4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the Proposed Project (Wind Farm and Grid Connection) and its component parts which are the subject of separate planning applications under Section 37E (Proposed Wind Farm) and Section 182A (Proposed Grid Connection) of the Planning and Development Act 2000, as amended. The current application for planning permission to An Bord Pleanála in accordance with Section 37E of the Planning and Development Act 2000, (as amended) is for the Proposed Wind Farm. For the purpose of this application the proposed development, hereafter the 'Proposed Wind Farm' will consist of the following:

i. *9 no. wind turbines with an overall turbine tip height of 185 metres; a rotor blade diameter of 163 metres; and hub height of 103.5 metres, and associated foundations and hard-standing areas;*
ii. *A thirty-year operational life of the wind farm from the date of full commissioning of the wind farm and subsequent decommissioning;*
iii. *Underground electrical cabling (33kV) and communications cabling;*
iv. *A temporary construction compound;*
v. *A temporary security cabin;*
vi. *A meteorological mast with a height of 30 metres and associated foundation and hard-standing area;*
vii. *A new gated site entrance on the L3248;*
viii. *Junction accommodation works and a new temporary access road off the L3248, to facilitate turbine delivery to the site;*
ix. *Upgrade of existing site tracks/roads and provision of new site access roads, junctions and hardstand areas.*
x. *Upgrade of the existing L7039/L70391 junction for secondary site access off the L70391;*
xi. *A borrow pit;*
xii. *Spoil Management;*
xiii. *Tree felling;*
xiv. *Site Drainage;*
xv. *Biodiversity Enhancement Plan (including restoration of a segment of the Eastwood River, and planting of natural woodland and hedgerow);*
xvi. *Operational Stage site signage; and*
xvii. *All ancillary works and apparatus.*

The Proposed Grid Connection, which will be subject to a separate planning application under Section 182A of the Planning and Development Act, 2000 (as amended) is entirely located within the townlands of Strogue and Clonmore, Co. Tipperary, and will consist of the following:

1. *1 no. permanent 110kV substation compound (2 no. control buildings with welfare facilities, all associated electrical plant and apparatus, security fencing, underground cabling, wastewater holding tank, site drainage and all ancillary works);*
2. *a temporary construction compound;*
3. *2km underground 110kV electrical cabling route (including joint bays and watercourse crossings) which will run through the L-7039 road and new track through agricultural land; and*
4. *2 no. new end masts that will break the existing Ikerrin to Thurles 110kV OHL.*

The 2km underground cabling route will connect the permanent 110kV substation to the 2 no. new end masts. If planning consent is granted, construction will be undertaken by a statutory undertaker having a right or interest to provide services in connection with the Proposed Wind Farm.

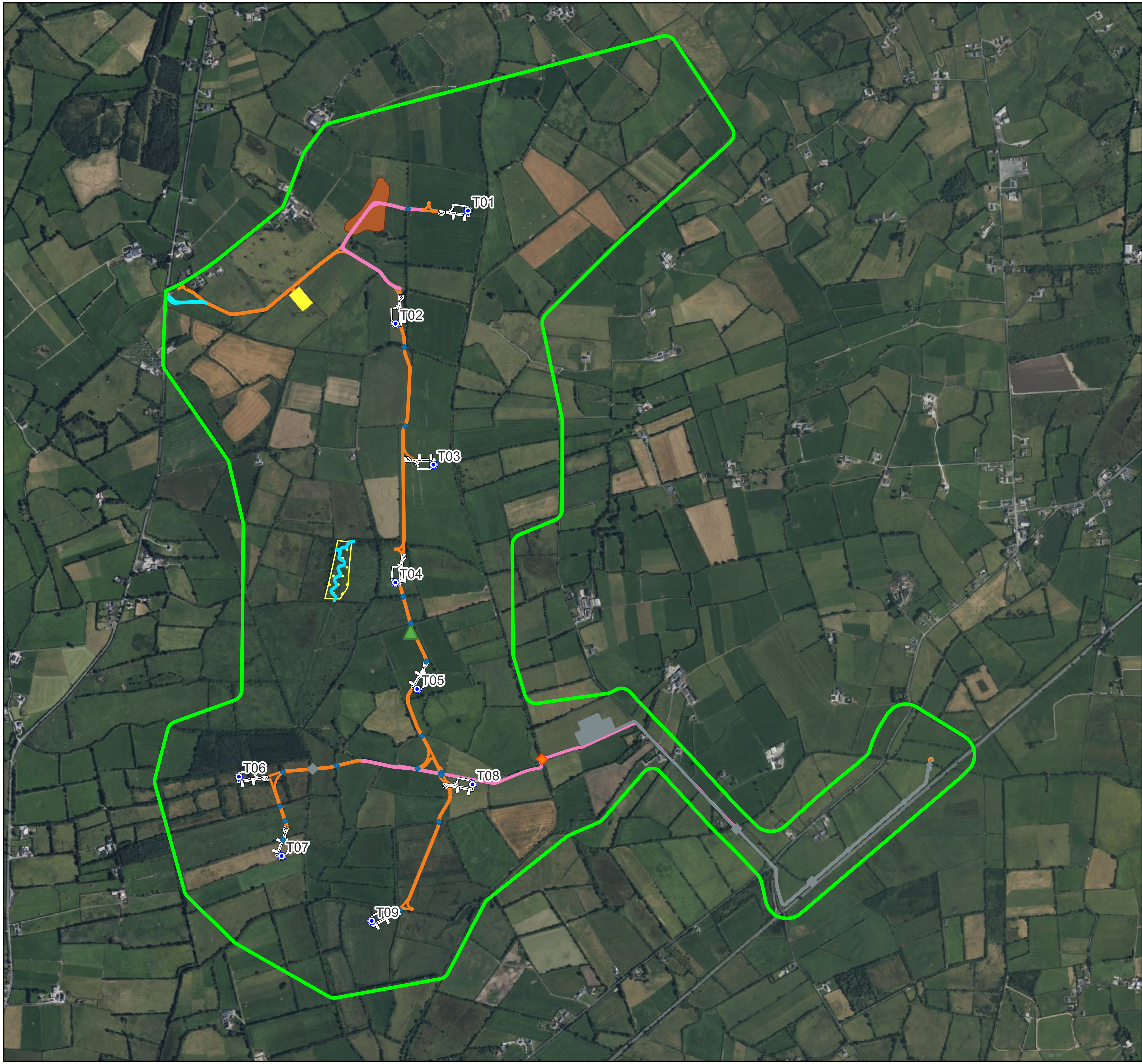
The 'Proposed Project' which entails the Proposed Wind Farm (Section 37E) and Proposed Grid Connection (Section 182A) has been assessed within this EIAR. The Proposed Project is located within the EIAR Study Boundary or the 'Site' and measures approximately 650 hectares. The Proposed Project is illustrated on Figure 1-3 and Figure 1-3a (aerial).

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 Proposed Project Layout

The layout of the Proposed Wind Farm which is the subject of the 37E application is shown on Figure 4-1. Planning drawings of the Proposed Wind Farm can be found in Appendix 4-1. Figure 4-2 illustrates the Proposed Grid Connection, and detailed drawings of the Grid Connection (separate S182A Application but assessed within this EIAR) can be found in Appendix 4-5.

The layout of the Proposed Project (i.e. the Proposed Wind Farm and Proposed Grid Connection together) has been designed to minimise the potential environmental effects of its construction, operation and decommissioning, while at the same time maximising the energy yield of the wind resource passing over the Site. Please see Figure 4-3 for details. A constraints study, as described in Chapter 3: Consideration of Reasonable Alternatives, has been carried out to ensure that turbines and ancillary infrastructure are sited in the most appropriate areas of the Site.



Map Legend

- EIAR Study Boundary
- Proposed Turbines
- Proposed Turbine Hardstands
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Temporary Borrow Pit
- Proposed Temporary Security Cabin
- Existing Roads for Upgrade/ Resurface
- Proposed New Roads
- Proposed Temporary Abnormal Entrance
- Proposed Clear Span Crossing
- HDD Crossings
- Proposed Culverts
- River Enhancement 1.8ha Natural Woodland
- River Enhancement Segment
- Separate 182A Application

N

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Drawing Title: Borrisbeg Wind Farm Design	
Project Title: Borrisbeg Renewable Energy Development	
Drawn By: NS	Checked By: KM
Project No.: 220310	Drawing No.: Figure 4-1
Scale: 1:16,000	Date: 2023-12-07

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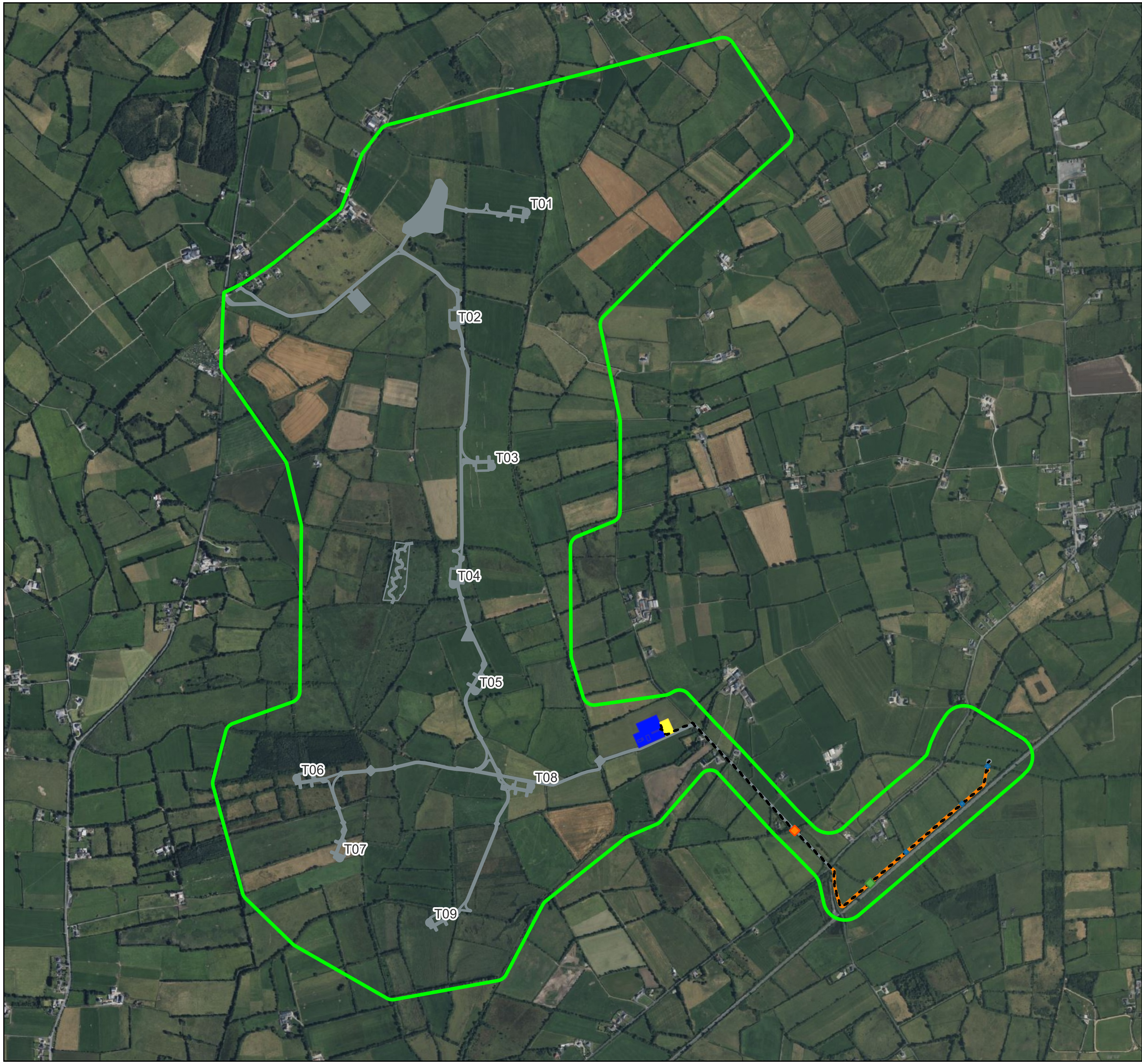

Map Legend

- EIAR Study Boundary
- Proposed Grid Connection Cable Route
- Proposed End Masts
- Proposed New Road for Underground Cable
- Proposed Permanent 110kV Substation
- Temporary Substation Construction Compound
- Proposed Clear Span Crossing
- Proposed HDD Crossing
- Proposed Culverts
- S37 Infrastructure

N

Drawing Title: Proposed Grid Connection Design	
Project Title: Borrisbeg Renewable Energy Development	
Drawn By: NS	Checked By: KM
Project No.: 220310	Drawing No.: Figure 4-2
Scale: 1:16,000	Date: 2023-12-07

