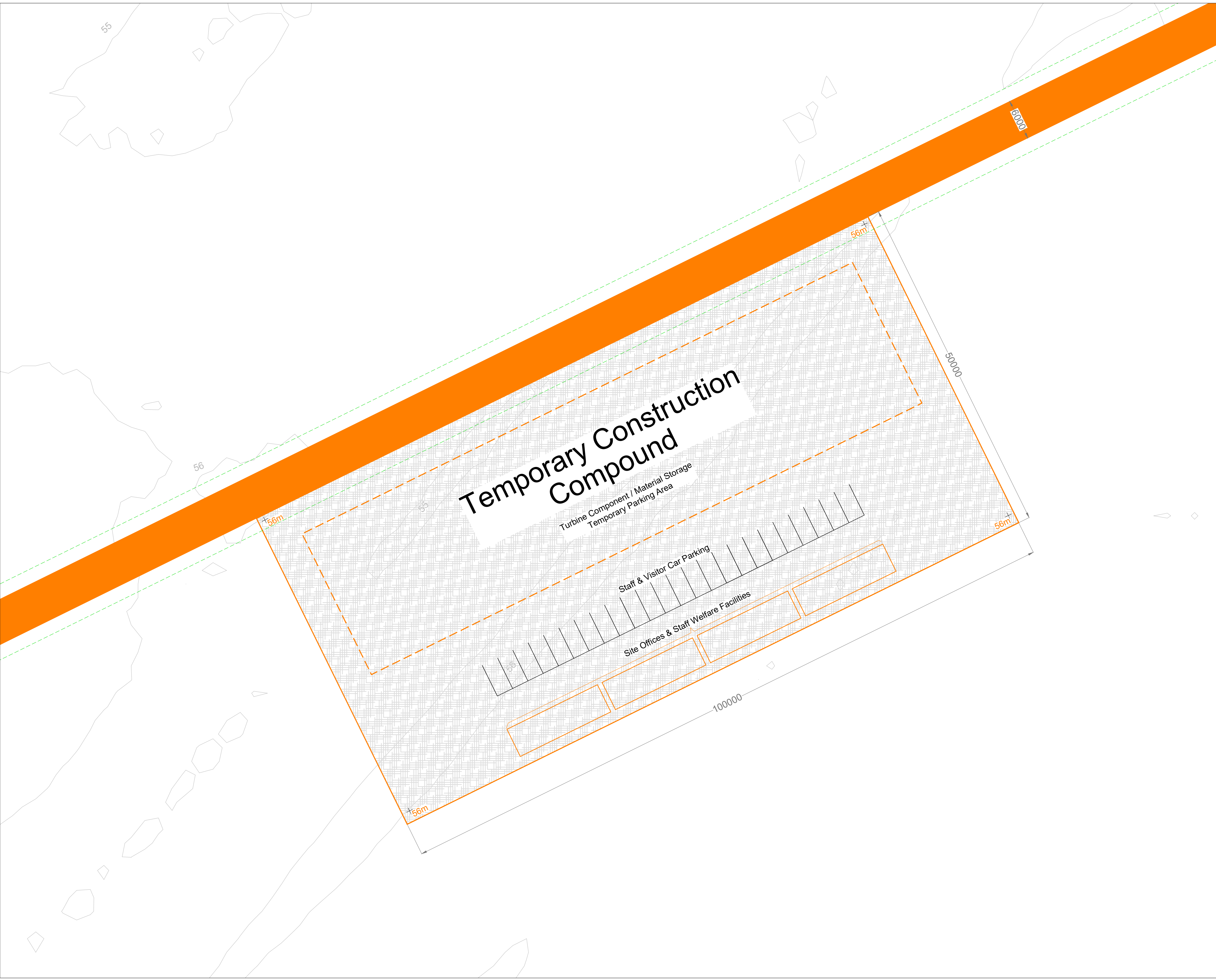
Two temporary security cabins will be installed within the site for the duration of the construction phase of the proposed development. The security cabins will be located close to the eastern and western construction site entrances off the N62 National Route.

The security cabins will be prefabricated structures measuring 7.2 metres by 2.5 metres and 2.85 metres in height. The cabins will serve as the check in and check out point for staff and visitors during the construction phase. The cabins will be removed upon commissioning of the wind farm development. The typical layout and sections of the proposed security cabins is shown in Figure 4.22.

4.3.11 Sand and Stone Requirements

The volumes of granular fill (sand and stone) required for the construction of the proposed development, outlined in Table 4.3 below, have been estimated based on the proposed development footprint and the proposed final levels for the various infrastructure. Construction grade granular fill and higher quality, final surfacing fill (including sand) will both be required for the construction of the proposed development. Granular fill volumes have been estimated using the following methodology:

- The peat located beneath all proposed hardstanding areas (excluding the substation compounds) and roads will be excavated and replaced with construction grade granular fill up to the existing ground level.
- The hardstanding areas and roads will be constructed to approximately 1 metre above the existing ground level. The first 600mm (approx.) above ground level will comprise construction grade granular fill and the final 600mm (approx.) surface layer will comprise higher quality, final surfacing materials generally washed gravels.
- The proposed substation compound will be constructed to approximately 50.26 metres OD. The peat excavated beneath the various construction compound footprints will be replaced with construction grade granular fill. The final 500mm will comprise the higher quality, surfacing materials.
- The internal site underground cable trenches will be approximately 1200mm in depth. The cable trench will be backfilled up to approximately 600mm with sand, within which the ducting will be placed. Suitable materials from the excavations of the trenches will be reinstated to form the final layer of the trench.



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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Construction Compound layout is indicative. Final Arrangement will be on per contractor's requirements.

Drawing Legend

Proposed Road

Works Area for Internal Cabling

N

Figure 4.17

DRAWING TITLE:

Temporary Construction Compound 1

PROJECT TITLE:

Derrinlough Wind Farm, Co. Offaly

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **171221**	DRAWING No.: **171221 - 23**
SCALE: **1:500 @ A3**	DATE: **18.02.2020**

OS SHEET No.: 3487, 3488, 3489, 3490, 3491, 3537, 3538, 3539, 3540, 3541, 3586, 3587, 3588, 3589, 3590, 3643, 3644, 3645, 3646, 3700, 3701, 3702, 3703, 3704

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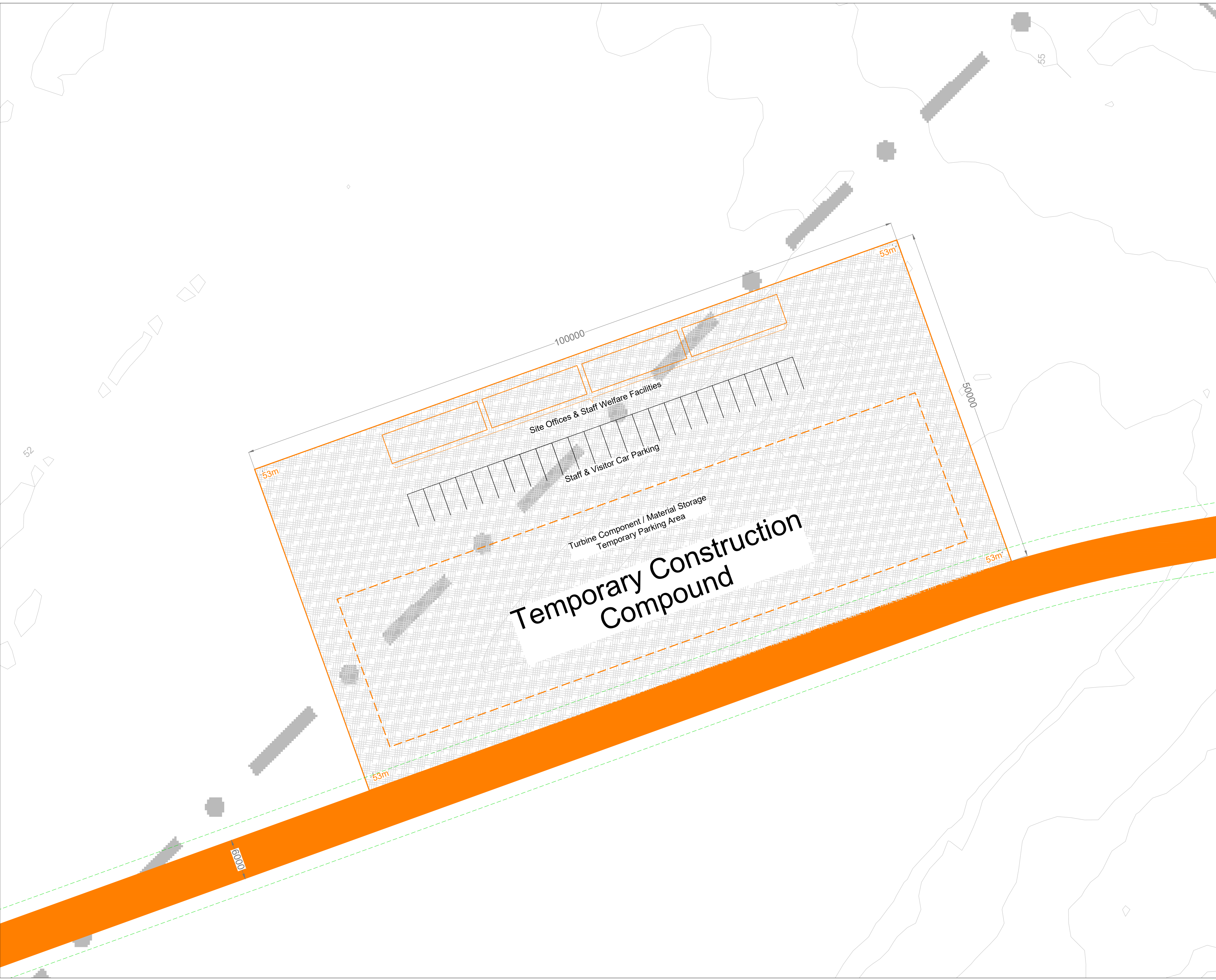

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Construction Compound layout is indicative. Final Arrangement will be on per contractor's requirements.