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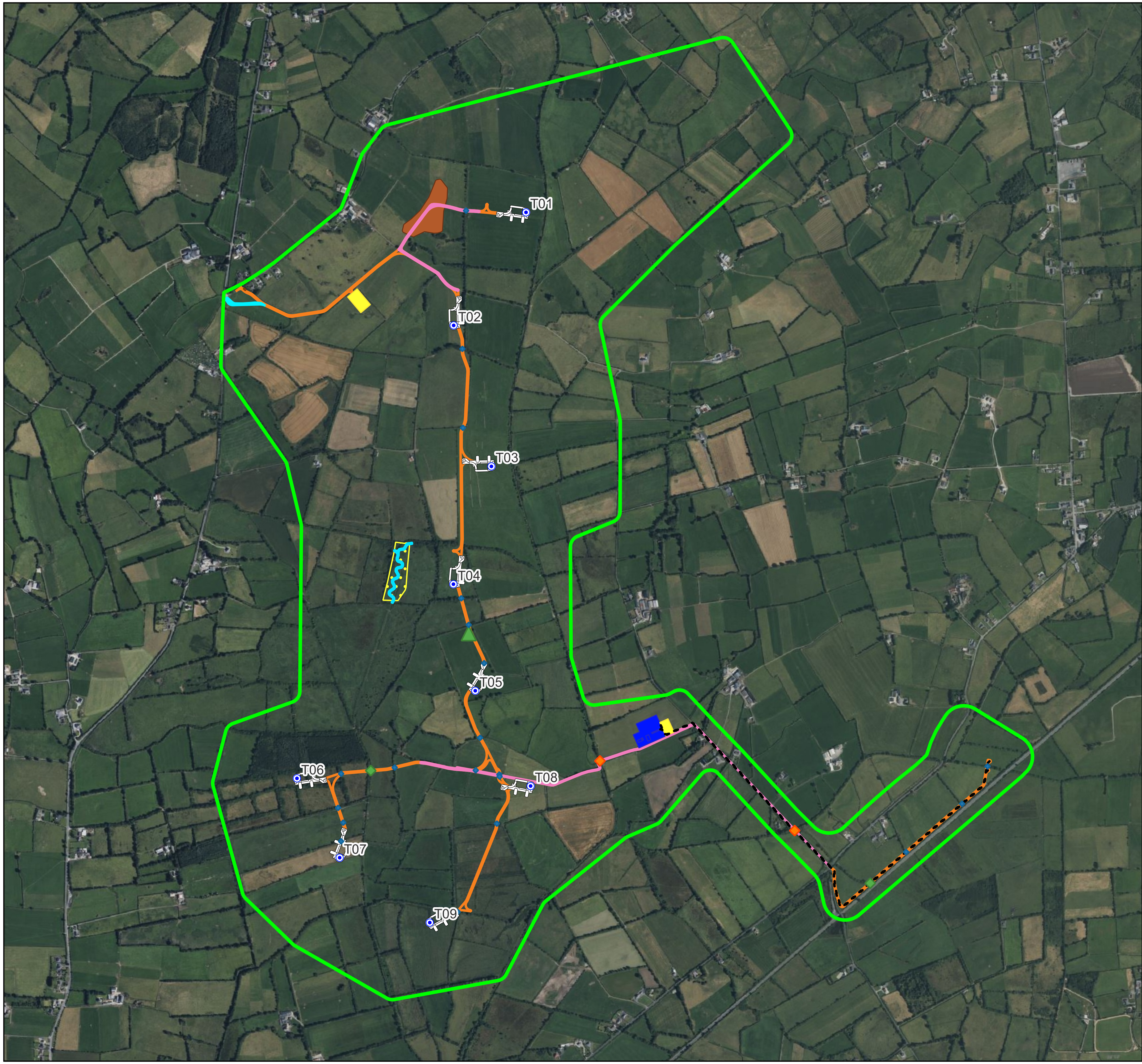

Map Legend

- EIAR Study Boundary
- Proposed Turbines
- Proposed Turbine Hardstands
- Proposed Met Mast
- Proposed Temporary Compounds
- Proposed Permanent 110kV Substation
- Proposed Grid Connection Cable Route
- Proposed End Masts
- Proposed Temporary Borrow Pit
- Proposed Temporary Security Cabin
- Existing Roads for Upgrade/ Resurface
- Proposed New Roads
- Proposed Temporary Abnormal Entrance
- Proposed Clear Span Crossing
- Proposed HDD Crossing
- Proposed Culverts
- River Enhancement 1.8ha Natural Woodland
- River Enhancement Segment

N

Drawing Title: Proposed Project	
Project Title: Borrisbeg Renewable Energy Development	
Drawn By: NS	Checked By: KM
Project No.: 220310	Drawing No.: Figure 4-3
Scale: 1:16,000	Date: 2023-12-07

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4.3 Proposed Project Components

4.3.1 Proposed Wind Farm

4.3.1.1 Wind Turbines

4.3.1.1.1 *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 ITM Grid Reference coordinates of the proposed turbine locations are listed in Table 4-1 below. The final top of foundation level of the turbine foundations will be determined by the actual ground conditions at each proposed turbine location and may differ slightly from those listed in Table 4-1.

Table 4-1 Proposed Wind Turbine Locations and top of foundation level

Turbine	ITM X	ITM Y	Top of Foundation Levels (metre OD)
1	613427	676731	112
2	613113	676241	110
3	613277	675630	110.6
4	613112	675119	109.3
5	613207	674658	109
6	613447	674244	110
7	612619	673934	108.7
8	613447	674244	108.7
9	613009	673653	108.7

4.3.1.1.2 *Turbine Type*

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

- Foundation unit;
- Tower;
- Nacelle (turbine housing);
- Rotor.

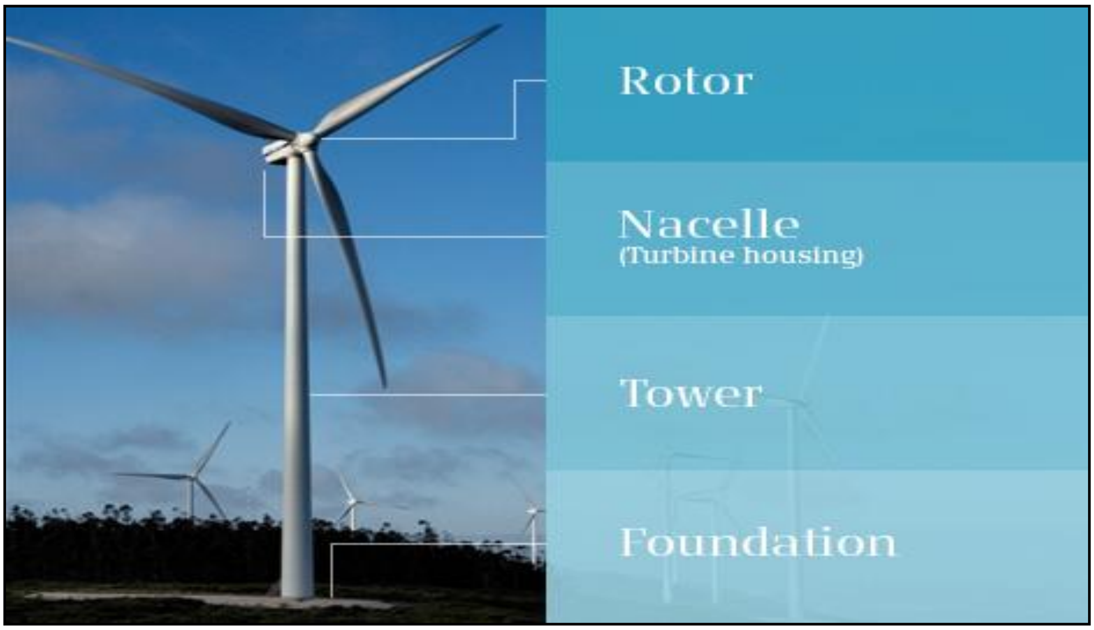


Plate 4-1 Wind Turbine Components

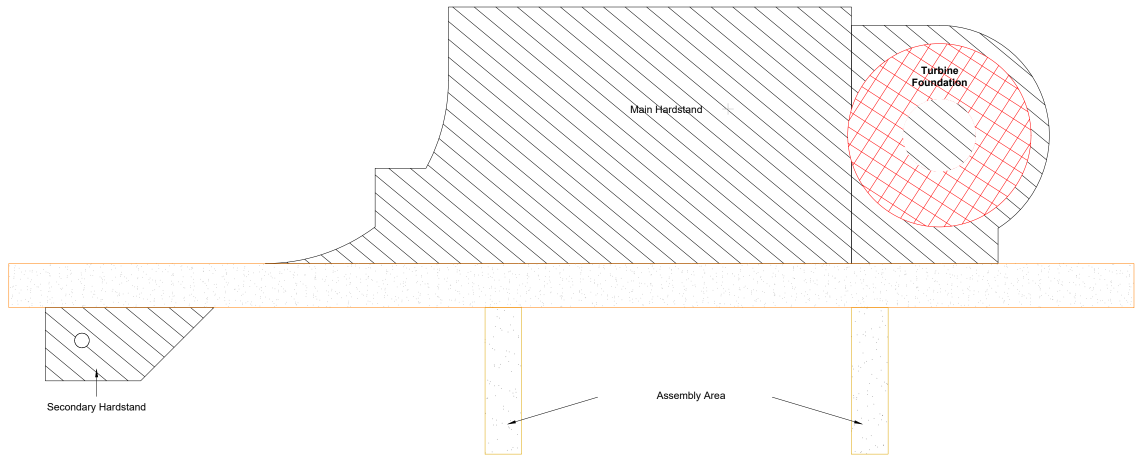
The proposed wind turbines to be installed on the Site will have the following dimensions:

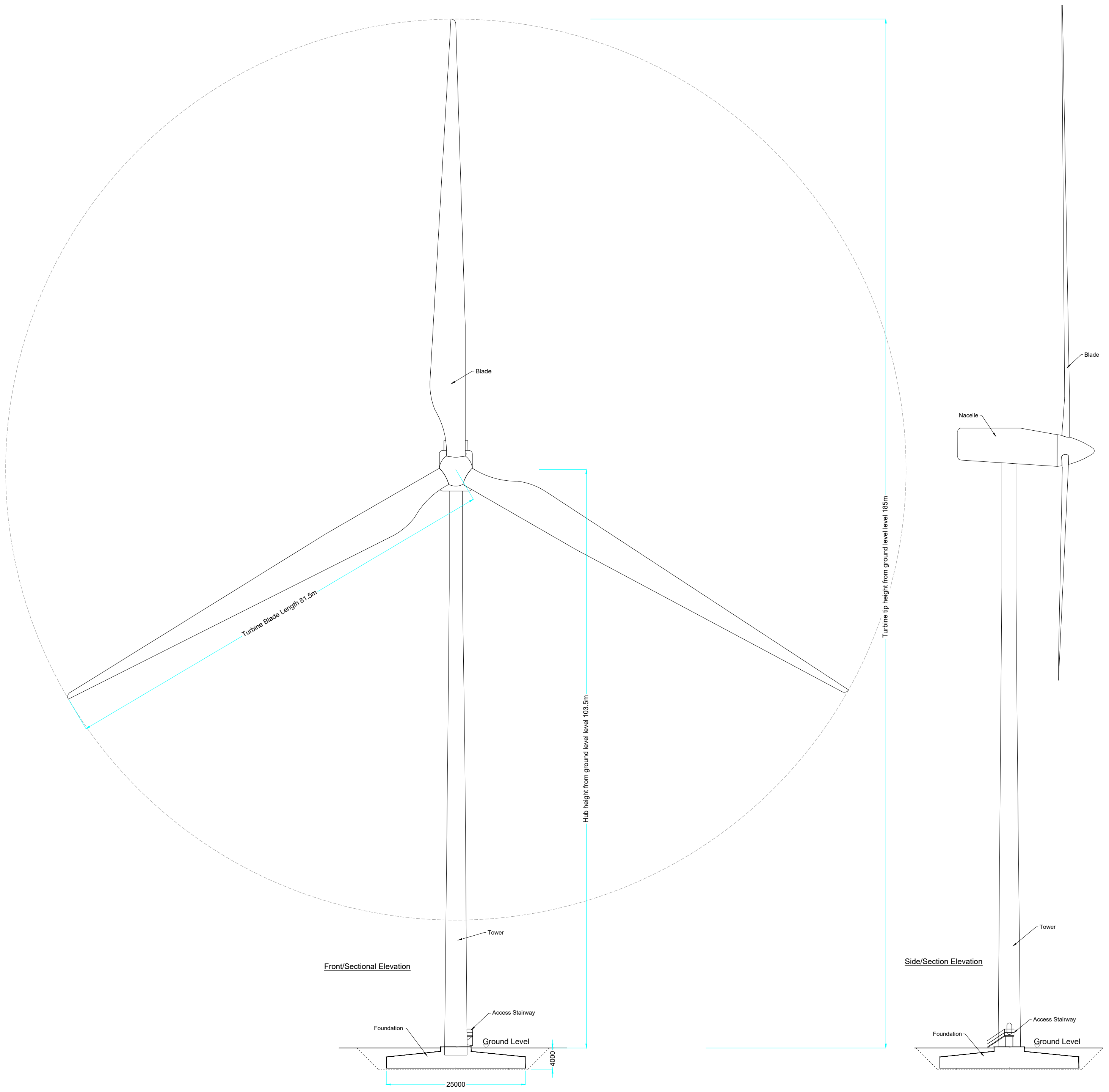
- Turbine Tip Height –185 metres
- Hub Height –103.5 metres
- Blade Rotor Diameter: - 163 metres

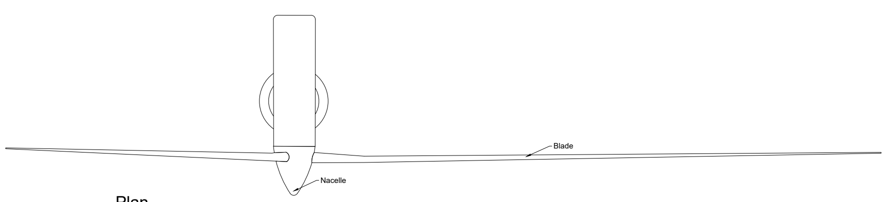
Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics. The wind turbines that will be installed on the Site will be conventional three-blade turbines, which will be geared to ensure the rotors of all turbines rotate in the same direction at all times.

The turbines will be multi-ply coated to protect against corrosion. It is proposed that the turbines would be of a light grey colour to blend into the sky background to minimise visual impact as recommended in the 2006 WEDGs and '*The Influence of Colour on the Aesthetics of Wind Turbine Generators*' (ETSU, 1999).

A drawing detailing the proposed wind turbine is shown in Figure 4-4. The individual components of a geared wind turbine nacelle and hub are shown in Figure 4-5 below. Wind turbines without a gearbox (i.e., direct drive) may also be considered. This will have no impact on the external design.







Plan

Drawing Notes
1. Proposed wind turbines to have a maximum ground to blade tip height of 185m, blade length of 81.5m and hub height of 103.5m
2. Ground level represents the top of turbine foundation.

PROJECT TITLE: Borrisbeg Wind Farm EIAR & PA			
DRAWING TITLE: Wind Turbine Elevations & Plan			
PROJECT No.: 220310		DRAWING No.: Fig 4-4	SCALE: 1:500 @ A1
DRAWN BY: GO	CHECKED BY: N/A	DATE: 09.11.2023	REVISION.: D01

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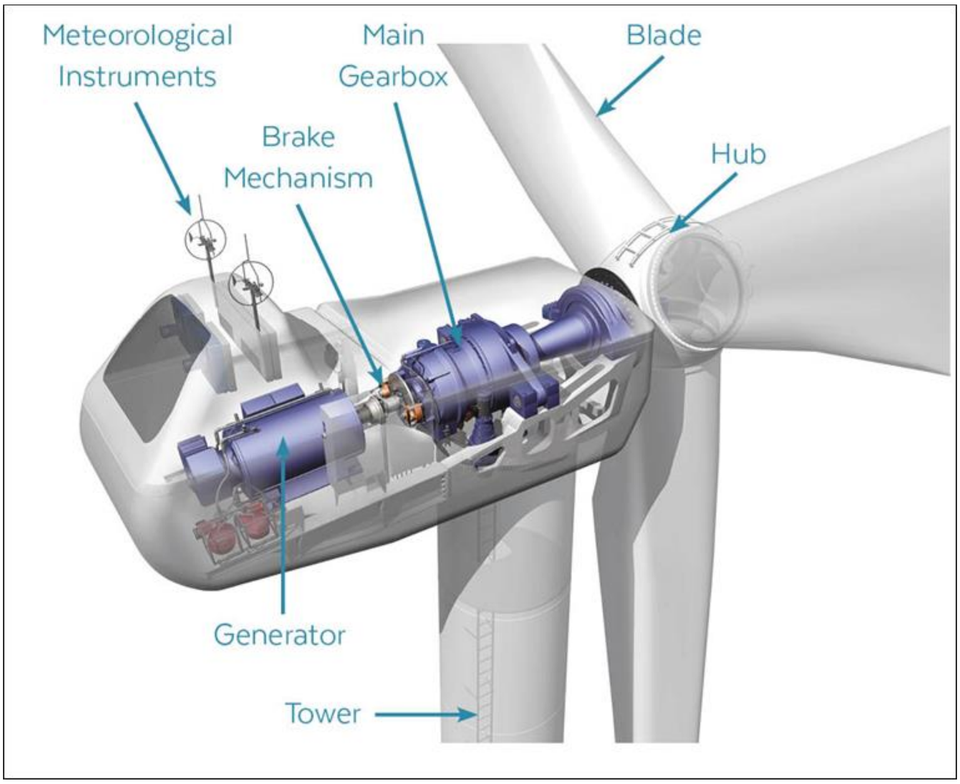
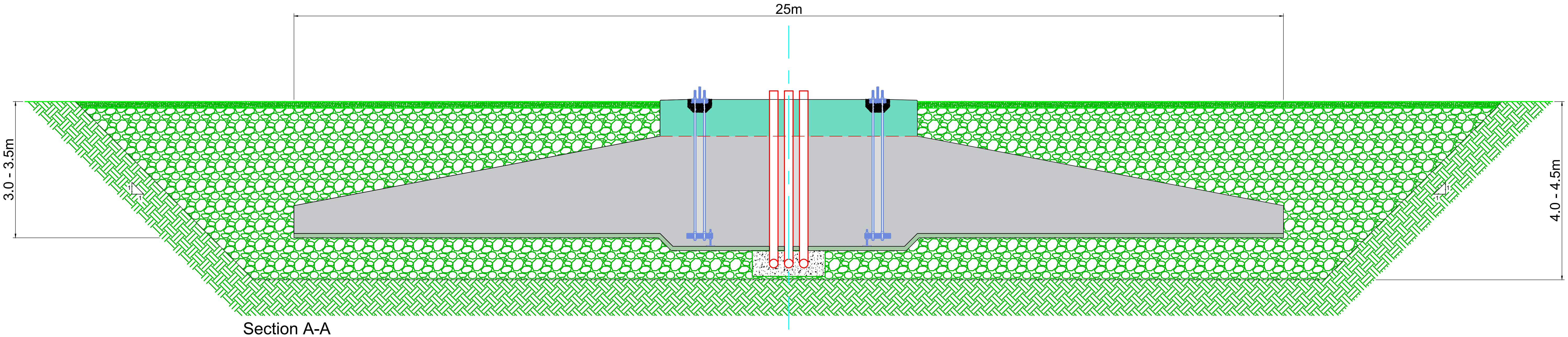


Figure 4-5 Turbine nacelle and hub components

4.3.1.1.3 Turbine Foundations

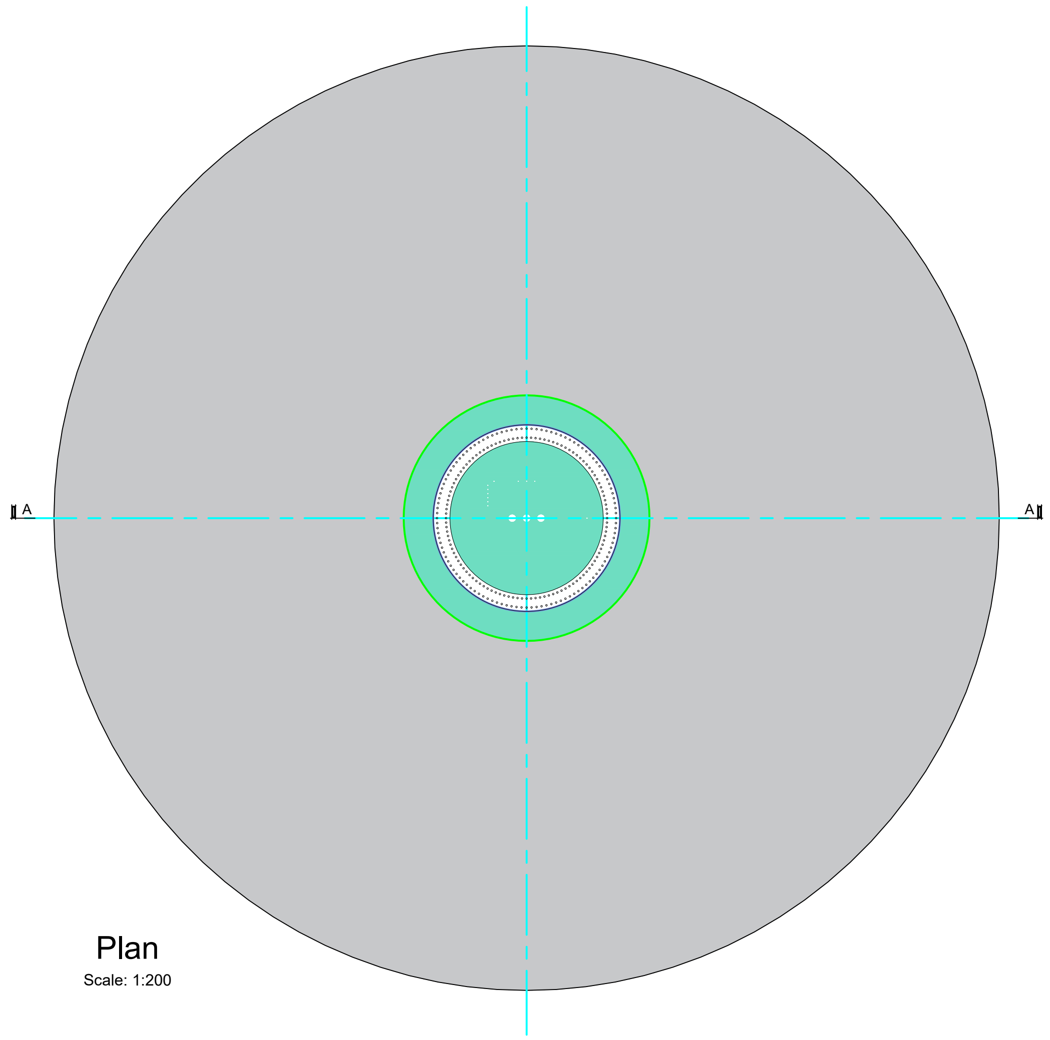
Turbine foundations are constructed by excavating soil to sub-formation level. Imported structural fill and blinding is placed and compacted to formation level. A reinforced concrete base is cast in-situ. The turbine foundation transmits any load on the wind turbine into the ground. The approximate horizontal and vertical extent of the turbine reinforced concrete foundation will be 25m and 4m respectively. Where ground conditions are unfavourable to excavate and replace, piles will be installed to formation level. Please see Figure 4-6 and Figure 4-7 for gravity and bored piled foundations.

The size of the concrete foundation will be approximately 25 m in diameter, based off current models of this scale, but will depend on the loads specified by the turbine manufacturer selected from the competitive tender process. After the formation level has been reached, the turbine "Anchor Cage" is levelled, and reinforcing steel is built up around and through the anchor cage (Plate 4-2 below). The outside of the foundation is shuttered with formwork to allow the pouring of concrete and is backfilled with granular fill to finished surface level (Plate 4-3 below).



Section A-A
Scale 1:100

A base layer of Clause 804 material to be placed underneath the concrete



Plan
Scale: 1:200

PROJECT TITLE: Borrisbeg Wind Farm EIAR & PA			
DRAWING TITLE: Gravity Foundations Details			
PROJECT No.: 220310	DRAWING No.: Fig 4-6		SCALE: As shown @ A3
DRAWN BY: GO	CHECKED BY: N/A	DATE: 09.11.2023	REVISION.: D01

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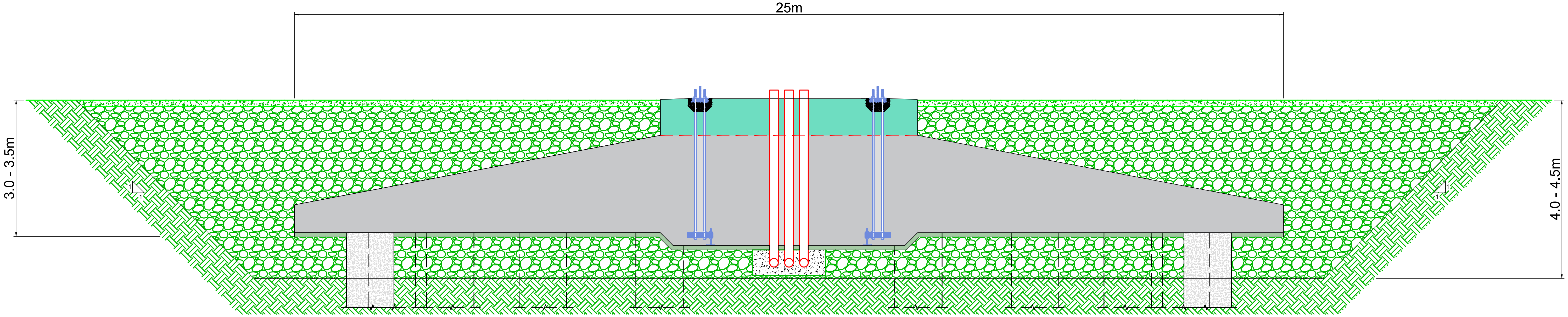
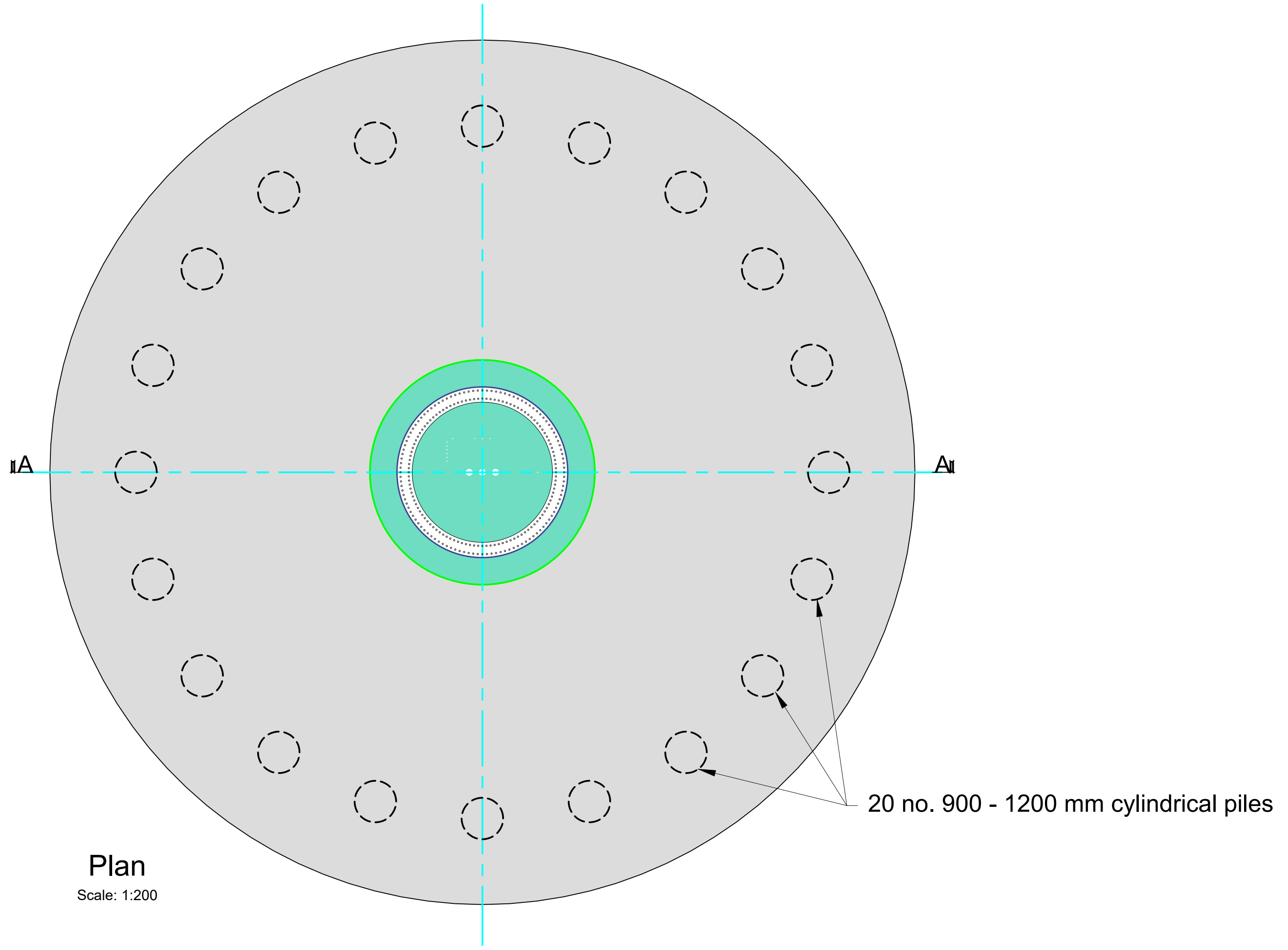


Section A-A

Scale 1:100

A base layer of Clause 804 material to be placed underneath the concrete



Plan

Scale: 1:200

PROJECT TITLE: Borrisbeg Wind Farm EIAR & PA			
DRAWING TITLE: Bored Pile Foundations Details			
PROJECT No.: 220310	DRAWING No.: Fig 4-7		SCALE: As shown @ A3
DRAWN BY: GO	CHECKED BY: N/A	DATE: 09.11.2023	REVISION.: D01

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Plate 4-2 Turbine Foundation Anchor Cage surrounded by reinforcing steel.