Drawing Legend

Proposed Road

Works Area for Internal Cabling

N

Figure 4.18

DRAWING TITLE:
Temporary Construction Compound 2

PROJECT TITLE:
Derrinlough Wind Farm, Co. Offaly

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **171221**	DRAWING No.: **171221 - 24**
SCALE: **1:500 @ A3**	DATE: **18.02.2020**

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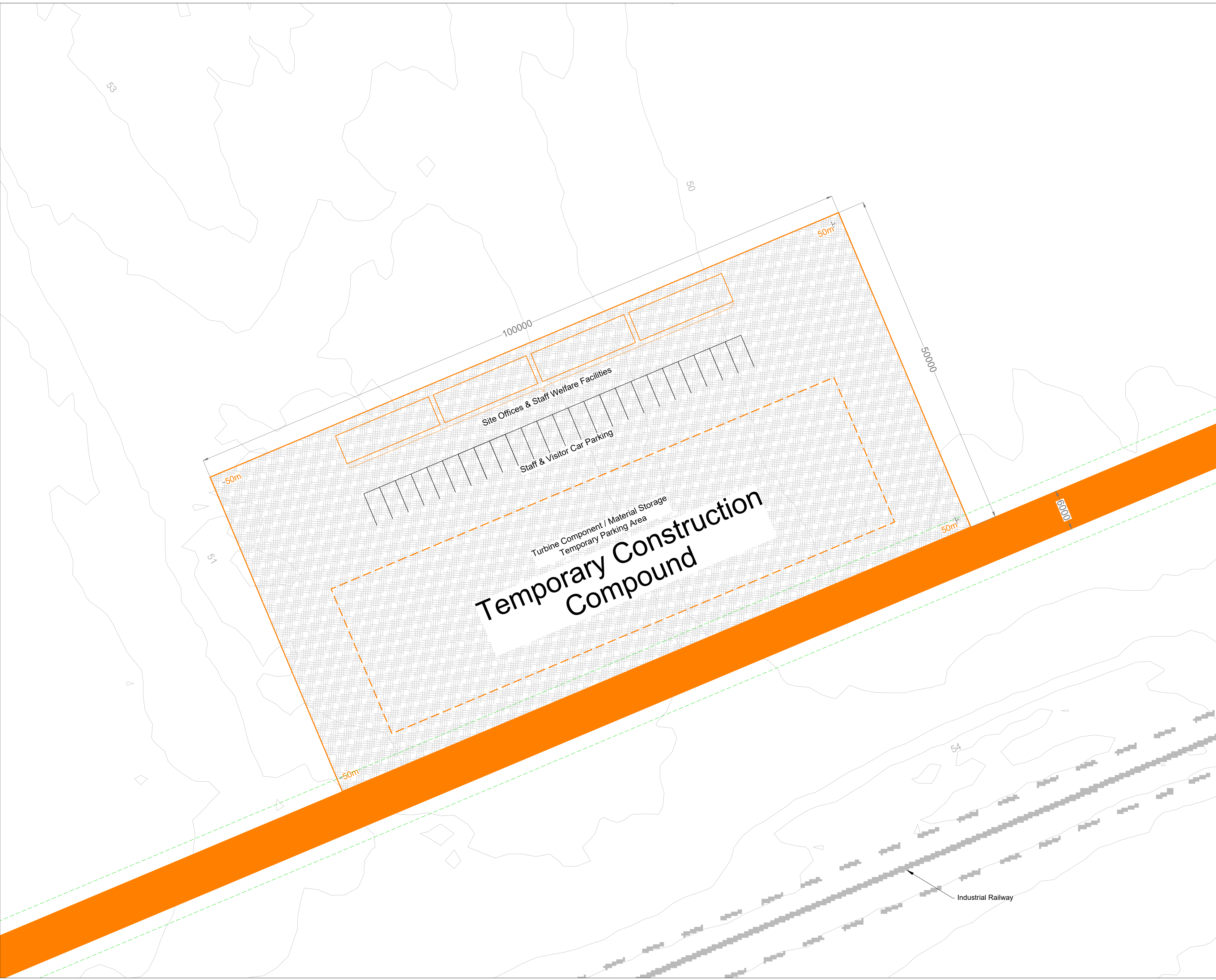

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Construction Compound layout is indicative. Final Arrangement will be on per contractor's requirements.

Drawing Legend

Proposed Road

Works Area for Internal Cabling

N

Figure 4.19

DRAWING TITLE:

Temporary Construction Compound 3

PROJECT TITLE:

Derrinlough Wind Farm, Co. Offaly

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **171221**	DRAWING No.: **171221 - 25**
SCALE: **1:500 @ A3**	DATE: **18.02.2020**

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Construction Compound layout is indicative. Final Arrangement will be on per contractor's requirements.

Drawing Legend

- Proposed Road
- Works Area for Internal Cabling

N

Figure 4.20

DRAWING TITLE:

Temporary Construction Compound 4

PROJECT TITLE:

Derrinlough Wind Farm, Co. Offaly

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **171221**	DRAWING No.: **171221 - 26**
SCALE: **1:500 @ A3**	DATE: **18.02.2020**

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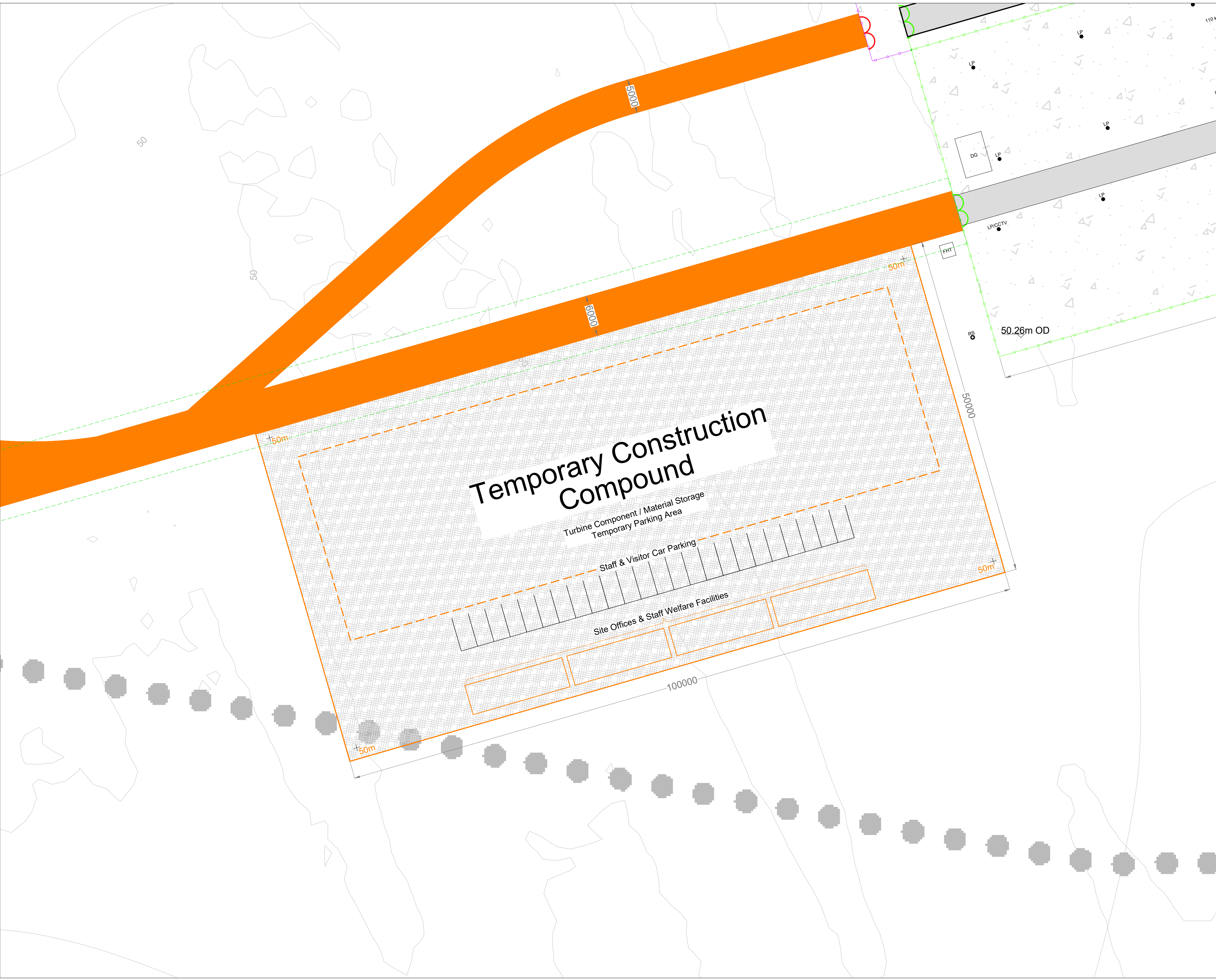

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Construction Compound layout is indicative. Final Arrangement will be on per contractor's requirements.

Drawing Legend

- Proposed Road
- Works Area for Internal Cabling

N

Figure 4.21

DRAWING TITLE:
Temporary Construction Compound 5

PROJECT TITLE:
Derrinlough Wind Farm, Co. Offaly

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **171221**	DRAWING No.: **171221 - 27**
SCALE: **1:500 @ A3**	DATE: **18.02.2020**

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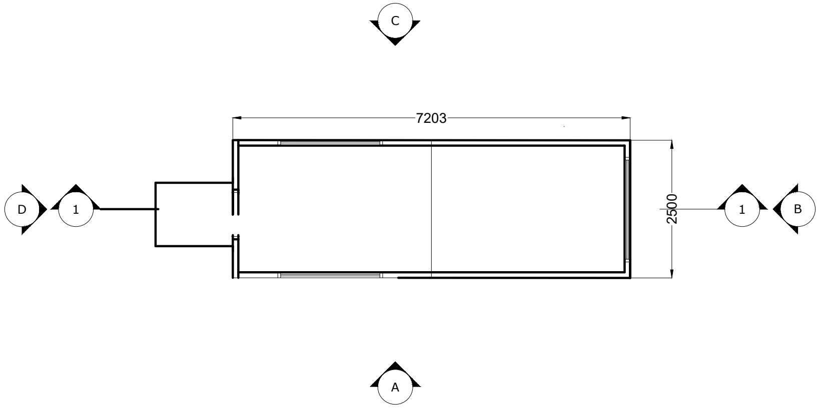
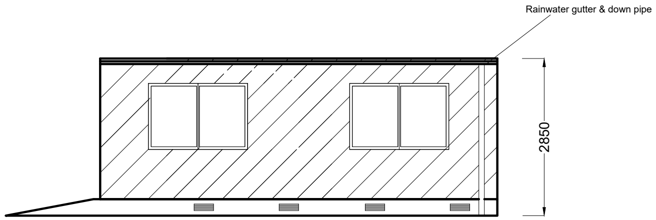
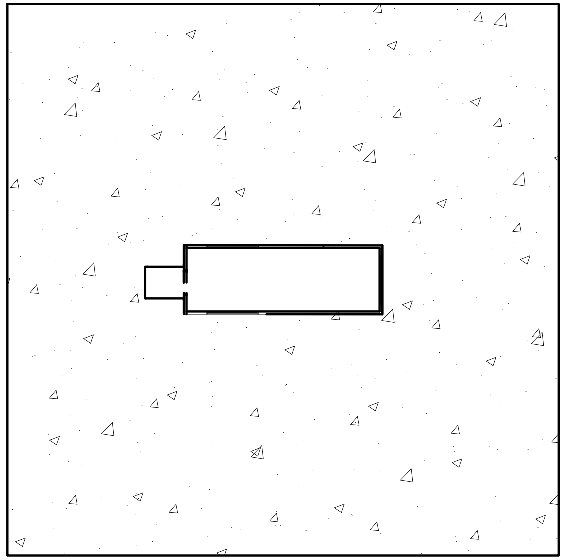




Elevation A

Security Compound Layout



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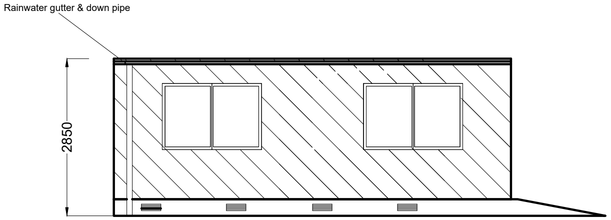

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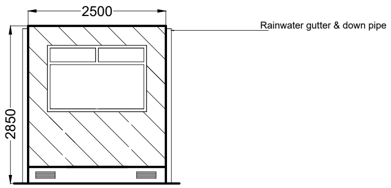

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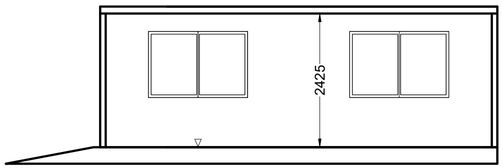
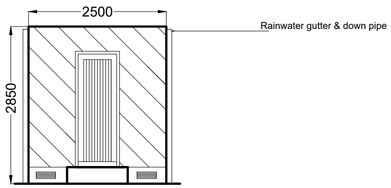


Section 1-1



Elevation D

Figure 4.22

DRAWING TITLE:
Typical Security Cabin Detail

PROJECT TITLE:
Derrinlough Wind Farm, Co. Offaly

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **171221**	DRAWING No.: **171221 - 48**
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Table 4.2 outlines the sources of both the construction grade and surfacing granular fill. The construction grade granular fill and the higher quality, surfacing granular fill and sand will be sourced from local, authorised quarries. The locations of existing in relation to the proposed site are shown in Figure 4.23. These and/or other authorised quarries will be used as sources of stone during the construction of the proposed development.

Table 4.2 Granular Fill Volumes Required

Development Component	Area (m^2) (approx.)	Stone Fill Required (m^3)
Turbine no. 1	6,775	8,054
Turbine no. 2	6,775	8,054
Turbine no. 3	6,775	8,574
Turbine no. 4	6,775	9,613
Turbine no. 5	6,775	12,210
Turbine no. 6	6,775	8,574
Turbine no. 7	6,775	13,249
Turbine no. 8	6,775	9,093
Turbine no. 9	6,775	9,093
Turbine no. 10	6,775	8,574
Turbine no. 11	6,775	8,054
Turbine no. 12	6,775	8,054
Turbine no. 13	6,775	8,054
Turbine no. 14	6,775	8,833
Turbine no. 15	6,775	8,054
Turbine no. 16	6,775	8,054
Turbine no. 17	6,775	8,054
Turbine no. 18	6,775	8,054
Turbine no. 19	6,775	8,054
Turbine no. 20	6,775	8,054
Turbine no. 21	6,775	9,093
New Access Roads	199,740	310,785

Development Component	Area (m^2) (approx.)	Stone Fill Required (m^3)
Construction Compounds	25,000	32,300
Substation	17,500	39,560
Met Masts	1,490	2,750
2 No. Underpass	N/A	1,000
Amenity Pathways	19,500	9,750
Security Cabin Compounds	800	800
N52-N62 Junction Bypass	1,300	5,775
Totals (m^3) (including 25% contingency factor)		735,275

4.3.12 Peat and Spoil Management Plan

4.3.12.1 Quantities

The approximate quantity of peat and non-peat material (spoil), requiring management on the site of the proposed development has been calculated, as presented in Table 4.3 below. These quantities were calculated by FTC as part of the Peat and Spoil Management Plan in Appendix 4.2 of this EIAR.

Table 4.3 Approximate Peat and Spoil Volumes Requiring Management

Development Component	Peat Volume (m^3)	Spoil Volume (m^3)
21 no. Turbines and Hardstanding Areas	152,535	57,700
Access Roads	57,150	29,465
Substation	18,963	6,326
Met Masts	3,490	780
Temporary Construction Compounds and Security Cabin Compounds	37,800	8,570
2 No. Underpasses	1,440	4,200

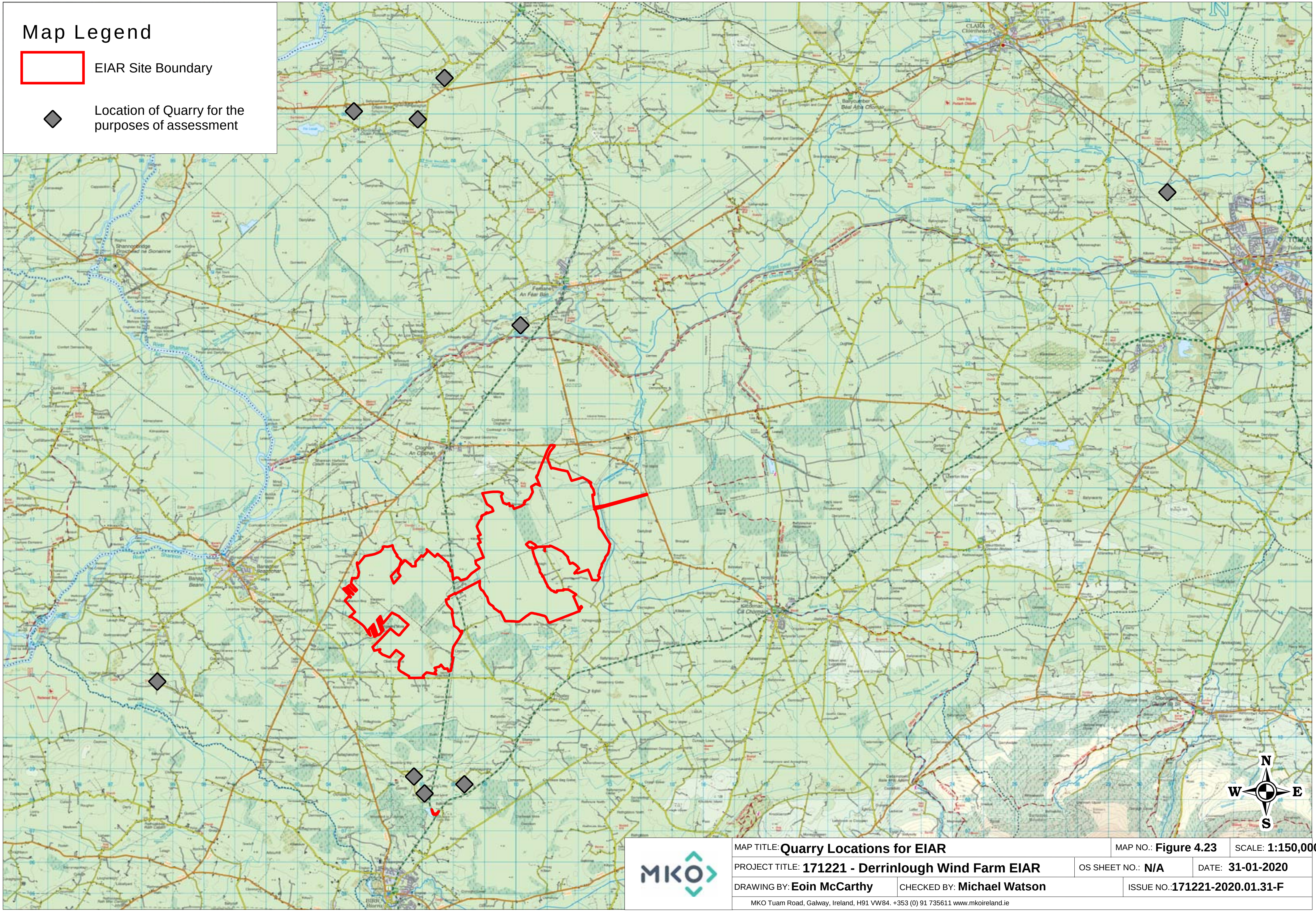
Cable Route and Grid Connection	7,345	0
N52/N62 Junction Bypass	0	6,920
Sub Total	**278,723**	**113,961**
Total Peat and Spoil to be managed (m^3)		**392,684**

Note a factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied and is included to the excavated peat and spoil volumes above to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

4.3.12.2 Peat and Spoil Management

The site which is generally flat consists predominantly of bare, locally re-vegetated cutaway peat and shallow peat with an extensive drainage network. The site has been extensively harvested by Bord na Móna using mechanical harvesting equipment resulting in a well-drained and extensively trafficked peat. Bord na Móna has considerable experience in the handling of peat in these circumstances, both during peat production operations and during wind farm construction projects, particularly Mountlucas, Bruckana and Oweninny wind farms which are located on very similar terrain. This experience has shown that the most environmentally sensitive and stable way of handling and moving of peat is its placement across the site and at locations as close as possible to the excavation areas. The proposed methodology as outlined in the FTC Peat and Spoil Management Plan is summarised below.

- The following recommendations/best practice guidelines for the placement of peat and non-peat spoil alongside the proposed infrastructure elements should be considered and taken into account during construction.
- All excavated peat and non-peat will be placed/spread alongside the proposed infrastructure elements on site, where possible.
- The placement of excavated spoil should be restricted to areas where the peat depth is less than 2m. Given the flat topography/nature of the site, this approach for the placement of excavated spoil is deemed appropriate.
- The peat and spoil placed adjacent to the proposed infrastructure elements should be restricted to a maximum height of 1m over a 7m wide corridor on both sides of the proposed infrastructure elements. It should be noted that the designer should define/confirm the maximum restricted height for the placed peat and spoil.
- The placement of excavated peat and spoil is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat and spoil within the placement areas may require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.
- Where there is any doubt as to the stability of the peat surface then no excavated spoil shall be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface.
- Where practical, it should be ensured that the surface of the placed peat and spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the peat and spoil should be carried out as placement of peat and spoil within the placement area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat and spoil.
- Finished/shaped side slopes in the placed peat and spoil shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat and spoil are encountered then slacker slopes will be required.


Map Legend
EIAR Site Boundary
Location of Quarry for the purposes of assessment
N
W
E
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MKO
MAP TITLE: Quarry Locations for EIAR
MAP NO.: Figure 4.23
SCALE: 1:150,000
PROJECT TITLE: 171221 - Derrinlough Wind Farm EIAR
OS SHEET NO.: N/A
DATE: 31-01-2020
DRAWING BY: Eoin McCarthy
CHECKED BY: Michael Watson
ISSUE NO.: 171221-2020.01.31-F
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- All placed spoil 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.
- Movement monitoring instrumentation may be required adjacent to the access road where peat has been placed. The locations where monitoring is required will be identified by the designer on site.
- Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.
- An interceptor drain should be installed upslope of the designated spoil placement areas to divert any surface water away from these areas. This will help ensure stability of the placed spoil and reduce the likelihood of debris run-off.
- All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction

4.3.13 Site Activities

4.3.13.1 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 4-5 of this EIAR. The CEMP sets out the key environmental considerations to be taken into account by the contractor during construction of the proposed development. The CEMP also details the mitigation measures to be implemented in order to comply with the environmental commitments outlined in the EIAR. The contractor will be contractually obliged to comply with all such measures. It is intended that the CEMP would be updated prior to the commencement of the development, to include any additional mitigation measures, conditions and or alterations to the EIAR and application documents that may emerge during the course of the planning process and would be submitted to the Planning Authority for written approval in advance of commencement of any construction works on site.