Plate 4-3 Finished Turbine Foundation

4.3.1.1.4 *Hard Standing Areas*

Hard standing areas consisting of levelled and compacted granular fill are required around each proposed turbine 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 are shown on Figure 4-1. The layout represents the full extent of the hard standing areas but may be subject to optimisation according to the turbine supplier's requirements.

4.3.1.1.5 *Generating Capacity*

Modern wind turbine generators currently have a typical generating capacity in the 4 to 7 MW range, with the generating capacity continuing to evolve upwards as technology improvements are achieved by the turbine manufacturers. Turbines of the exact same make, model and dimensions can have different generating potential depending on the capacity of the electrical generator installed in the turbine nacelle. The exact generating capacity of the installed turbine will be designed to match the wind regime on the Site and will be determined by the selected manufacturer. For the purposes of this EIAR, a rated generating capacity of 7 MW has been chosen to calculate the potential capacity of the proposed 9-turbine renewable energy development, which would result in an estimated installed capacity of 63 MW.

Based on this estimated installed capacity, the Proposed Wind Farm therefore has the potential to produce 198,676 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 36%[1] is used here.

C = Rated output of the wind farm: 63 MW

The MWh of electricity produced by the Proposed Wind Farm would be sufficient to supply a range of approximately 47,304 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)[2].

4.3.1.2 Site Roads

4.3.1.2.1 *Road Construction Types*

To provide access within the Site and to connect the wind turbines and associated, infrastructure, existing roads and tracks will need to be upgraded and new access roads will need to be constructed. The road construction design has taken into account the following key factors:

1. *Buildability considerations;*

[1] *https://www.eirgridgroup.com/site-files/library/EirGrid/ECP-2-2-Solar-and-Wind-Constraints-Report-Area-I-v1.0.pdf*
[2] *Commission for Regulation of Utilities 2017: Review of Typical Consumption Figures – Decision Paperhttps://www.cru.ie/document_group/review-of-typical-consumption-figures-decision-paper/*

2. *Making use of existing infrastructure where possible;*
3. *Minimising excavation arisings;*
4. *Serviceability requirements for construction and wind turbine delivery and maintenance vehicles;*

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

The Proposed Wind Farm makes use of the existing road network insofar as possible. It is proposed to upgrade approximately 930m of existing site roads and tracks and approximately 1.1km of the L-70391 which is within the Site, and to construct approximately 6 kilometres of new access roads. The upgrade of the L-70391 comprises widening of approximately 460m and resurfacing of the entire route. It is estimated that the internal wind farm roads will require resurfacing approx. 3 times during the operational life which is factored into our estimated stone requirements detailed in section 4.3.1.11 below.

Upgrade of Existing Access Roads or Tracks

The existing tracks on-site were constructed using the excavate and replace construction technique, therefore proposed road widening will to be founded on competent stratum. Cross section details of widening of existing roads is shown in Figure 4-8.

The general construction methodology for upgrading of existing roads or tracks is summarised below.

1. *Access road construction shall be to the alignment of the existing road/ track.*
2. *Excavation will be required on one or both sides of the existing access track to a competent stratum.*
3. *Granular fill to be placed in layers in accordance with the designer's specification.*
4. *The upgraded roads will be constructed at the same level as existing ground levels in order to ensure natural flow paths are maintained in areas within the floodplain.*
5. *Existing drains will be culverted under the proposed access track which will provide a drainage outlet for flood water following a significant flood event, preventing any damming effect from the proposed access roads within the site-specific flood zones.*
6. *Placement of spoil berms along the proposed access roads shall be avoided within the site-specific flood zones.*
7. *Access roads to be finished with a layer of capping material across the full width of the road (the finish of the L70391 Local Road will be subject to requirements of TCC Roads Section).*
8. *A layer of geogrid/geotextile may be required at the surface of the existing access road in areas of excessive rutting (to be confirmed by on-site engineer).*
9. *For excavations in spoil, side slopes shall be not greater than 1 (v): 2. This slope inclination will be reviewed during construction, as appropriate.*
10. *The finished road width will be approximately 5m, with localised widening at bends and changes in direction.*
11. *On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.*
12. *A final surface layer shall be placed over the existing access track, as per design requirements, to provide a suitable road profile and graded to accommodate wind turbine construction and delivery traffic.*

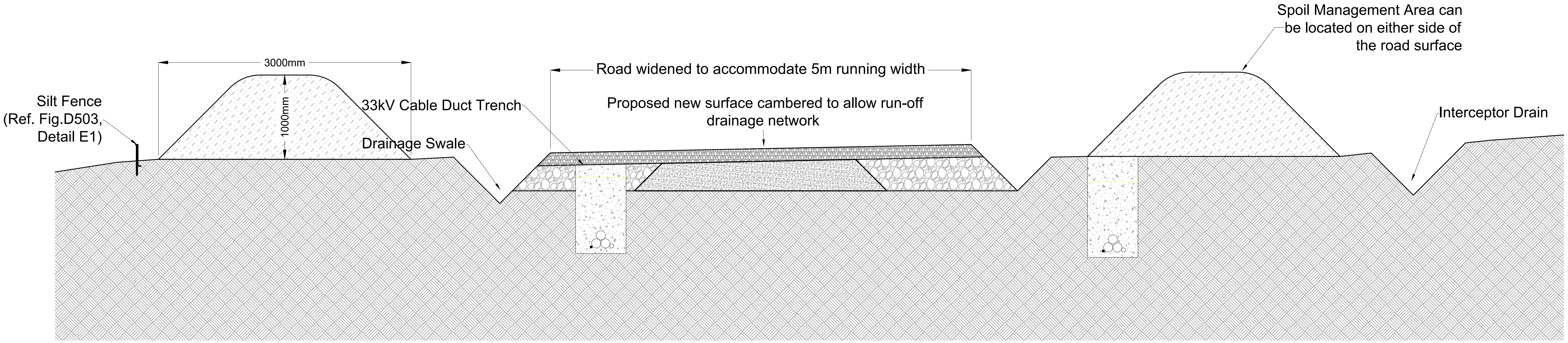
Construction of New Roads

Due to the ground conditions, new access roads are proposed to be founded on competent stratum. The standard make-up of the founded access tracks will be a stone thickness of c.500mm. Cross section details of new excavated roads is shown in Figure 4-9.

The general construction methodology for construction of excavated roads is summarised below.

1. *Excavation will take place to a competent stratum beneath the topsoil (as agreed with the site designer and resident engineer).*
2. *Road construction will be carried out in sections of approximately 50m lengths i.e., no more than 50m of access road to be excavated without re-placement with stone fill.*
3. *The proposed new roads will be constructed at the same level as existing ground levels in order to ensure natural flow paths are maintained in areas within the floodplain.*
4. *Existing drains will be culverted under the proposed access track which will provide a drainage outlet for flood water following a significant flood event, preventing any damming effect from the proposed access roads within the site-specific flood zones.*
5. *Placement of spoil berms along the proposed access roads shall be avoided within the site-specific flood zones.*
6. *The road build-up will be approximately 500mm of selected granular fill. Granular fill to be placed in layers in accordance with the designer's specification.*
7. *Access roads to be finished with a layer of capping material across the full width of the road.*
8. *A layer of geogrid/geotextile may be required at the surface of the competent stratum.*

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



Existing Excavated Road Widening Section

The cabling may be placed on either side of the roads, on both sides of the road or within the road. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

The placement of the spoil berm will be avoided within the flood zone

PROJECT TITLE: **Borrisbeg Renewable Energy Development**			
DRAWING TITLE: **Upgrade of Existing Excavated Access Roads Section**			
PROJECT No.: 220310	DRAWING No.: Fig 4-8	SCALE: 1:50 @ A3	
DRAWN BY: GO	CHECKED BY: N/A	DATE: 23.11.2023	REVISION.: P01

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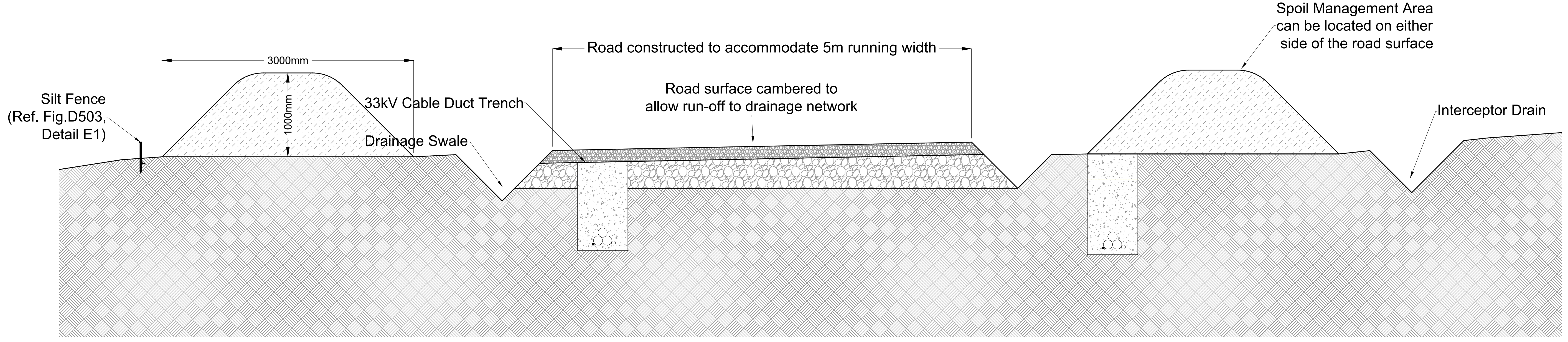
Drawing Notes

1. Widening can occur to either side of existing roads dependent on site conditions.

2. Depths of road fill to vary dependent on site conditions.



Excavated Road Section

The cabling may be placed on either side of the roads, on both sides of the road or within the road. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

The placement of the spoil berm will be avoided within the flood zone

PROJECT TITLE: **Borrisbeg Renewable Energy Development**			
DRAWING TITLE: **New excavate and replace access road section**			
PROJECT No.: 220310		DRAWING No.: Fig 4-9	SCALE: 1:50 @ A3
DRAWN BY: GO	CHECKED BY: N/A	DATE: 23.11.2023	REVISION: P01

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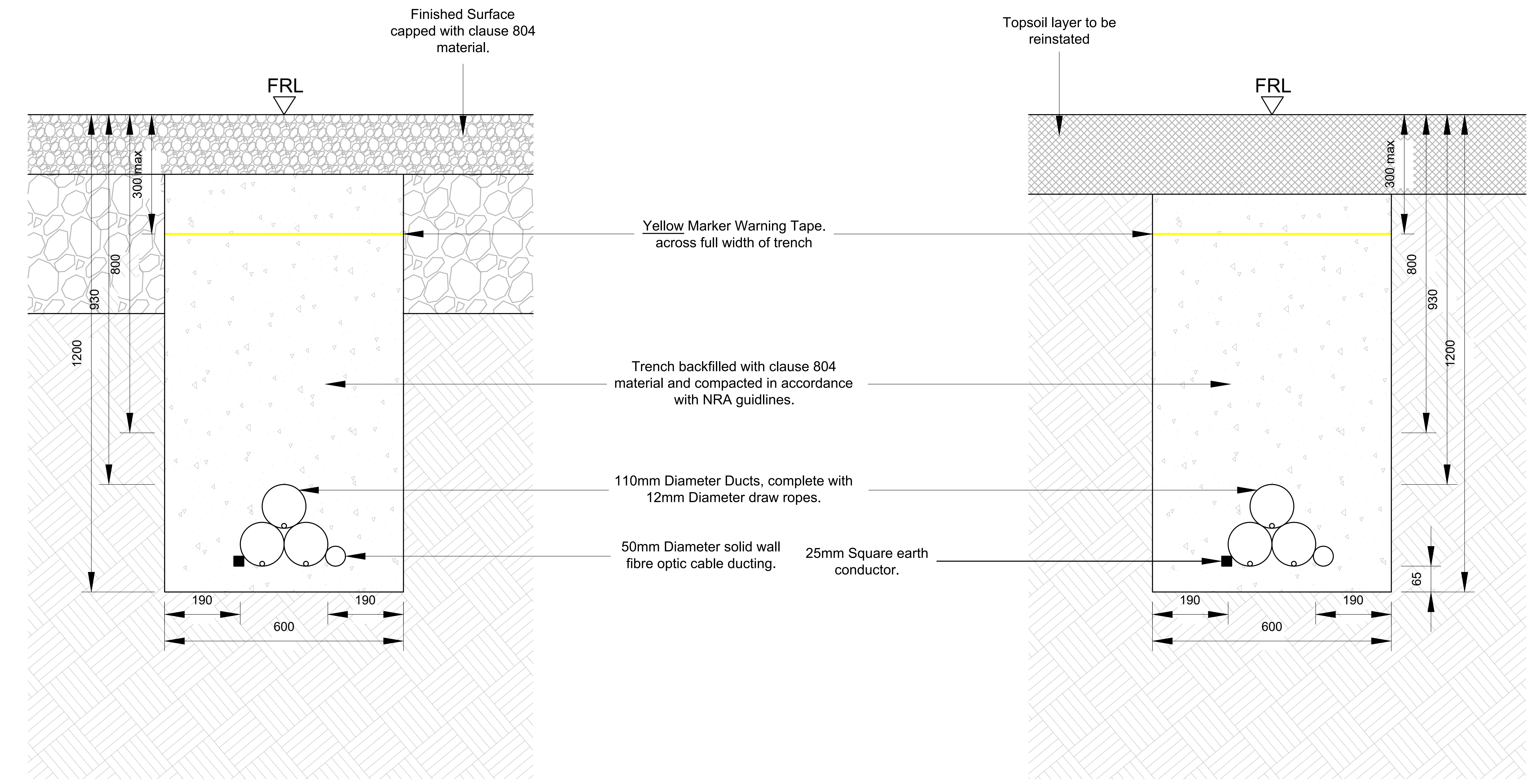
4.3.1.3 Underground Electrical (33kV) and Communications Cabling

Each turbine will be connected to the on-site electricity substation (part of the Proposed Grid Connection) via underground 33 kV (kilovolt) electricity cabling. Fibre-optic cables will also connect each wind turbine and the met mast to the on-site substation. The electricity and fibre-optic cabling connecting to the on-site substation compound will be run in cable ducts approximately 1.2 metres beneath ground level, along the sides of roadways or under the roadways. The route of the cable ducts will follow the access track to each turbine location and are illustrated on the site layout drawings included as Appendix 4-1, the exact number and configuration of cable ducting may vary within the cabling trench. Figure 4-10 below shows two variations of a typical cable trench, one for off-road trenches and one for on-road trenches. The cabling may be placed on either side of the roads, on both sides of the road and/or within the road. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

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



33kV Cable - On Road Trench Detail - Cross Section

33kV Cable - Off Road Trench Detail - Cross Section

PROJECT TITLE: Borrisbeg Wind Farm EIAR & PA			
DRAWING TITLE: 33kV Cable Trench Sections			
PROJECT No.: 220310		DRAWING No.: Fig 4-10	SCALE: 1:10 @ A3
DRAWN BY: GO	CHECKED BY: N/A	DATE: 09.11.2023	REVISION.: D01

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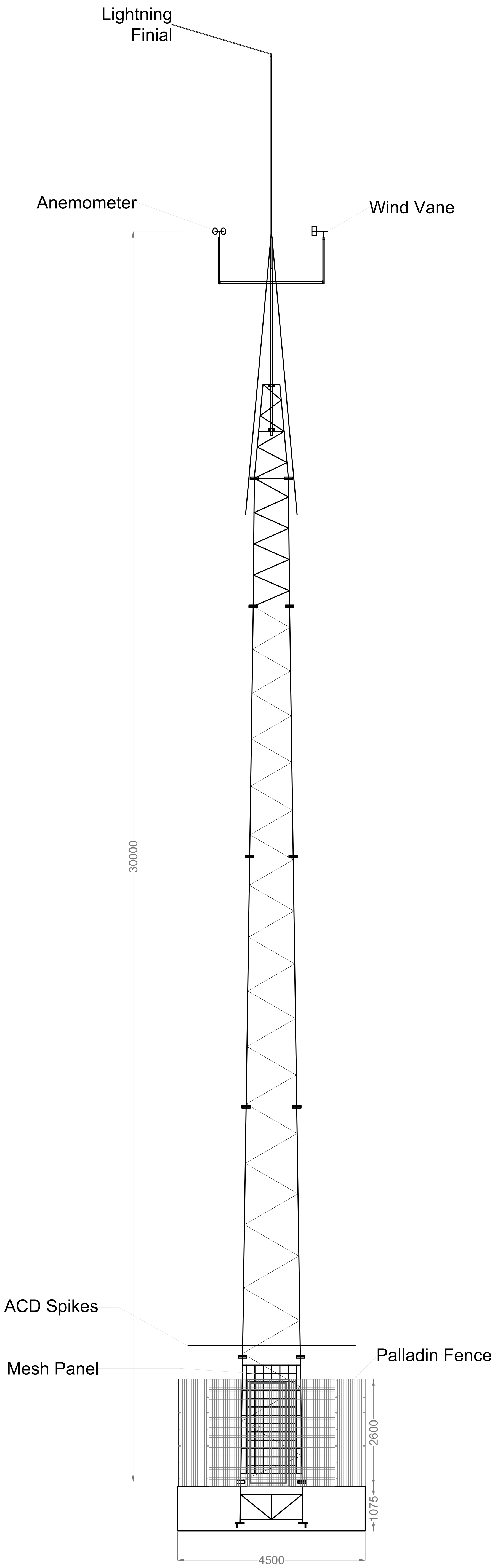
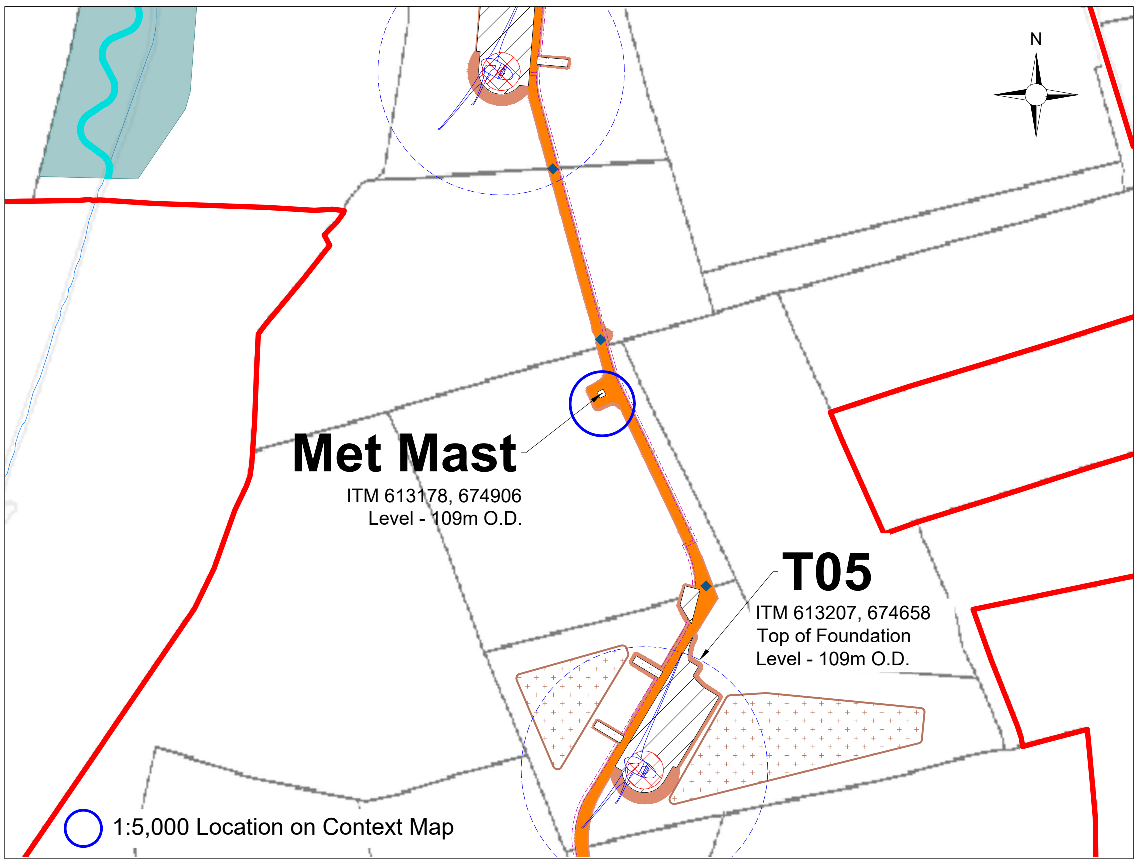
4.3.1.4 Meteorological Mast

One meteorological (met) mast is proposed as part of the Proposed Wind Farm. The met mast will be equipped with wind monitoring equipment at various heights. The proposed met mast will be located at ITM X618790, ITM Y746386 as shown on the Site layout drawing in Figure 4-1. The mast will be a free-standing slender lattice structure 30 metres in height. The mast will be constructed on a hard-standing area sufficiently large to accommodate the equipment that will be used to erect the mast. The proposed meteorological mast is shown in Figure 4-11.



Mast Elevation
Scale: 1:100



Scale: 1:200

Note:

1. Met Mast exact detail may differ depending on the selected manufacturer.
2. Finished level of the mast to match ground conditions.
3. Mast/foundation orientation to be confirmed with met mast supplier.
4. Earthing and ducting requirements to be confirmed with met mast supplier and forwarded to foundation designer

PROJECT TITLE: **Borrisbeg Renewable Energy Development**			
DRAWING TITLE: **Met Mast**			
PROJECT No.: 220310	DRAWING No.: Figure 4-11	SCALE: As shown @ A3	
DRAWN BY: GO	CHECKED BY: KD	DATE: 05.12.2023	REVISION.: P01

MKO

Email: info@www.mkoireland.ie /Website: www.mkoireland.ie

4.3.1.5 Temporary Construction Compound

A temporary construction compound measuring approximately 4,950m^2 in area will be located in the northern section of the Site, approximately 520m from the construction phase entrance. The location of the proposed construction compound is shown on the layout drawing in Figure 4-1. The layout of this construction compound is shown on Figure 4-12.

The construction compound will include a bunded refuelling and containment area for the storage of lubricants, oils and site generators etc, and full retention oil interceptor, waste storage area, temporary site offices, staff facilities and car-parking areas for staff and visitors. Temporary port-a-loo toilets and 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 a permitted waste collector to wastewater treatment plants. There will also be a water supply on site for hygiene purposes, by way of a temporary storage tank. Construction materials and turbine components will be brought directly to the proposed turbine locations following their delivery to the Site.

Project Design Drawing Notes

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

Drawing Legend

- Proposed Road
- Cut
- Fill

PROJECT TITLE:
Borrisbeg Renewable Energy Development

DRAWING TITLE:
Temporary Construction Compound

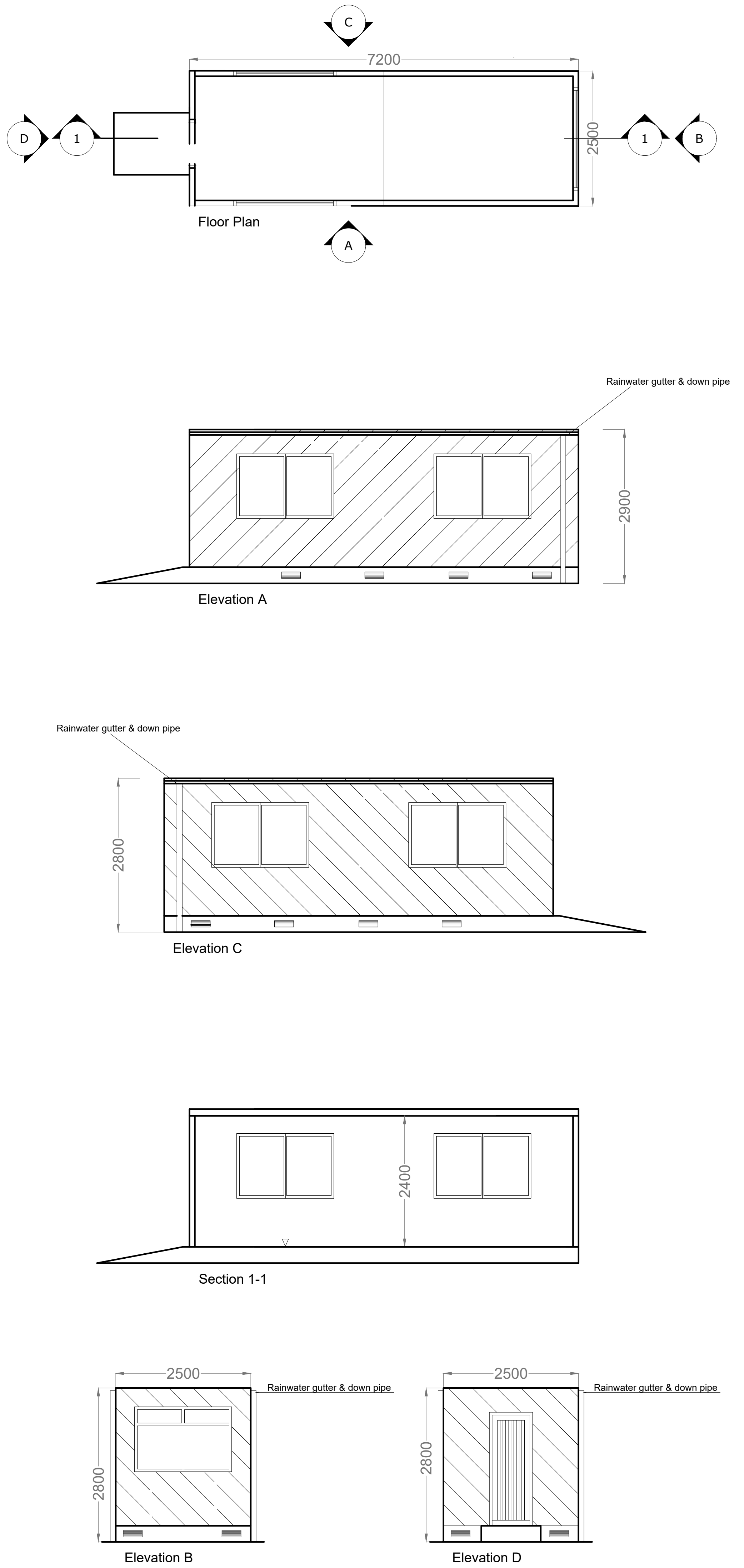
PROJECT No.:	DRAWING No.:	SCALE:
220310	Fig 4-12	1:500 @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION:
GO	N/A	09.11.2023	D01

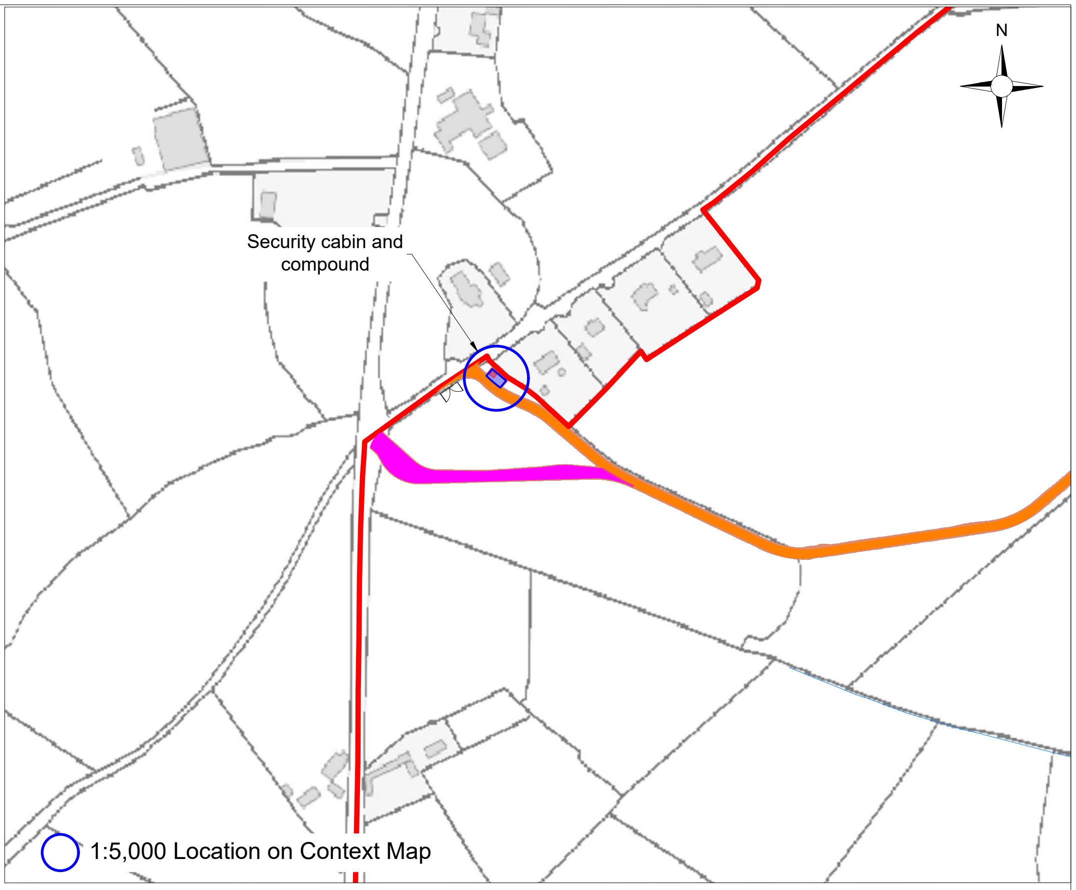
OS SHEET No.: 4341, 4342, 4399, 4400, 4457, 4458