4.3.13.2 Refuelling

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 bunded areas.

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 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 wind farm. 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 used during all refuelling operations.

4.3.13.3 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. 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, or a Siltbuster-type concrete wash unit (http://www.siltbuster.com) or equivalent. 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 will be removed off-site by an appropriately authorised waste collector for disposal at an authorised waste facility. 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 Plates 4.4 and 4.5 below.

Plate 4.4 Concrete washout area

Plate 4.5 Concrete washout area

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.

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 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.
- Site roads will be constructed to the required standard to allow transport of the turbine components around the site, and hence, concrete delivery trucks will be able to access all areas where the concrete will be needed. 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 agreed with suppliers before work starts, agreeing routes, prohibiting on-site washout and to agree 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.

4.3.13.4 Concrete Pouring

Because of the scale of the main concrete pours that will be required to construct the proposed development, 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 will 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, and used when necessary, for freshly placed concrete to avoid the surface washing away in heavy rain.
- In the event of there being surplus concrete after completion of a pour, the concrete will be taken off-site and disposed of at an appropriately authorised facility.

4.3.13.5 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 ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site 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.

4.3.13.6 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. Site roads will already be constructed before other road-going trucks begin to make regular or frequent deliveries to the site (e.g. with steel or concrete). The site roads will be well finished with 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.

However, in the interest of best practice wheelwash facilities will be provided. Figure 4.24 includes typical details of a proposed self-contained wheelwash system for use during the construction phase of works. A wheelwash will be located at each of the construction and delivery entrances as shown on the site layout drawings included as Appendix 4.1.

The contractor will be responsible for ensuring that all vehicles egressing the site have used the wheelwash facilities. However, a road sweeper will be made available by the contractor for the cleaning of public roads in the event that they are dirtied by trucks associated with the proposed development.

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

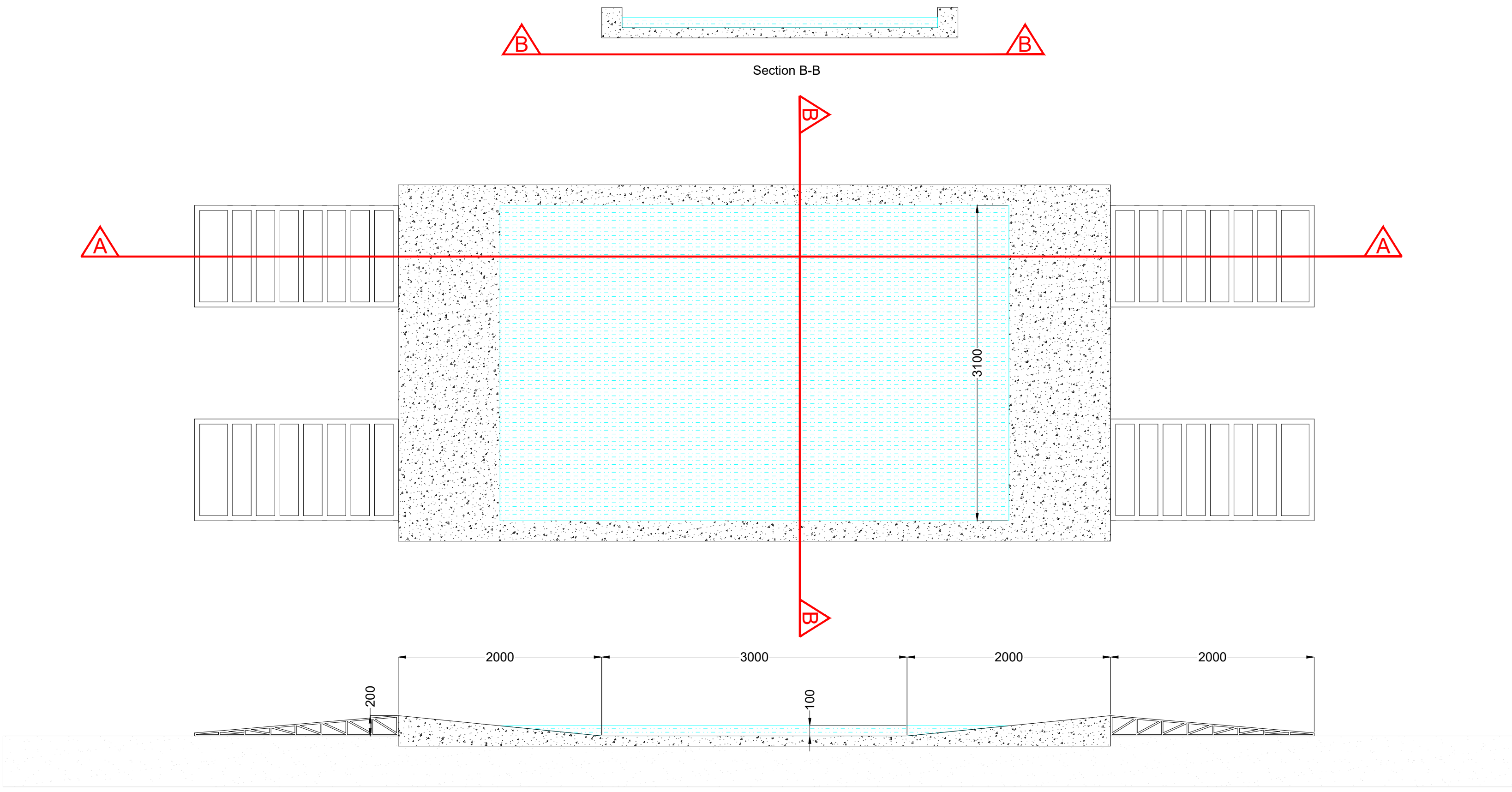

Figure 4.24

DRAWING TITLE:
Typical Wheel Wash Detail

PROJECT TITLE:
Derrinlough Wind Farm, Co. Offaly

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **171221**	DRAWING No.: **171221 - 49**
SCALE: **1:50 @ A3**	DATE: **18.02.2020**

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4.3.14 Site Entrances

The proposed development site will be accessed via existing site entrances off the N62, R357 and L7009 (local Stonestown Road).

Three entrances are proposed for the construction stage of the proposed development in order to transport turbine components, materials and equipment to the site. The entrance locations are depicted on Figure 4.1 and can be described as follows:

- Existing entrance off the N62 to Drinagh Bog;
- Existing entrance off the N62 to Clongawny Bog; and
- Existing entrance off the R357 which connects Drinagh and Noggus Bog.

The main entrances for the construction phase of the proposed development are located along the N62. These two entrances will provide access east and west into Drinagh and Clongawny bogs, respectively and will be designed to facilitate both materials delivery to the site (stone, steel and concrete) as well as large oversize components such as turbine blades and tower sections. Upgrade works will be required to these entrance locations in order to accommodate access and egress of turbine delivery and construction vehicles. Following construction these entrances will be closed by erecting fencing, however they may need to be reopened during the lifetime of the development should replacement blades or other abnormal loads be required to access the site.

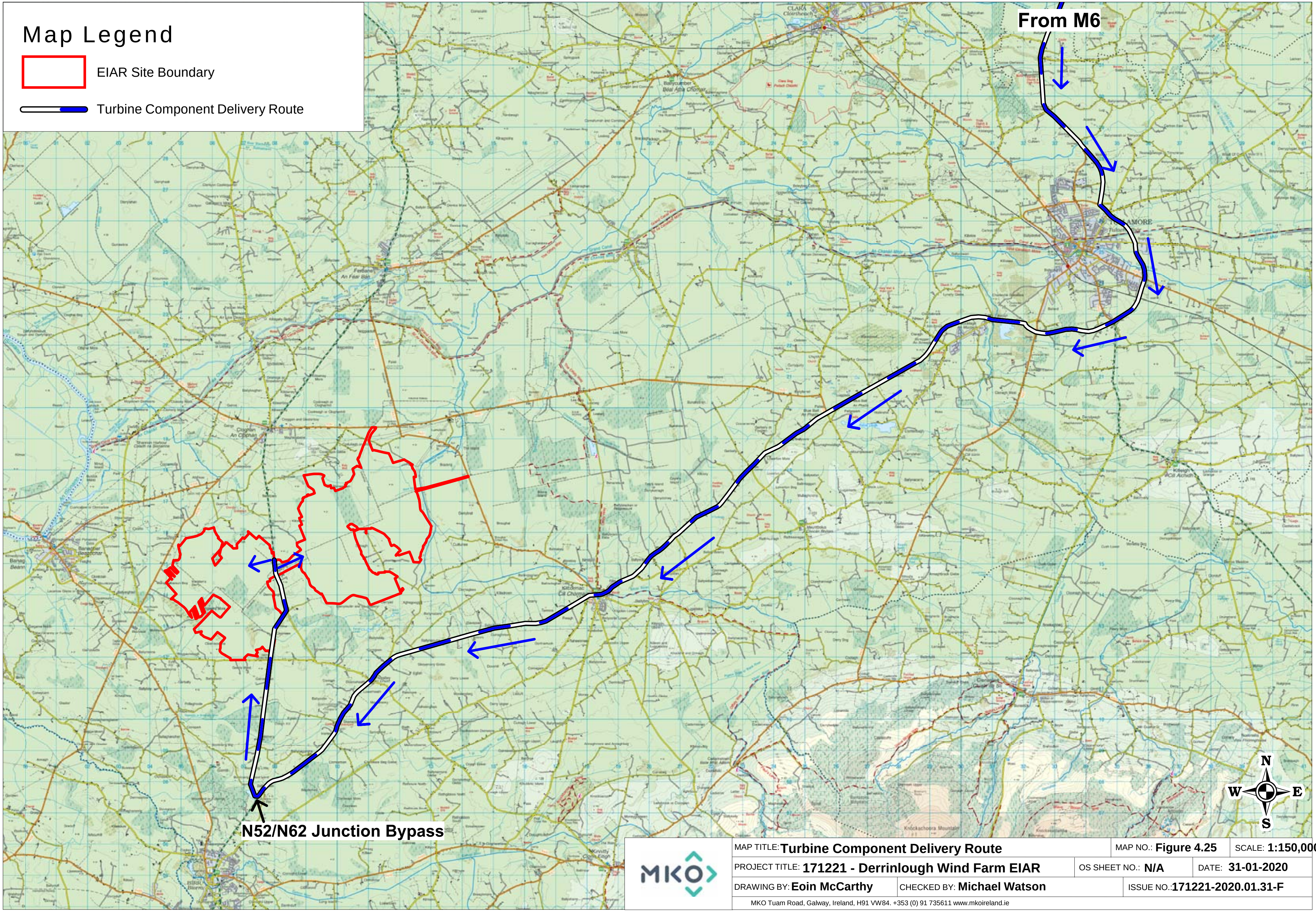
The access off the R357 will be used for the substation and grid connection works only and will not be used to provide access for turbine components. As such, this site entrance will have comparatively low level of construction traffic and associated material deliveries. Minor upgrade works will be required to this entrance location in order to accommodate access and egress of construction vehicles. This entrance will be upgraded after construction to provide permanent access to a proposed amenity car park. In addition, the existing machine pass off the L7009 Local Road will be upgraded to provide permanent access to the proposed substation and local access to the amenity during the operational phase.