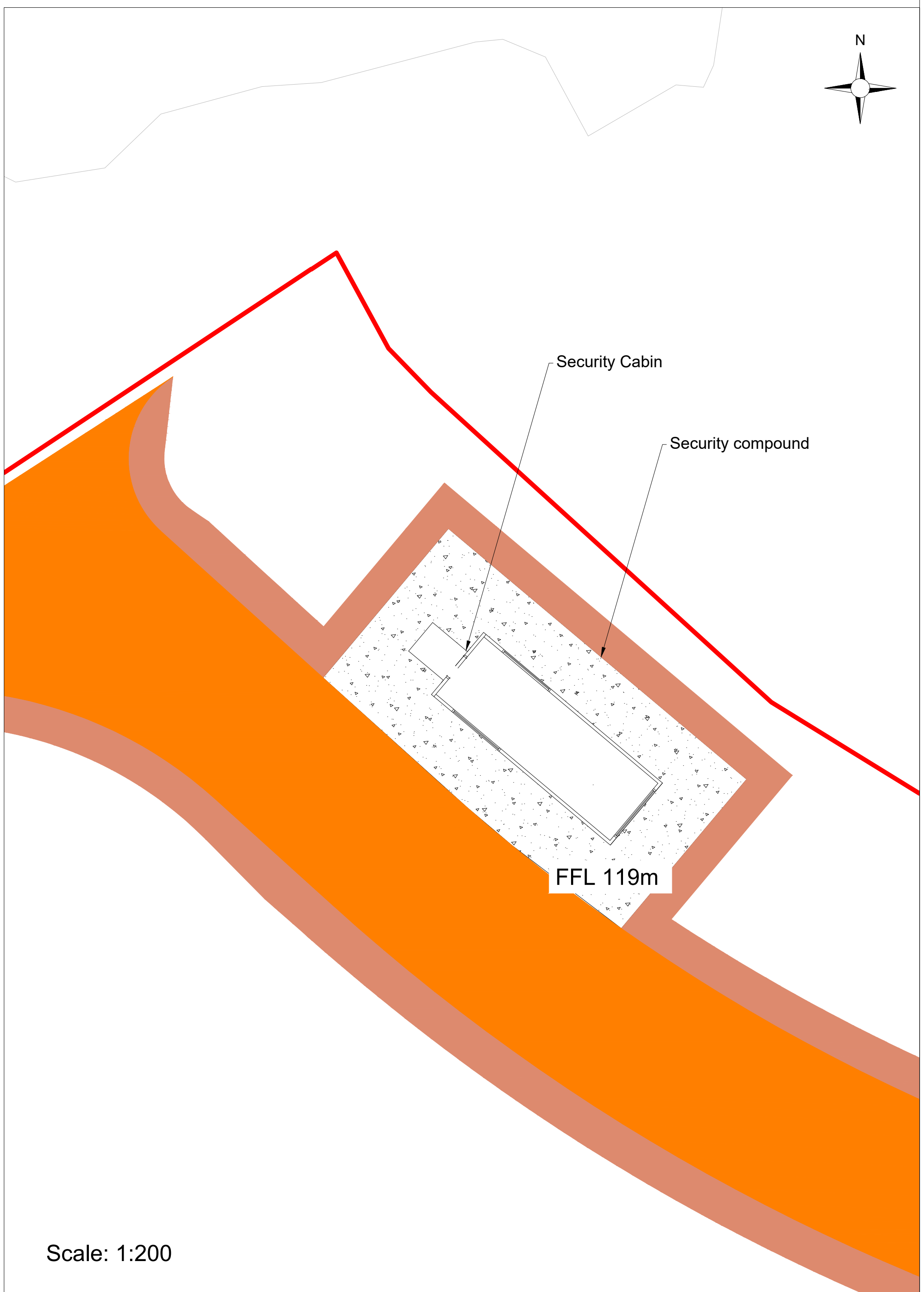
4.3.1.6 Temporary Security Cabin

A temporary security cabin will be located on a layby off the new proposed access road, just inside the general construction entrance off the L3248. The layout and sections of the security cabin is shown on Figure 4-13. Please see Figure 4-1 for location details. This entrance will be gated (Figure 4-14), and the cabin will serve as the check in and check out point for staff and visitors during the construction phase. The security cabin will be a prefabricated structure measuring approximately 7.2 metres by 2.5 metres and 2.85 metres in height. The temporary cabin will be removed as part of the post-construction reinstatement works of the Proposed Wind Farm.



Scale: 1:100





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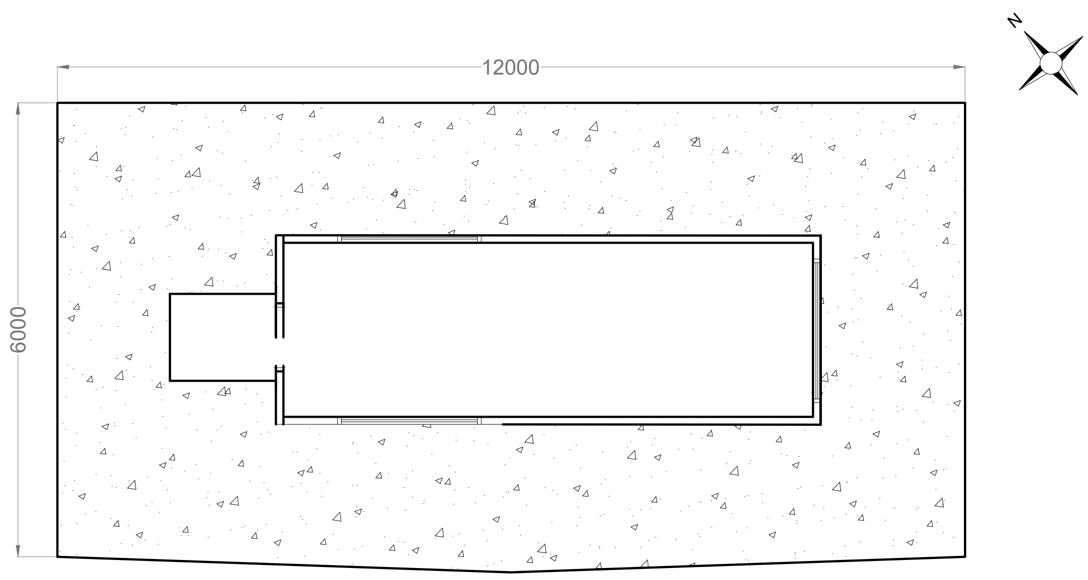


Security Compound Layout

Scale: 1:100

PROJECT TITLE:
Borrisbeg Renewable Energy Development

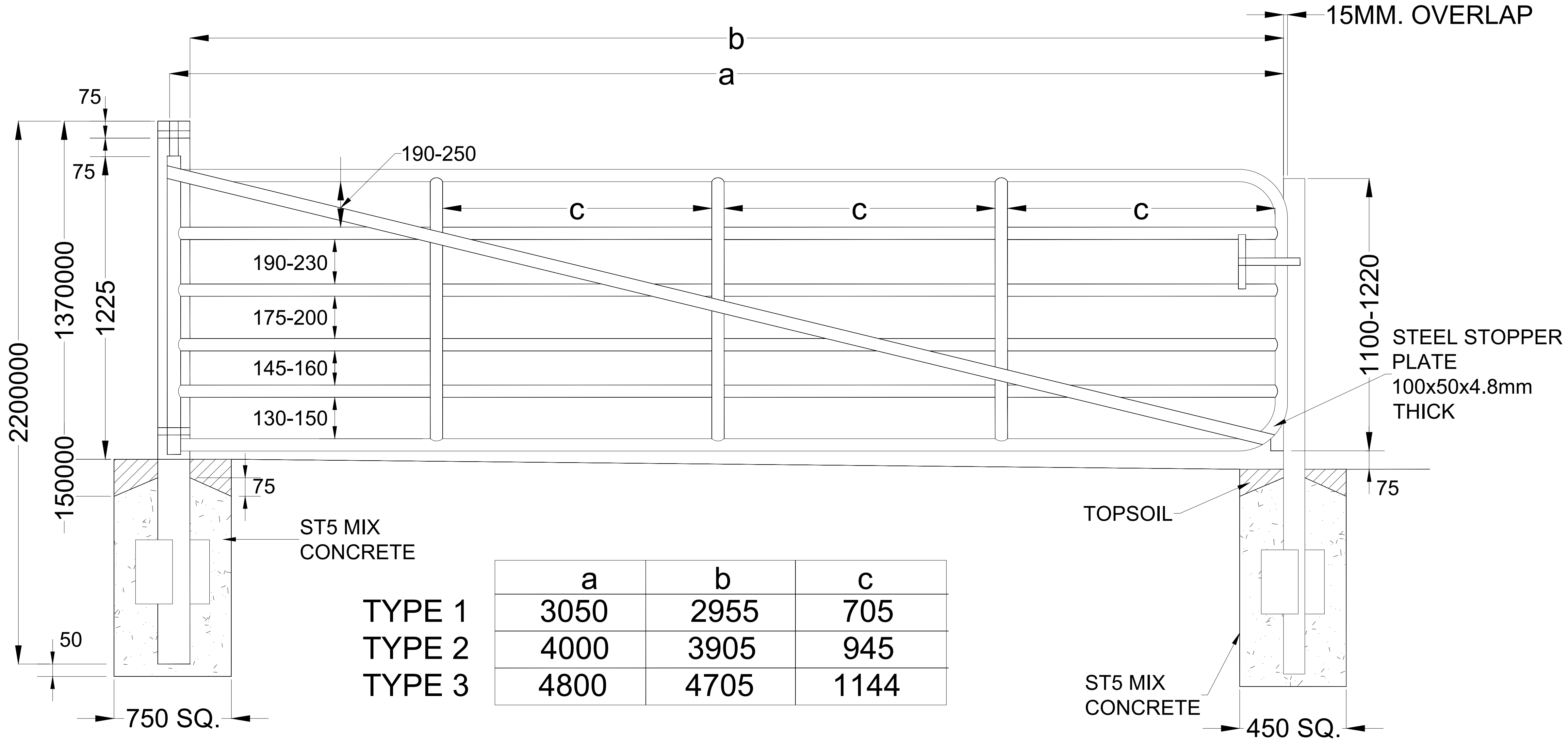
DRAWING TITLE:
Standard Security Cabin & Compound

PROJECT No.:	DRAWING No.:	SCALE:
220310	Figure 4-13	As shown @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
GO	KD	16.11.2023	P01

MKO

Email: info@www.mkoireland.ie /Website: www.mkoireland.ie



	a	b	c
TYPE 1	3050	2955	705
TYPE 2	4000	3905	945
TYPE 3	4800	4705	1144

PROJECT TITLE:
Borrisbeg Renewable Energy Development

DRAWING TITLE:
Field Gate Detail

PROJECT No.:	DRAWING No.:	SCALE:
220310	Figure 4-14	1: 20 @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
GO	KD	16.11.2023	P01

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4.3.1.7 Tree Felling and Replanting

4.3.1.7.1 *Tree Felling*

Tree felling will be required within and around Wind Farm infrastructure footprint to allow for the construction of the proposed turbine, access roads underground cabling, and the other ancillary infrastructure. Further details on tree felling required within and around development footprint is detailed in Chapter 6 of this EIAR.

Approximately 3.44 hectares of conifer will be felled to accommodate Turbine 9 and its associated infrastructure. Turbine no. 6 requires felling of 0.78 hectares of adjacent forestry to ensure appropriate setbacks for bat foraging are maintained. In addition, hedgerows and tree lines (approx. 1.8km) within bat buffers and those that intersect with the proposed road network, require removal. Please see Appendix 6-2 Bat report for details.

Therefore, a total of 4.22 hectares of forestry and 1.8km of linear vegetation will be felled and/or removed to facilitate the construction of the Proposed Wind Farm.

In addition to the forestry felling, segments of hedgerows will require removal to facilitate the construction of wind farms roads and ancillary infrastructure, and to achieve the required Bat foraging buffers from the proposed turbines. Please see Chapter 6 for details. Figure 4-15 shows the extent of the commercial forestry to be permanently felled as part of the Proposed Wind Farm.

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

4.3.1.7.2 *Forestry Replanting*

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

The identified 4.22 hectares of forestry that will be permanently felled for the Proposed Wind Farm will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that will be issued in respect of the Proposed Wind Farm. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service. The replacement of the felled forestry as part of the Proposed Wind Farm may occur on any lands, within the State benefitting from Forest Service Technical Approval[3] for afforestation, should the Proposed Wind Farm receive planning permission. Under the Forestry Regulations 2017, all applications for licences for afforestation require the prior written approval (technical approval) of the Minister for Agriculture, Food and the Marine. Before the Minister can grant approval, he/she must first determine if the project is likely to have significant effects on the environment (for EIA purposes) and assess if the development, individually or in combination with other plans or projects is likely to have a significant effect on a European site (for Habitats purposes).

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

It is proposed to plant by hand, approximately 1.8 hectares of natural woodland within the Wind Farn Site along a segment of the Eastwood River, as shown in Figure 4-16. Please see Chapter 6 Biodiversity and Appendix 6-4 Biodiversity Management and Enhancement Plan for details. In addition to this, approximately 5.17km of hedgerow will be replanted within the Site.

For the balance of the replanting obligation, the applicant commits to replanting the remaining 2.42 hectares of conifer forestry, outside the hydrological catchment within which the Proposed Project is located. On this basis, it is reasonable to conclude that there will be no cumulative effects associated with the replanting of 2.42 hectares of forestry. Therefore, the forestry replanting is not considered further in the impact assessment chapters of this EIAR. In addition, the applicant commits to not commencing the Proposed Project until both a felling and afforestation licence(s) is in place and, therefore, this ensures the afforested lands are identified, assessed and licenced appropriately by the relevant consenting authority.

4.3.1.7.3 *Hand Planting Methods*

Planting will be by hand. The main forms of planting, as described in the Forestry Schemes Manual, are set out as follows.

Slit Planting

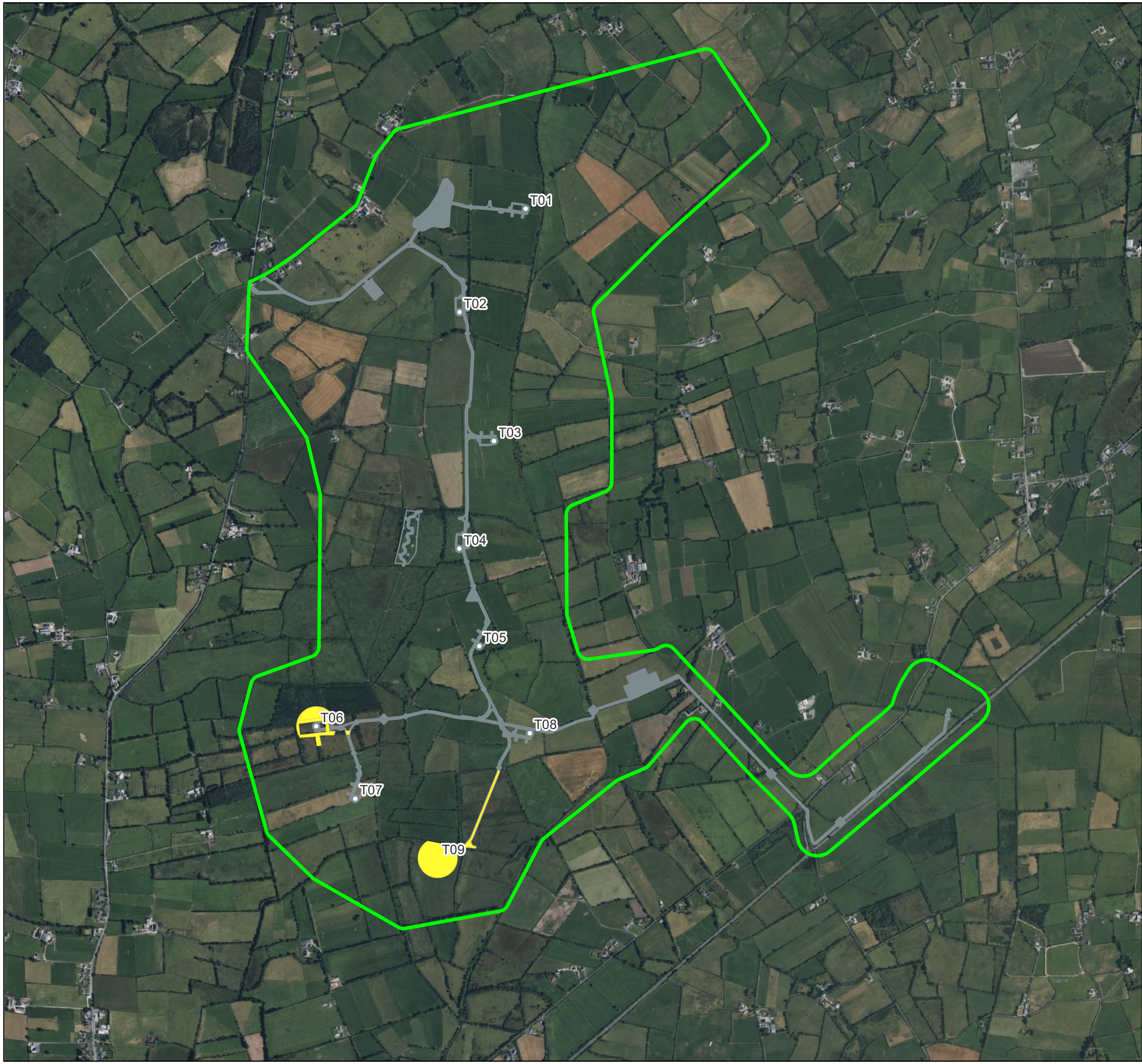
A spade is used to make a vertical slit in the ground. The tree roots are carefully positioned in the slit to ensure that roots are equally spaced in the vertical slit created. The slit is closed and firmed up ensuring the tree is vertical and upright. It is important to ensure that roots are not bent over which can lead to poor development, e.g., J root. This form of planting can be suitable for ribbons, mounds and ripped ground.

Angle Notch

A spade is used to cut a T or L-shaped slit in the ground. The spade is used to lift the slit and the tree roots placed underneath to ensure good root distribution without causing damage. The slit is closed and firmed up to ensure that stem is left vertical and upright.

Pit Planting

A spade is used to dig a hole and the tree roots placed in the centre. Soil is placed around the tree and firmed in, ensuring that it is upright and straight. This form of planting can be used in sensitive sites where no ground preparation has taken place. It may also be appropriate for steep slopes where other types of preparation may lead to sediment runoff. The Technical Approvals for the proposed replacement lands include the species approved for afforestation.



Map Legend

- EIAR Study Boundary
- Proposed Turbine Layout
- Proposed Project Footprint
- Proposed Felling (4.22 ha)

N

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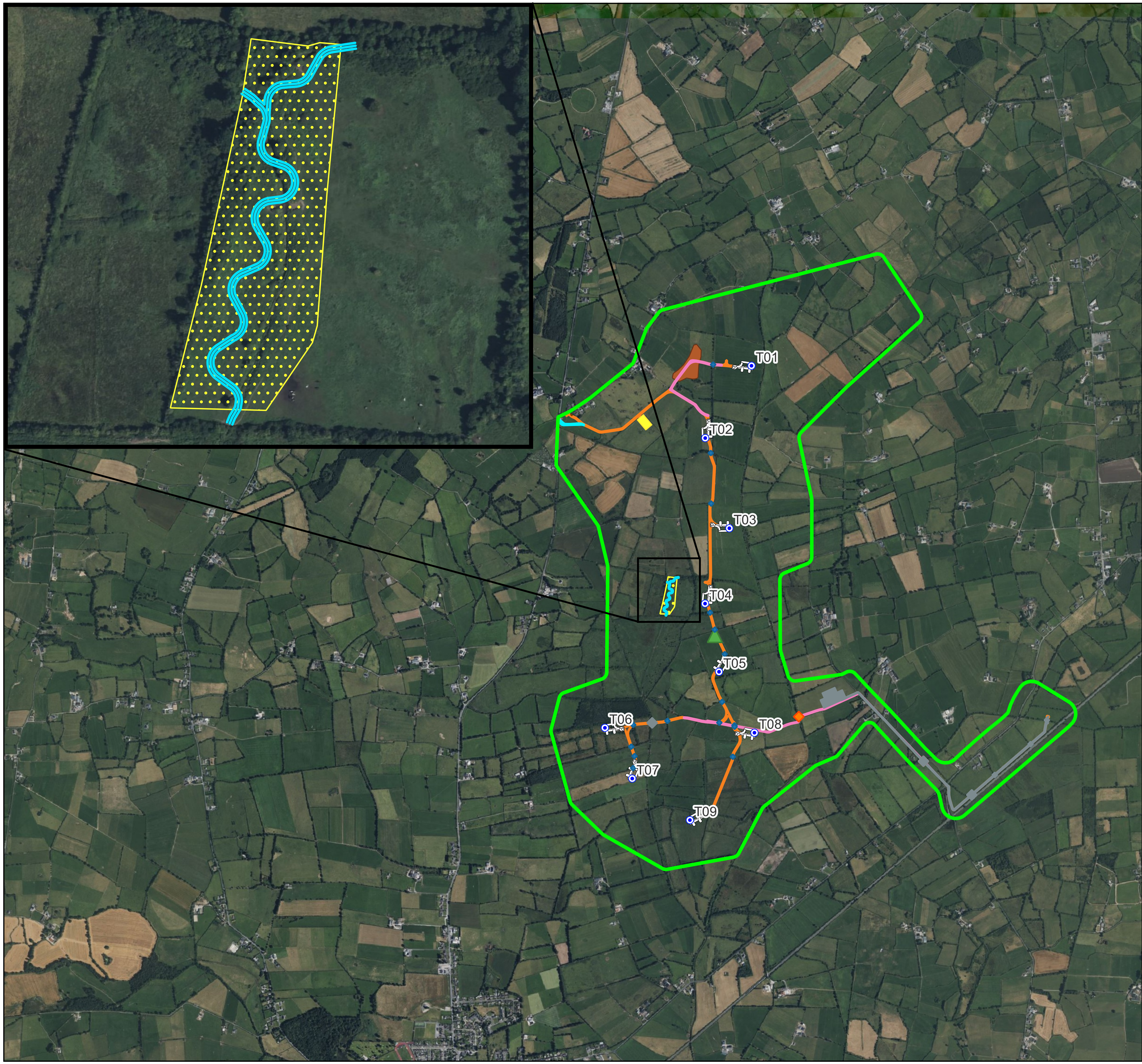
Drawing Title	
Proposed Forestry Felling	
Project Title	
Borrisbeg Renewable Energy Development	
Drawn By: NS	Checked By: KM
Project No.: 220310	Drawing No.: Figure 4-15
Scale: 1:17,500	Date: 2023-12-12

MKO
Planning and Environmental Consultants
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
email:info@mkoireland.ie
Website: www.mkoireland.ie



Map Legend

- EIAR Study Boundary
- Proposed Turbines
- Proposed Turbine Hardstands
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Temporary Borrow Pit
- Proposed Temporary Security Cabin
- Existing Roads for Upgrade/ Resurface
- Proposed New Roads
- Proposed Temporary Abnormal Entrance
- Proposed Clear Span Crossing
- HDD Crossings
- Proposed Culverts
- River Enhancement 1.8ha Natural Woodland
- River Enhancement Segment
- Separate 182A Application

N

Drawing Title: Proposed Forestry Replanting- Woodland Conservation Areas	
Project Title: Borrisbeg Renewable Energy Development	
Drawn By: NS	Checked By: KM
Project No.: 220310	Drawing No.: Figure 4-16
Scale: 1:25,000	Date: 2023-12-07

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4.3.1.8 Borrow Pit

It is estimated that approx. 90,000m^3 of stone material will be required to construct the Proposed Wind Farm. It is intended to obtain the majority of materials (approx. 70,000m^3) for the construction of the Proposed Wind Farm from the proposed on-site borrow pit (with the remaining 20,000m^3 to come from local licenced quarries). Please see Figure 4-17 for details of the proposed borrow pit. The proposed on-site borrow pit is located approximately 350m west of T1 and measures approximately 24,351m^2 with an estimated volume of 71,567m^3.

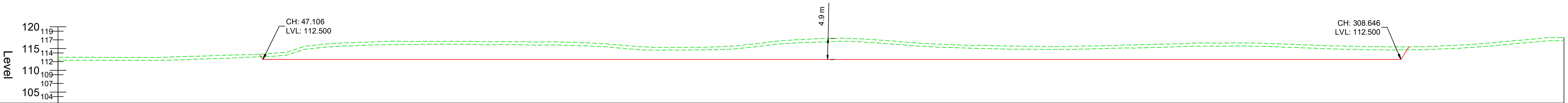
Access to the borrow pit will be via an existing access road which will be regraded within the borrow pit and constructed in the same manner as a new access road (see section 4.3.1.2 above) to access T1. Please see Figure 4-18 for details. Post-construction, the borrow pit will be backfilled with excavated spoil, then reseeded or left to vegetate naturally. A stock-proof fence will be erected after construction materials have been extracted to prevent unauthorised access.

The extraction of material from the borrow pit is a construction phase activity only of the Proposed Wind Farm which will be a temporary operation run over a short period of time. Hardcore materials will be extracted from the borrow pit (and some turbine locations, if necessary), principally by means of rock breaking. Depending on the hardcore volume, blasting may also be used as a more effective rock extraction method, capable of producing significant volumes of rock in a matter of milliseconds. Blasting will only be carried out after notifying any potentially sensitive residents. These two methods are discussed below. The processing and crushing of boulders may be required to achieve the grading requirements for use in construction. The potential noise and vibration impact on sensitive receptors associated with the rock extraction measures, detailed below, are assessed in Chapter 12 of this EIAR. Post-construction, any unsafe areas around the borrow pit area will be permanently secured and a stock-proof fence will be erected around the borrow pit area to prevent access to this area. Appropriate health and safety signage will also be erected on this fencing and at locations around the fenced area.

The extraction of rock from the borrow pit will be a temporary operation during the construction phase. The topsoil and subsoil will be stripped back and temporarily stockpiled using standard tracked excavators. Two extraction methods have been assessed for breaking out the useful rock below: rock breaking and blasting. Please see section 4.9.1.8.2 below for the borrow pit construction methods.