New internal site roads (29.3km) will be constructed as part of the initial phase of the construction of the wind farm for access to turbine locations as depicted on Figure 4.1.

4.3.15 Turbine and Construction Materials Transport Route

It is proposed that the large wind turbine plant will be delivered via the M6 before turning south onto the N52 at Junction 5 (Tullamore/Kilbeggan). The route follows the N52 south, bypassing Tullamore to the east and passing through the settlements of Blue Ball, Kilcormac and Five Alley. Deliveries will turn right onto the N62 (at the junction known as Kennedy's Cross) and will proceed northwards towards Cloghan to the proposed site entrances, immediately north of Derrinlough Briquette Factory. The proposed route is shown on Figure 4.25. All deliveries of turbine components to the site will only be by way of the proposed transport route outlined in Figure 4.25.

Other construction materials will be delivered to the site via the proposed haul route shown on Figure 4.25 and other haul routes that will be determined based on the source of the construction material which will be included in the Traffic Management Plan for the proposed development. Traffic movements generated by the proposed development are discussed in in Section 14.1 of Chapter 14, Material Assets.



MAP TITLE: **Turbine Component Delivery Route** | MAP NO.: **Figure 4.25** | SCALE: **1:150,000**

PROJECT TITLE: **171221 - Derrinlough Wind Farm EIAR** | OS SHEET NO.: **N/A** | DATE: **31-01-2020**

DRAWING BY: **Eoin McCarthy** | CHECKED BY: **Michael Watson** | ISSUE NO.: **171221-2020.01.31-F**

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4.3.15.1 Turbine Delivery Accommodation Works

A new temporary arrangement will be required at Kennedy's Cross, located in the townland of Ballindown, (junction of the N52 and N62 National Secondary Roads), comprising construction of a new junction bypass road across third party lands, to facilitate the delivery of turbine components and other abnormal loads. The proposed new road will measure approximately 160 metres in length and have a 6 metre running width.

The access road itself would be constructed as per the general construction methodology for new excavated roads as outlined in Section 4.9.2 below. The locations of these works and an overview of the proposed accommodation works are shown in Figure 4.26 and on the layout drawings in Appendix 4.1 of this EIAR. Gates will be installed at the junctions of the temporary road with the N52 and N62, respectively. These gates will be locked between scheduled turbine deliveries.

Following the completion of the construction phase of the proposed development the gates will remain in-situ. The temporary turbine delivery access road will be closed, covered with a layer of topsoil and reseeded. It would only be used again in the event that an oversized delivery was required for wind turbine maintenance purposes.

4.3.15.2 Traffic Management

A turbine with a maximum blade length of 75 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 80.4 metres, including the blade which overhangs the back of the vehicle. The total length of the tower transporter is 49.6 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 will be smaller than the design test vehicles.

The turbine delivery vehicles have been modelled accurately in the Autotrack assessments for the site, as detailed in Chapter 14: Material Assets of this EIAR.

The need to transport a wind turbine blade measuring up to 75 metres 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 gets unusual loads from origin to destination. Given the extensive number of wind farms already built and operating in Ireland, transport challenges are something the wind energy industry and the specialist transport sector has become particularly adept in finding solutions to.

A traffic management plan has been prepared as part of the traffic impact assessment set out in Chapter 14 of this EIAR and is included in the Construction Environmental Management Plan (CEMP) which is contained in Appendix 4.3.

The deliveries of turbine components to the site will be made in convoys of three to five vehicles at a time, and mostly 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.

Project Design Drawing Notes

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2. Drawings not to be used for construction/contract conditions.
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4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Proposed Road

N

Figure 4.26

DRAWING TITLE:

Site Layout Plan - Sheet 8 of 8 (N52 - N62)

PROJECT TITLE:

Derrinlough Wind Farm, Co. Offaly

DRAWING BY: Joseph O Brien	CHECKED BY: Eoin McCarthy
PROJECT No.: 171221	DRAWING No.: 171221 - 11
SCALE: 1:5,000 @ A3	DATE: 18.02.2020

OS SHEET No.: 3487, 3488, 3489, 3490, 3491, 3537, 3538, 3539, 3540, 3541, 3586, 3587, 3588, 3589, 3590, 3643, 3644, 3645, 3646, 3700, 3701, 3702, 3703, 3704

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It is not anticipated that any section of the local 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 will be made outside the normal peak traffic periods to avoid disruption to work and school-related traffic.

Prior to the construction of the proposed development a full dry run of the proposed transport operation along the proposed route will be completed using vehicles with attachments to simulate the dimensions of the turbine components. Following this dry run the Traffic Management Plan will be reviewed and updated with the haulage company when the exact transport arrangements are known, delivery dates confirmed and escort proposals in place. The plan will then be submitted to Offaly County Council for agreement in advance of any abnormal loads using the local roads. The plan 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 Community Benefit Proposals

Bord na Móna presently operate two wind farm community gain schemes at its wind farms in Mountlucas and Bruckana. These schemes were established in 2014 thanks to the help and cooperation of the communities surrounding the wind farms. The Community Gain Schemes for Bruckana and Mountlucas Wind Farms were set up on the basis of community involvement and public consultation.

The Community gain scheme consists of a fixed level of funding (based on the installed capacity of the wind farm) that is made available each calendar year for community led projects in the local area. During 2017 and 2018, a 'near neighbour' scheme was established for residents in the vicinity of the Bruckana and Mountlucas wind farms. The near neighbour schemes offer electricity bill payers living within a prescribed distance of a wind turbine an annual contribution towards their electricity usage. In addition to the electricity contribution payment, the Scheme will also offer participants a contribution towards the completion of energy measures on the property and/or education support.

Bord na Móna is proposing to replicate its proven Community Gain Scheme model for Derrinlough Wind Farm and a Community Gain Scheme will be established for the proposed development in accordance with best practice requirements. The fund will be available for the lifetime of the project and will look to support the local community, through funding of projects and services, as required. A description of the Community Benefit proposal is outlined below and in the 'Derrinlough Wind Farm Community Report' which is contained in Appendix 2.3.

4.4.1 Community Gain and Near Neighbour Scheme

In addition to employment during the construction and operational phases of the proposed development and annual rates that will be paid to the local authority by the developer, a range of other benefits associated with the development will be provided to the local community through the annual Community Gain Scheme. The aim of this scheme is to provide financial assistance to local communities and not-for-profit organisations around the development. In order to be eligible for funding, projects must fall within the thematic areas of: Amenities, Community Facilities, Culture/Heritage, Energy Efficiency/Improvements, Education and Recreation/Health. A key criterion is that the projects and initiatives will benefit the communities surrounding the wind farm.

The Near Neighbour Scheme will offer electricity bill payers living within a prescribed distance of a wind turbine an annual contribution towards their electricity usage. In addition to the electricity contribution payment, the Scheme will also offer participants a contribution towards the completion of energy measures on the property and/or education support. This is in line with existing near neighbour schemes that are active at other Bord na Móna Powergen Wind Farms.

The value of the fund for the Community Gain and Near Neighbour Schemes will be directly proportional to the installed capacity and energy produced at the site, which based on current proposals, will be in the region of €10 million over the lifetime of the project.

4.4.2 Renewable Energy Participation Scheme Scheme/Community Ownership

Public Consultation on the Renewable Electricity Support Scheme (RESS) 1 closed for submissions in January 2020. The consultation paper set out the high-level details for the provision of a Renewable Energy Participation Scheme (REP Scheme) in Annex C (REP Scheme) for Community Participation in renewable developments. The key element proposed is:

- Providing Irish Citizens, or not for profit community entities (to be defined), to invest in renewable electricity generation projects in the Republic of Ireland - prioritising those that live in closer proximity to the Relevant Projects.

The Department of Communications, Climate Action and Environment envisage finalisation of the RESS Scheme in 2020.

If the proposed development utilises the RESS then any community benefit stipulations that are outlined in the finalised RESS will be incorporated into the operation of the wind farm and will be of enduring benefit to the local community.

4.5 Amenity Pathways and Carpark

Approximately 18 kilometres of amenity pathways (walkways and cycleways) will be provided as part of the construction of the proposed development. The amenity pathways will be mainly located on the proposed internal road network. The roads will be re-purposed following construction to form the amenity pathways, in addition to being used for maintenance access during operation. The amenity pathways will have a high quality, final surfacing granular fill.

In addition, approximately 6.5 km of dedicated amenity pathways are proposed to provide access points/links into and out of the site as follows:

- Internal link to R437 allowing further access to Drinagh and Derrybrat to facilitate potential future connection to Lough Boora Parklands.
- Link from the R357 and L7009 providing connectivity to the local Stonestown and wider Cloghan area.
- Link to the L7005 providing connectivity to the local Drinagh area.
- Link to the Bord na Móna boundary in Clongawny West to facilitate potential future connection to the R438.
- Link to the Bord na Móna boundary in southwest Drinagh to facilitate potential future connection to the proposed Whigsborough Walkway.

These amenity pathways and additional connections are discussed and shown in the Derrinlough Amenity Plan which is contained in Appendix 4.4 and are illustrated in Figure 4.1. The additional connections will be 3 metres in width and will be constructed using a similar methodology as outlined in Section 4.9.2.1 below.

A new public car park will also be provided for recreational use during the operational stage. The car park will be located adjacent to the proposed access off the R357, immediately north of the proposed substation. The location and configuration of the proposed car park, which will have capacity for 15 vehicles and will include suitable signage, is shown in Appendix 4.1. As outlined in Section 4.3.3, amenity connectivity between Clongawny and Drinagh Bogs will be via an underpass beneath the N62 only.

4.6 Site Drainage

4.6.1 Introduction

The drainage design for the proposed wind farm development has been prepared by Hydro Environmental Services Ltd. (HES), and by the firm's principal, Mr. Michael Gill. The drainage design has been prepared based on experience of the project team of other wind farm sites in peat-dominated environments, and the number of best practice guidance documents referred to in the References section of the EIAR.

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the proposed development. There is an existing drainage system and surface water discharges from the site which are regulated by the Environmental Protection Agency (Licence Ref. P0500-01). The proposed development drainage design for the proposed development 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. The assessment of potential impacts on hydrology and hydrogeology due to the construction, operation and decommissioning of the proposed development is included in Chapter 9: Hydrology and Hydrogeology.

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.

4.6.2 Existing Drainage Features

The surface of the cutover bog is drained by a network of parallel field drains that are typically spaced every 15 - 20m. The field drains are approximately 0.5 - 1.5m deep and in most areas, they intercept the mineral subsoil underlying the peat. These field drains mostly feed into larger surface water drains which drain the main catchments across the two bogs. There are a number of shorter cross drains which intersect the small field drains. There are various outfalls on the bog boundaries which comprise mainly pumped outfalls but also some areas of gravity drainage. Surface water draining/pumped from the site is routed via settlement ponds (in accordance with the IPC licence requirements) prior to discharge into off-site drainage channels, streams and rivers.

4.6.3 Drainage Design Principles

Drainage water from any works areas of the wind farm site will not be directed to any natural watercourses within the site. Two distinct methods will be employed to manage drainage water within the 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 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.

4.6.4 Drainage Design

A preliminary drainage design for the proposed wind farm, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in the drainage figures included in Appendix 4.5 to this EIAR. The proposed wind farm drainage process flow is shown on Figure 4.27. The drainage design employs the various measures further described below.

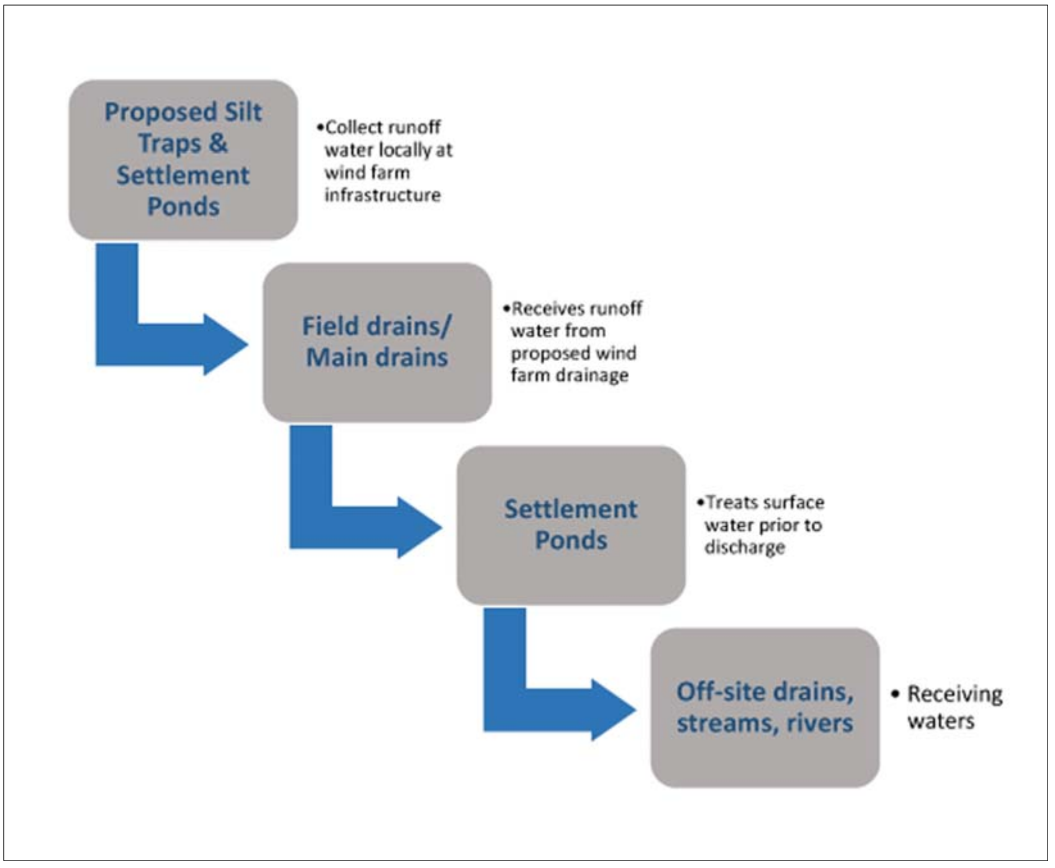

Figure 4.27 Proposed Wind Farm Drainage Process Flow

4.6.4.1 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 will 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 as 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.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.6.4.3), 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 4.6.4.4). 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.

4.6.4.2 Collector Drains

Collector drains 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.

Collector drains 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.

Collector drains 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.

4.6.4.3 Check Dams

The velocity of flow in the interceptor drains and collector drains, 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 also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.

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 to 6-inch stone will be built up on either side and over the straw bale to a maximum height of 600 mm 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.

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 150 mm 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.

4.6.4.4 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, or areas where they are not likely to give rise to peat stability issues.

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 re-concentrated 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.

The slope in the channel leading into the spreader will be less than or equal to 1%. The slope downgradient of the spreader onto which the water will dissipate will have a grade of less than 6%. The availability of slopes with a grade of 6% or less will determine the locations of level spreaders. If a slope grade of less than 6% is not available in the immediate area downgradient of a works area at the end of a diversion drain, a piped slope drain will be used to transfer the water to a suitable location.

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.

4.6.4.5 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 (settlement) ponds prior to diffuse discharge to the vegetation filters via a level spreader.

4.6.4.6 Stilling Ponds/Settlement Ponds

Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase and will remain in place to attenuate 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 at each required location as two separate ponds in sequence, a primary pond and a secondary pond. 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 primary stilling pond will reduce the velocity of flows to less than 0.5 metres per second to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary stilling pond will reduce the velocity of flows to less than 0.3 metres per second. Water will flow out of the secondary 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 will be sized according to the size of the area they will be receiving water from but will be sufficiently large to accommodate peak flows storm events. 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. All material excavated during pond construction will be used locally for landscaping and berm construction around these ponds.

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.

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 if 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.

4.6.4.7 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 peaty 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 4.6 and Plate 4.7 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 4.6 Silt Bag with water being pumped through

Plate 4.7 Silt bag under inspection

4.6.4.8 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.

4.6.4.9 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.

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 CIRIA (No. C648, 1996). Up to three silt fences may be deployed in series.

The Stage 1 (Coarse) silt fence will consist of a geotextile fabric such as Terram 1000 attached by staples to fixed stakes. The Terram sheets will be folded in an L shape with one metre extending horizontally in towards the works area. This horizontal section will be buried at a distance of approximately 150mm beneath a clean stone surface. Terram 1000 is a permeable fabric through which water can pass, but through which sediment particles cannot. It does however, impede water flow and can lead to the backing up of water and sediment, which reduce its effectiveness.

The Stage 2 (Medium) silt fence will consist of straw bales, embedded approximately 100mm into the soil/ground and fixed in place with stakes. A geotextile fabric will be pegged and stapled to the straw bales and stakes.

The Stage 3 (Fine) silt fence will be similar to the Stage 1 fence, with the addition of a course sand and/or fine gravel at the base of the geotextile.

In the case of all three types of fence, the geotextile fabric will be embedded at least 150mm below the ground surface.

In a small number of locations around the proposed site where space between the works areas and watercourses may be limited, silt fence designs will be combined to increase their effectiveness. For example, a straw bale silt fence (Stage 2) may be double wrapped with geotextile fabric (Stage 1) and course sand/fine gravel added on the upgradient side (Stage 3). The most suitable type, number or combination of silt fences will be determined on a location specific basis for the various parts of the site. Although they may be indicated in the drainage designs shown in Appendix 4.5 to be just a single line, silt fences may be installed in series on the ground.

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

4.6.4.10 Culverts

Culverts will be required where site roads, crane pads and turbine pads cross main bog drainage networks. Indicative locations of the culverts are shown on the drawings in Appendix 4.5.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). 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 doesn't 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.

4.6.5 Floating Road Drainage

Where sections of floating road are to be installed instead of excavated roads, cross drains will be installed beneath the road construction corridor to maintain existing clean water drainage paths. Large surface water drainage pipes will be placed at these locations below the level of the proposed road sub-base. These drainage pipes will be extended each side of the proposed road and cable trench construction corridor, along the paths of the existing drains.

With the exception of the installation of cross drains under the floating road corridor, minimal additional drainage will be installed to run parallel to the roads, in order to maintain the natural hydrology of the peatland areas over which the roads will be floated.

4.6.6 Cable Trench Drainage

Cable trenches are typically constructed in short controlled sections, thereby minimising the amount of ground disturbed at any one time and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences. This operation normally occurs over a period of 2-4 hours.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the up-gradient side of the trench and is temporarily sealed/smoothed over using the back of the excavator bucket. Should any rainfall cause runoff from the excavated material, the material is therefore collected and contained in the downgradient cable trench. Excess subsoil is removed from the cable trench works area immediately upon excavation, and in the case of the proposed development, would be transported to one of the on-site borrow pit storage areas or used for landscaping and reinstatements of other areas elsewhere on site.

4.6.7 Site and Drainage Management

4.6.7.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures outlined above, will be brought on-site in advance of any works commencing.

An appropriate amount of straw bales, clean stone, terram, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

4.6.7.2 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations, large movements of overburden or large scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

4.6.7.3 Reactive Site Drainage Management

The final drainage design prepared for the proposed development prior to commencement of construction will have to provide for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the environmental clerk of works or supervising hydrologist on-site. The environmental clerk of works or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to situation on the ground as a particular time.

In the event that works are giving rise to siltation of watercourses, the environmental clerk of works or supervising hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures such as those outlined above will be installed in advance of works recommencing.

4.6.8 Drainage Maintenance

An inspection and maintenance plan for the drainage system onsite will be prepared in advance of commencement of any works. Regular inspections of all installed drainage features will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the environmental clerk of works or the supervising hydrologist. The drainage inspection and maintenance plan is included in the CEMP in Appendix 4.3 of this EIAR.

If necessary, any excess sediment build up behind check dams will be removed. For this reason, check dams will be inspected and maintained weekly during the construction phase of the project to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the project and following rainfall events to ensure the structure of the dam is still effective in controlling flow. Any scouring around the edges of the check dams or overtopping of the dam in normal flow conditions will be rectified by reinforcement of the check dam.

Drainage swales will be regularly inspected for evidence of erosion along the length of the swale. If any evidence of erosion is detected, additional check dams will be installed to limit the velocity of flow in the channel and reduce the likelihood of erosion occurring in the future.

A water level indicator such as a simple staff gauge or level marker will be installed in each silt trap with marks to identify when sediment is at 50% of the trap's capacity. Sediment will be cleaned out of the silt trap when it exceeds 50% of trap capacity. Silt traps will be inspected weekly during the construction phase of the project and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

The frequency of drainage system inspections will be reduced following completion of the construction phase of the project. Weekly inspections during the construction phase will be reduced to monthly, bi-monthly and eventually quarterly inspections during the operational phase. The frequency will be increased or decreased depending on the effectiveness of the measures in place and the amount of remedial action required in any given period.

4.7 Construction Management

4.7.1 Construction Timing

It is estimated that the construction phase will take approximately 24 to 30 months from starting onsite to the full commissioning of the wind farm. The commencement of construction works where the removal of woody vegetation is required, or where works take place in sensitive breeding habitats (such as birch scrub and emergent wetland vegetation), will be scheduled to occur outside the bird nesting season (1st of March to 31st of August) to avoid any potentially significant effects on currently nesting birds. Construction may commence at any stage from September onwards to March, so that construction activities are ongoing by the time the next breeding bird season comes around, and can continue throughout the next breeding season.

4.7.2 Construction Sequencing

The construction phase can be broken down into three main phases, 1) civil engineering works: 18 months, 2) electrical works: 18 months, and 3) turbine erection and commissioning: 9 months. The main task items under each phase are outlined below.

Civil Engineering Works

- Create new entrance(s) and hardcore existing entrances (where required).
- Construct new site roads (permanent and temporary), drainage ditches and culverts.
- Clear and hardcore area for temporary site offices. Install same.
- Construct remaining new site roads and hard-standings and crane pads.
- Construct underpasses beneath the N62 and the existing industrial railway line.
- Construct the substation, control buildings and groundworks for the substation compound.
- Excavate/pile for turbine bases where required. Store soil/peat locally for backfilling and re-use. 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.

Electrical Works

- Construct bases/plinths for transformer.
- Excavate trenches for site cables, lay cables and backfill. Provide ducts at road crossings.
- Install external electrical equipment at substations
- Install transformer at compound.
- Erect stock proof and palisade fencing around substation area.
- Install internal collector network and communication cabling.
- Construct grid connection.

Turbine Erection and Commissioning

- Backfill tower foundations and cover with suitable material.
- Erect towers, nacelles and blades.
- Complete electrical installation.
- Install anemometry masts and decommission and remove existing 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 1st October 2022(Q4 2022) has been selected as an arbitrary start date for construction activities.

ID	Task Name	Task Description	Q4 2022	Q1 2023	Q2 2023	Q3 2023	Q4 2023	Q1 2024	Q2 2024	Q3 2024
1	Site Health and Safty									
2	Site Compounds	Site Compounds, site access, fencing, gates								
3	Site Roads	Construction/upgrade of roads, construct underpasses install								
4	Turbine Hardstands	Excavate/pile for turbine bases where required								
5	Turbine Foundations	Fix reinforcing steel and anchorage system, erect								
6	Substation Construction and Electrical Works	Construct substation, underground cabling, grid								
7	Backfilling and Landscaping									
8	Turbine Delivery and Erection									
9	Substation Commissioning									
10	Turbine Commisioning									

Figure 4.28 Indicative Construction Schedule

4.7.3 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 and is addressed in Section 4.3.13. The proposed procedures for the implementation of the mitigation measures outlined in such a CEMP and their effectiveness and completion is typically audited by way of a Construction and Environmental Management Plan Audit Report. The CEMP Audit Report effectively lists all mitigation measures prescribed in any of the planning documentation, all conditions attached to the grant of planning permission and any further mitigation measures proposed during the detailed design stage, and allows them to be audited on a systematic and regular basis. 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 audit report. 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.

The Contractor will be responsible for implementing the mitigation measures specified throughout the EIAR and compiled in the Audit Report which is included in the CEMP. The Contractor will also be responsible for ensuring that all construction staff understand the importance of implementing the mitigation measures. The implementation of the mitigation measures will be overseen by the environmental clerk of works 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.

4.8 Construction Methodologies

4.8.1 Turbine Foundations

Foundations for wind turbines may be of the gravity, rock anchored or piled type. Trial pitting, peat probing and gouge coring has been carried out at each of the turbine base locations to determine the depth of excavation and fill required (refer to Section 4.3.11 and Section 4.3.12). Based on the geotechnical investigations to date, the majority of the foundations at the proposed Derrinlough wind farm are expected to be piled. Piling depths will depend on site conditions. These will be established by confirmatory geotechnical investigations prior to the construction of the proposed development. The exact dimensions of foundations will be determined by pre-construction structural design calculations incorporating appropriate factors of safety.

Each of the turbines to be erected on site will have a reinforced concrete base. Overburden will be stripped off the foundation area to a suitable formation using a 360° excavator and will be placed across the site as close to the excavation as practical. A five-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 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 typically 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 site in 2 or more parts depending on the turbine type. A 360° excavator 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.

4.8.2 Site Roads and Crane Pad Areas

The construction methodologies for the road types and crane pad areas are listed in Section 4.3.2 below are set out below.

Straight sections of proposed roadways will require a running width of approximately 6 metres (6.5m including shoulders) to accommodate the transportation of large turbine components. Corners and junctions will have to be wider than six metres to allow the trucks to manoeuvre around bends. The proposed new roadways will incorporate passing bays to allow traffic to pass easily while traveling around the site. All site access roads will comply with the turbine supplier's requirements.

4.8.2.1 Construction of New Floating Roads

Floating access roads are the predominant road construction type proposed for the site and will be used in areas where the peat depth is in excess of 1m. The use of new floated access tracks will be limited on site to areas of flatter terrain i.e. typically less than 5 degree slope.

The general construction methodology for the construction of floating roads, as presented in FTC's Peat and Spoil Management Plan in Appendix 4.2, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

1. *Prior to commencing floating road construction movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.*
2. *Floating road construction shall be to the line and level requirements as per design/planning conditions.*
3. *Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.*
4. *Construction of road to be in accordance with appropriate design from the designer.*
5. *The typical make-up of the new floated access road is up to 1,200mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator. This may vary depending on designer requirements.*
6. *Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 5m wide pressure berm (typically 1m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.*
7. *The finished road surface width will be approximately 6m (to be confirmed by the designer).*
8. *Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.*
9. *To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.*
10. *Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.*
11. *Following end-tipping a suitable bull-dozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.*
12. *A final surface layer shall be placed over the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

4.8.2.2 Construction of New Excavated Roads

The general construction methodology for the construction of excavated roads, as presented in the Peat and Spoil Management Plan (Appendix 4.2), is summarised below. This methodology includes procedures that are to be included in construction to minimise any adverse impact on peat stability.

1. *Prior to commencing the construction of the excavated roads movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.*
2. *Interceptor drains should be installed upslope of the access road alignment to divert any surface water away from the construction area.*
3. *Excavation of roads shall be to the line and level given in the design requirements. Excavation should take place to a competent stratum beneath the peat (as agreed with the site designer).*
4. *Road construction should be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill unless otherwise agreed with the site designer or resident engineer on site.*
5. *All excavated peat shall be placed/spread alongside the excavations.*
6. *Side slopes in peat shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations should be carried out as the excavation progresses.*
7. *The surface of the finished excavated access road will be 1.2m above existing ground level.*

8. *A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the designer).*
9. *At transitions between floating and excavated roads a length of road of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated roa.*
10. *Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability. It should be noted that slopes greater than 5 degrees are not envisaged on site.*
11. *A final surface layer shall be placed over the excavated road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

4.8.2.3 Upgrade of Existing Roads

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

1. *Access road construction shall be to the line and level requirements as per design/planning conditions.*
2. *For upgrading of existing excavated access tracks the following guidelines apply:*
   a. *Excavation of the widened section of access road should take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.*
   b. *Benching of the excavation may be required between the existing section of access road and the widened section of access road depending on the depth of excavation required.*
   c. *The surface of the existing access track should be overlaid with up to 500mm of selected granular fill.*
   d. *A layer of geogrid/geotextile may be required at the surface of the existing access track and at the base of the widened section of access road (to be confirmed by the designer).*
   e. *For excavations in peat, side slopes shall be not greater than 1 (v): 2 or 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.*
3. *For upgrading of existing access tracks constructed using a floated construction technique the following guidelines apply:*
   a. *The surface of the existing access track should be graded/tidied up prior to the placement any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).*
   b. *Where granular fill has been used in the existing access track make-up, a layer of geogrid should be placed on top of the existing access track.*
   c. *The geogrid may be overlaid with up to 500mm of selected granular fill.*
   d. *Additional geogrid and granular fill may be required in certain sections of the works (to be confirmed by the designer).*
4. *Where the ground is sloping across a section of access road (side long ground) any road widening works required should be done on the upslope side of the existing access road, where possible.*
5. *At transitions between floating and existing excavated roads a length of road of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.*

6. *A final surface layer shall be placed over the existing access track, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

4.8.2.4 Crane Hardstands

All crane pads will be designed taking account of the loadings provided by the turbine manufacturer and will consist of a compacted stone structure. The crane hardstands will be constructed in a similar manner to the excavated site roads and will measure approximately to the turbine manufacturer's requirements. Where an excavated crane hardstand cannot be used due to the depth of peat, the hardstand will be supported by using reinforced concrete piles as per the methodology outlined for piled foundations summarised below. The position of the crane pads varies between turbine locations depending on topography, position of the site access road, and the turbine position.

4.8.3 Underpass

As outlined in Section 4.3.3, two permanent underpasses are proposed as part of the proposed development, the locations of which are as follows:

- Beneath the N62, immediately north of Derrinlough Briquette Factory.
- Beneath an existing Bord na Móna railway line in Clongawny Bog, immediately west of the N62 underpass.

Both underpasses will provide amenity connectivity between Clongawny and Drinagh Bogs and will also be used occasionally by vehicles for wind farm maintenance during the operational phase.

The underpasses will be approximately 35m in length, 4.5m wide and 4.5m high and will take the form of precast concrete box culverts which will be founded on an in-situ concrete base slab. As a worst-case, the structures may need to be underpinned by piles which have been assessed in this EIAR.

The method of construction proposed will ensure that the N62 will remain open during construction though traffic control will be required. It is envisaged that the structure will be completed in two phases, through single lane closure, in order to maintain traffic flow as follows:

- The site will be cleared and prepared for construction works. Material excavated will be stored locally for later reuse, where practicable.
- Temporary sheet piled walls will be installed to reduce the working width required and to provide protection and support to the excavations.
- One side of the existing road surface will be excavated to a depth of 6.5m.
- The required foundations for the precast concrete units will then be installed as required by the designers.
- A mobile telescopic crane will be required to lift the precast elements into place therefore temporary crane hardstands (approximately 25m x 10m) will be constructed on each side of the N62. Suitable laydown areas close to the excavation will also be required for storage of the precast elements upon delivery to site.
- The precast concrete box and wingwall sections will be placed in position by the telescopic crane. Elements of the installation may have to take place during off-peak periods and thus some limited night-time working is envisaged.
- Once the pre-cast elements are in place the area will be backfilled and the structural layers of the road will be built up.
- Road crash barriers will then be installed
- The above steps will be repeated for the other side of the road.
- The final road resurfacing (wearing course) will be installed and road edge protection will be completed.

Site drainage will be provided during the works to collect runoff which will be directed to a settlement pond.

A Traffic Management Plan will be implemented during the construction of the proposed development and will include for the construction of the underpass beneath the N62. This will be agreed prior to commencement of works with Offaly County Council and TII. The temporary traffic management arrangement will include some form of lane restrictions/road closures in order to construct the underpass.

4.8.4 Cable Trenching

The transformer in each wind turbine is connected to the substation through a network of buried electrical cables. The ground is trenched typically using a mechanical excavator. The top layer of soil is removed and saved so that it is replaced on completion. The electrical cables from wind turbines to the substation will be run in ducts approximately 1.2m below the ground surface. Typical trench details can be seen in Figure 4.14. On completion, the ground will be reinstated as previously described above.

Plate 4.8 Typical Cable Trench View

4.8.5 Grid Connection

As stated in Section 4.3.8 above, the proposed wind farm will connect to the existing national grid via a substation, in the north-eastern part of the Drinagh bog, and associated grid connections. The proposed wind farm will connect to the national electricity grid via either 110 kV overhead line or 110 kV underground cable.

4.8.5.1 Underground Cabling

The proposed underground cable option will be facilitated through two cable interface masts under the existing Shannonbridge to Portlaoise 110 kV overhead line. The existing overhead line conductor will be terminated at these two new structures in order to facilitate the looped cabling. There will be a double circuit underground trenching arrangement which will consist of 6 No. 160mm diameter HDPE power cable ducts to be installed into an excavated trench. This trench will be typically 2000mm wide by 1250mm deep to facilitate cabling into the station and trenching to accommodate 6 No. 160mm diameter HDPE power cable ducting exiting the station and continuing back to the interface masts.

The ducts are protected by CBM4 lean-mix concrete with cable protection strip laid over the concrete, warning tape, protective plates (if required) and backfill material. The trench will form part of a newly constructed permanent access track which will be utilised for maintenance and inspection works for the underground cable. The transition of the cabling system from underground into Derrinlough 110 kV Substation will be facilitated via cable chair.

The following text outlines the methodology to be followed during trenching works:

- Grade, smooth and trim trench floor when the required 1250mm depth and 2000mm width have been obtained. Any peat in cable trench to be removed and replaced with granular material.
- Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with the specification and compact it so that the compacted thickness is as per the ESB specification.
- Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing. Fit a secure cap / bung to the end of each duct run to prevent the ingress of dirt or water.
- Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
- Place cable protection strips on compacted CBGM B directly over the ducts.
- Lay the top row of ducts onto the freshly compacted CBGM B including the cable protection strips above the bottom row of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.
- Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.
- Place red cable protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.
- Place and thoroughly compact CBGM B material or Clause 804 backfill or soil backfill as specified and place warning tape at the depth shown on the drawings.
- For concrete and asphalt/bitmac road sections, carry out immediate permanent reinstatement in accordance with the specification and to the approval of the local authority.
- For unsurfaced/grass sections, backfill with suitable excavated material to ground level leaving at least 100 mm topsoil or match existing level at the top to allow for seeding or replace turves as per the specification of the local authority or landowner.
- Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12 mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes in preparation for cable installation at a later date. Excavated material will be stored close to the trench and utilised throughout the works.

4.8.5.2 Overhead Lines

The proposed design for the 110kV Looped line from the existing overhead line will require two new Loop In towers which will be constructed under the existing Shannonbridge – Portlaoise 110kV OHL. The existing OHL conductor will be terminated at these two interface structures in order to facilitate an OHL loop into Derrinlough 110kV Substation via lattice angle towers, terminal towers and onto gantry dropper's arrangement. The existing conductor will be removed between the loop in towers with the new connection looped through to the new Derrinlough 110kV Substation.

The new Loop In structure locations have been selected based on ground surveys, ground profiles, allowable angles and ruling span checks.

The following section outlines the methodology to be followed during construction works of the new Loop In tower structures which will be constructed underneath the existing 110 kV overhead line;

- The Steel lattice tower sites are scanned for underground services such as cables etc. Consultation with the landowner will help to identify services / constraints and ensure there are no unidentified services in the area.
- For each leg of 6 No. towers (24 in total) a foundation c.3m x 3.6m x 3.6m is excavated and the formation levels (depths) will be checked by the onsite foreman. See Plate 4.9 The excavated material will be temporarily stored close to the excavation and excess material will be used as berms along the site access roads.
- To aid construction, a concrete pipe is placed into each excavation to allow operatives level the mast at the bottom of the excavation. The frame of the reinforcing bars will be prepared and strapped to a concrete pipe with spacers as required. The reinforcing bars will be lifted into each excavated foundation using the excavator and chains/slings. The base and body section of each tower will then be assembled next to excavation.
- Concrete trucks will pour concrete directly into each excavation in distinct stages.
- A third pour for the leg of the tower 1m x 1m and will be 300mm over ground level.
- Once the main concrete foundation pour is cured after circa five days, metal shuttering is installed to accommodate the placement of concrete around the tower legs. During each pour, the concrete will be vibrated thoroughly using a vibrating poker.
- Once the concrete is set after the five days the shuttering is removed.
- The tower foundations will be backfilled one leg at a time with the material already excavated at the location. The backfill will be placed and compacted in layers. All dimensions will be checked following the backfilling process. All surplus excavated material and removed from the tower locations and stored in berms adjacent to the Substation Compound or distributed on site in accordance with approved environmental procedures.
- The existing overhead line will be de-energised by ESB so work can commence on the construction of the towers.
- An earth mat consisting of copper or aluminium wire will be laid circa 400mm below ground around the tower. This earth mat is a requirement for the electrical connection of the equipment on the tower structure.
- Once the base section of each tower is completed and the concrete sufficiently cured, it is ready to receive the tower body. Temporary hardstands may be removed and disposed of off site where necessary. See Plate 4.10.
- A hardstand area for the crane will be created by laying geogrid material on the ground surface and overlaying this geogrid with a suitable grade of aggregate.
- A physical barrier (Heras Fence Site Boundary) will be put in place to restrict plant from coming too close to the OHL.
- The towers will be constructed lying flat on the ground beside the recently installed tower base.
- The conductor will be moved off centre using a stay wire and weights to anchor the stay wire to ground.
- The tower section will be lifted into place using the crane and guide ropes.
- The body sections will be bolted into position.
- The conductor will be centred over the towers and held in place. Once the conductor is secured at both ends it is then cut and attached onto each tower. The section of conductor in between the two towers will be removed and utilised as connector wire for the new towers. See Plate 4.11

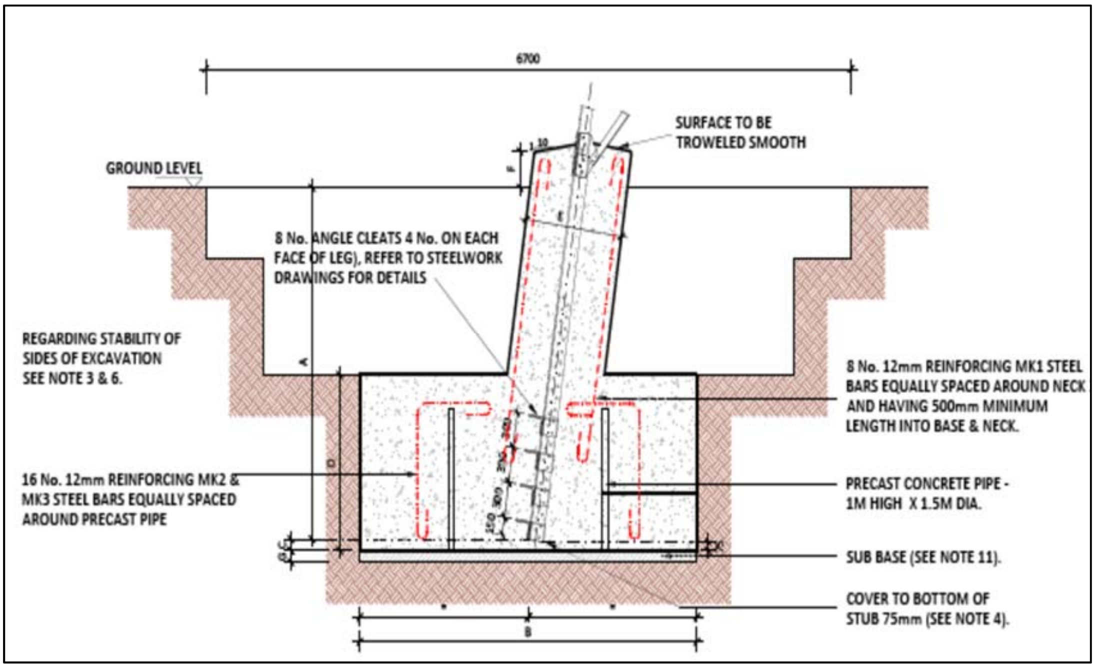

Plate 4.9 Steel lattice tower foundation

Plate 4.10 Steel lattice tower foundation complete

Plate 4.11 Completed End Mast Tower

4.8.5.3 Stringing of Conductors

Stringing of overhead lines on the supporting lattice structures will be kept clear of all obstacles along the straight by applying sufficient tension. This method requires the pulling of a light pilot line (nylon rope) which is normally carried by hand into the stringing wheels. This in turn is used to pull a heavier pilot line (Steel rope) which is subsequently used to pull the conductors from the drum stands using specifically designed "puller – tensioner" machines (Plate 4.12). The main advantages with this method are:

- The line is protected from surface damage
- Major obstacles can be completed without any significant disruption.

Plate 4.12 Puller – Tensioner Machine

Once the conductors have been pulled into position, one end of the straight is terminated on the appropriate tension fittings and insulator assemblies. The free end of the straight is then placed in temporary clamps which take the conductor tension. The conductor is then cut from the puller-tensioner and the conductor is sagged using a chain hoist. Bird flight diverters or warning spheres can be added following the sagging procedure if required.

4.8.6 Anemometry Mast Removal

There is an existing 100m high meteorological mast (Pl. Ref. 17/155) on Clongawny Bog which will be decommissioned, disassembled and removed from site as it will no longer be required due to the presence of the 2 No. new masts. The disassembly process will generally follow the sequencing shown on Table 4.4.

Table 4.4 Met Mast Removal Sequencing

Demolition Sequence	Description
Removal of Equipment	Equipment and monitors on the mast will be removed
Removal of hazardous materials	Electrical cabling, solar panels and other remaining electrical equipment
Removal of Mast Structure	Disassemble Mast Structure
Removal of Groundworks	Ground anchors will either be dug up and removed or remain in situ
Source segregation of material fractions	C&D waste recovery
Transport of materials to authorised facilities	Authorised Waste Collection Permit holders and Waste Facility or Licence holders.

4.8.7 Onsite Electricity Substation and Control Building

Once ground preparation as per the methodology for site roads as described in Section 4.3.2 is completed, the 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 nearby temporary storage area for later use in landscaping..
- The dimensions of the onsite substation area will be set to meet the requirements of Eirgrid and the necessary equipment to safely and efficiently operate the permitted wind farms;
- Two control buildings will also 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 and internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- The concrete 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 will be to ESB or Eirgrid specifications.

4.8.8 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 discussed above;
- A layer of geo-grid will be installed 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;
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- The compound will be fenced and secured with locked gates if necessary; and,
- Upon completion of the proposed development the temporary construction compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required.

4.9 Operation

The proposed development is expected to have a lifespan of approximately 30 years. Planning permission is being sought for a 30-year operation period commencing from the date of full operational commissioning of the wind farm. During the operational period, on a day-to-day basis the wind turbines will operate automatically, responding by means of anemometry 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 an off-site control centre. Each turbine will also be monitored off-site by the wind turbine supplier. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored at an off-site control centre 24-hours per day.

Each turbine will be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. In addition, there will be 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 electricity substation and site tracks will also require periodic maintenance.

4.10 Decommissioning

The wind turbines proposed as part of the proposed development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the proposed development may be decommissioned fully. The onsite substation will remain in place as it will be under the ownership of the ESB/EirGrid.

Upon decommissioning of the proposed development, the wind turbines would be disassembled in reverse order to how they were erected. 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 significant environment nuisances such as noise, dust and/or vibration. . Site roadways will be in use as amenity and recreational pathways, and therefore will not be removed during decommissioning. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required. Underground cables, including grid connection, will be removed and the ducting left in place. A decommissioning plan will be agreed with Offaly County Council three months prior to decommissioning the proposed development. An outline decommissioning plan is contained in the CEMP in Appendix 4.3.

However, 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".*