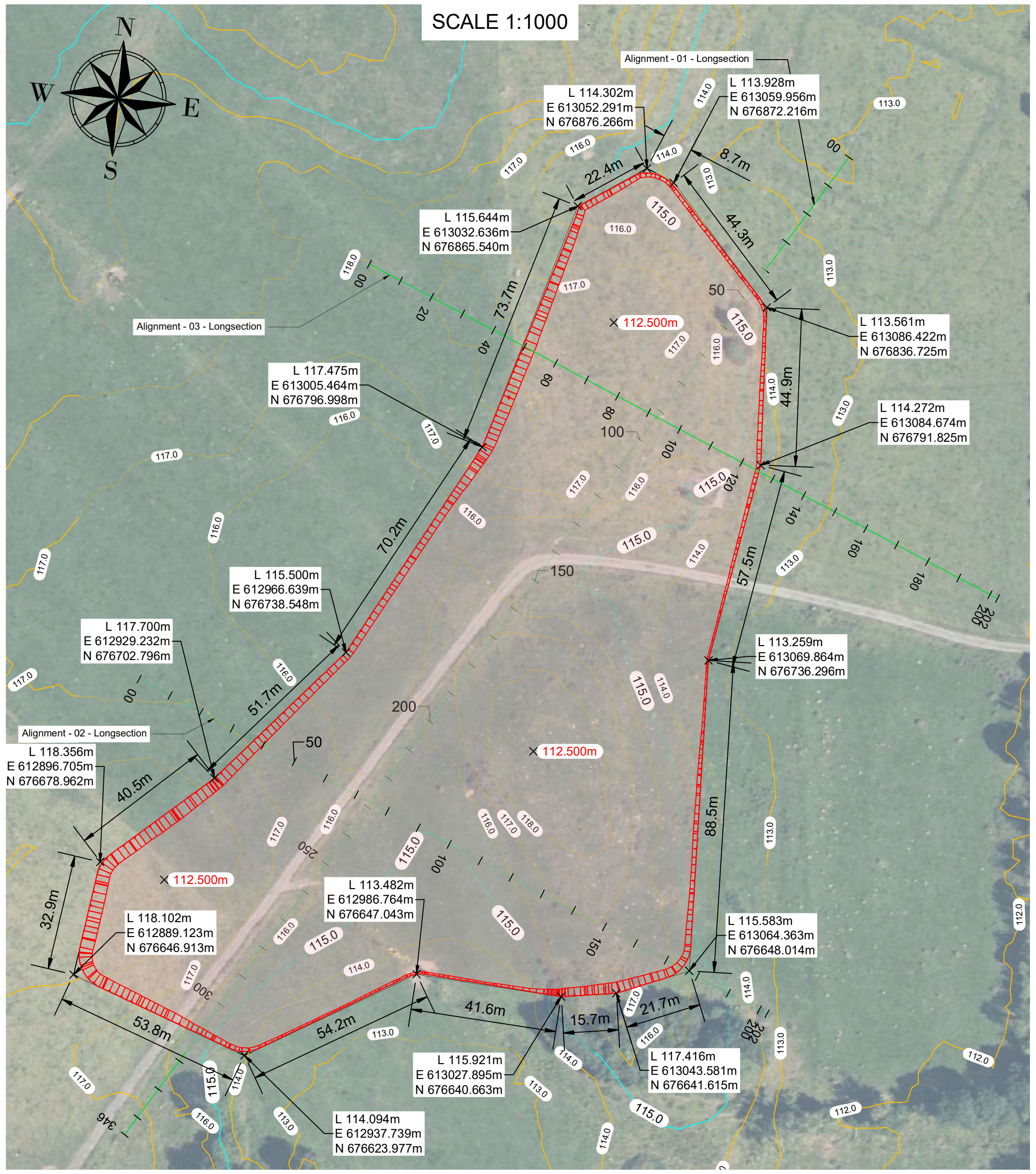
Alignment - 01 - Longsection

Scale: H 1:500, V 1:500



Chainage	Existing Levels
0.000	113.000
10.000	112.992
20.000	112.989
30.000	113.211
40.000	113.518
50.000	113.964
60.000	115.887
70.000	116.445
80.000	116.661
90.000	116.659
100.000	116.590
110.000	116.486
120.000	116.377
130.000	115.721
140.000	115.247
150.000	115.358
160.000	116.066
170.000	117.024
180.000	117.374
190.000	116.866
200.000	116.141
210.000	115.748
220.000	115.541
230.000	115.489
240.000	115.639
250.000	115.916
260.000	116.200
270.000	116.304
280.000	116.094
290.000	115.718
300.000	115.447
310.000	115.405
320.000	115.694
330.000	116.355
340.000	117.264
346.120	117.501

SCALE 1:1000



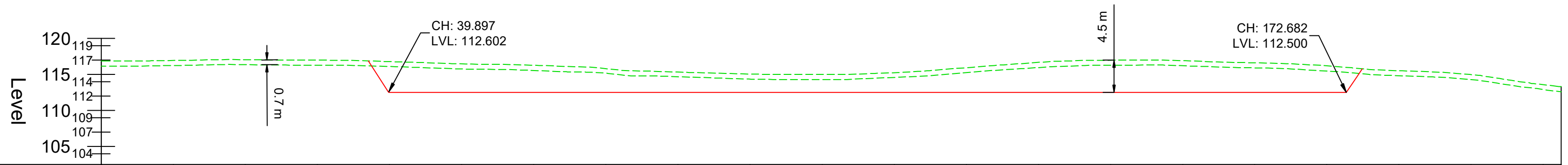
NOTES:

1. Overburden depth of 0.7m is based on available S.I. information including trial pits and boreholes; bedrock was encountered locally between 0.4-0.8m
2. Protective edge berms and/or fencing along the entire perimeter.
3. This drawing relates to the excavated borrow pit prior to reinstatement and construction of the access road to T1. Refer to drawing DANU-BBG-D003.2 for proposed details following the excavation of borrow pit material and construction of the T1 access road.

OVERBURDEN QUANTITIES	
AREA	VOLUME
24 649 m²	17 201 m³
BEDROCK QUANTITIES (below 0.7 m)	
AREA	VOLUME
24 351 m²	71 567 m³

Alignment - 02 - Longsection

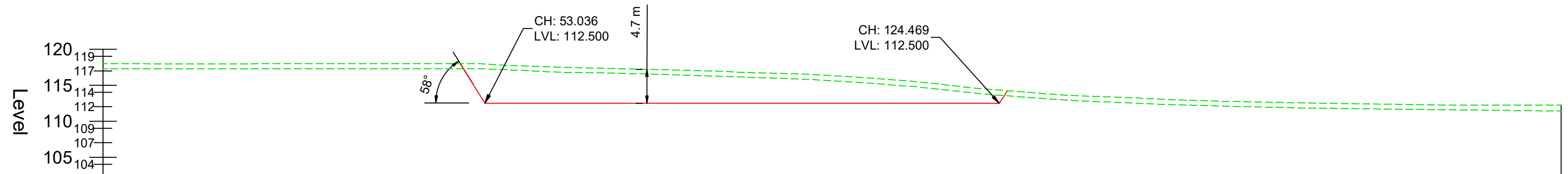
Scale: H 1:500, V 1:500



Chainage	Existing Levels
0.000	116.848
10.000	116.933
20.000	117.045
30.000	116.980
40.000	116.780
50.000	116.461
60.000	116.281
70.000	115.809
80.000	115.323
90.000	115.042
100.000	114.982
110.000	115.234
120.000	115.940
130.000	116.670
140.000	116.973
150.000	116.905
160.000	116.615
170.000	116.192
180.000	115.518
190.000	114.984
200.000	113.569
202.489	113.293

Alignment - 03 - Longsection

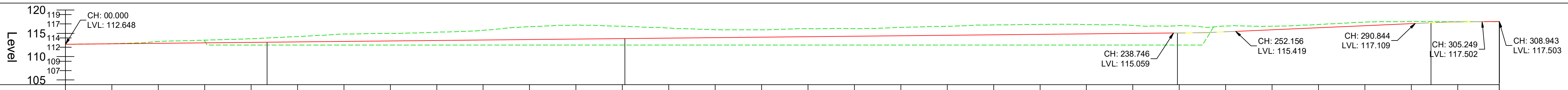
Scale: H 1:500, V 1:500



Chainage	Existing Levels
0.000	118.000
10.000	117.954
20.000	117.970
30.000	118.000
40.000	118.000
50.000	118.000
60.000	117.624
70.000	117.333
80.000	117.096
90.000	116.744
100.000	116.400
110.000	115.727
120.000	114.691
130.000	113.881
140.000	113.368
150.000	112.928
160.000	112.674
170.000	112.488
180.000	112.335
190.000	112.251
200.000	112.236
202.489	112.228

ENGINEER: Danu Energy CONSULTING www.danuenergy.ie	CLIENT: BUIRIOS LTD.
PROJECT: BORRISBEG RENEWABLE ENERGY DEVELOPMENT	
TITLE: BORROW PIT DETAILS	
SCALE: 1:1000	STATUS: PLANNING APPLICATION
PAPER SIZE: A1	DRAWN BY: A. ZOLOTAROV
	CHECKED AND APPROVED: C. Ó'DUBHTHAIGH
PROJECT PHASE: PLANNING	DATE: 27/09/2023
	DATE: 27/09/2023
DRAWING NUMBER: DANU-BBG-D003.1	REVISION: V4

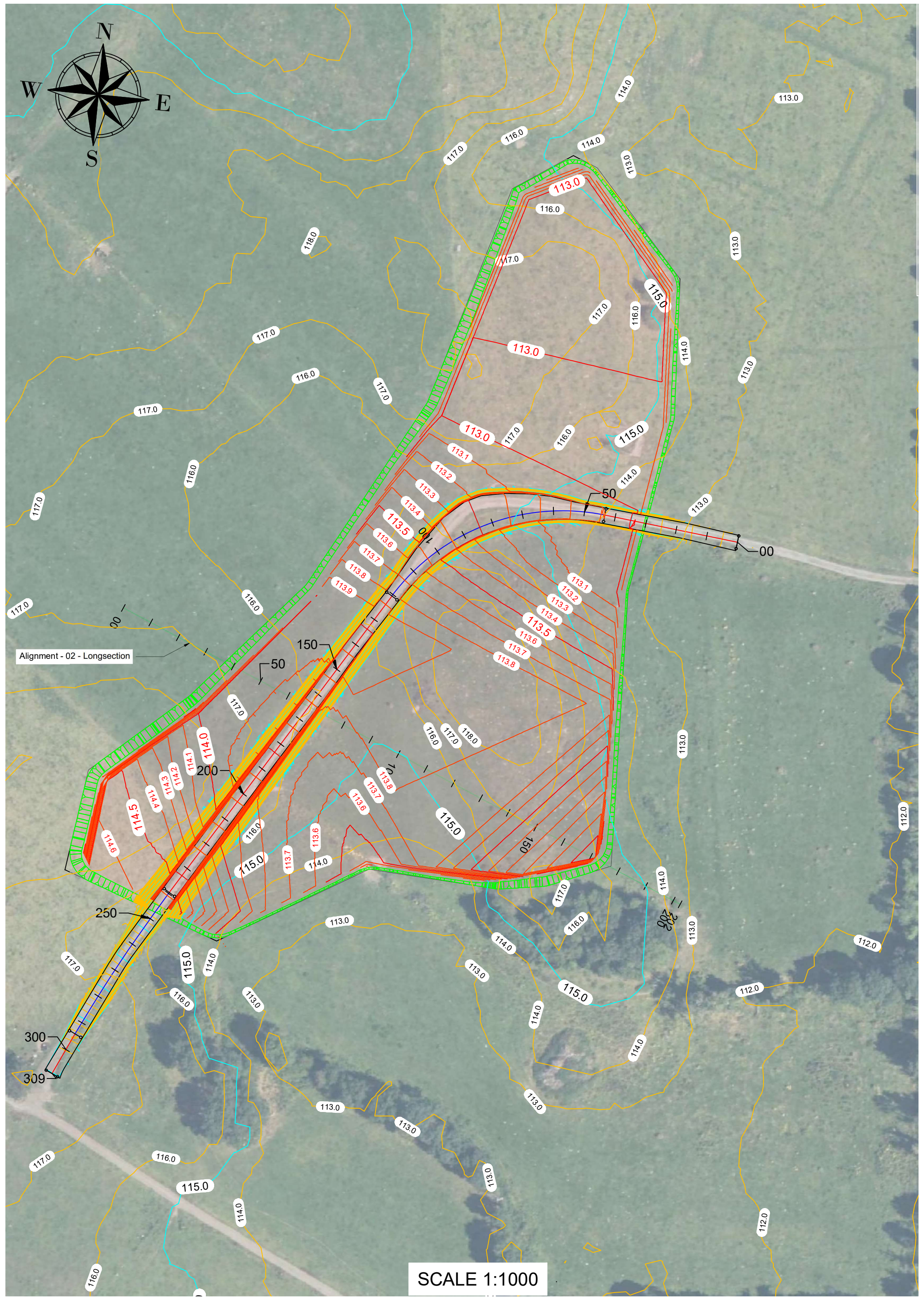
Alignment - 04 - Longsection
Scale: H 1:500, V 1:500



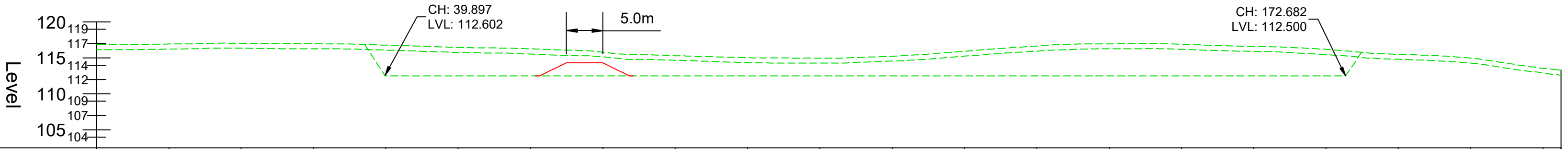
Chainage	Existing Levels
0.000	112.648
10.000	112.749
20.000	112.850
30.000	112.951
40.000	113.052
50.000	113.153
60.000	113.254
70.000	113.355
80.000	113.456
90.000	113.557
100.000	113.658
110.000	113.759
120.000	113.860
130.000	113.961
140.000	114.062
150.000	114.163
160.000	114.264
170.000	114.365
180.000	114.466
190.000	114.567
200.000	114.668
210.000	114.769
220.000	114.870
230.000	114.971
240.000	115.074
250.000	115.331
260.000	115.762
270.000	116.199
280.000	116.635
290.000	117.072
300.000	117.403
308.943	117.503

Vertical Geometry

Grade	G =1.010%, L =238.746
Curve	R =400.000, K =3.995, L =13.410
Grade	G =4.366%, L =38.688
Curve	R =400.000, K =3.996, L =14.755
Grade	G =0.673%, L =3.343



Alignment - 02 - Longsection
Scale: H 1:500, V 1:500



Chainage	Existing Levels
0.000	116.848
10.000	116.933
20.000	117.045
30.000	116.980
40.000	116.780
50.000	116.461
60.000	116.281
70.000	115.809
80.000	115.323
90.000	115.042
100.000	114.982
110.000	115.234
120.000	115.940
130.000	116.670
140.000	116.973
150.000	116.905
160.000	116.615
170.000	116.192
180.000	115.518
190.000	114.984
200.000	113.569
202.489	113.293

NOTES:

1. This drawing relates to the access road through the borrow pit post-excavation of bedrock
2. The elevated sections of access road shall include edge protection and additional marker posts
3. The borrow pit area will be partially reinstated with excess spoil and unsuitable material from elsewhere on site, along with the overburden material above the excavated bedrock.
4. Refer to drawing DANU-BBG-D003.1 for borrow pit excavation details

ENGINEER: Danu Energy CONSULTING, www.danuenergy.ie	CLIENT: BUIRIOS LTD.
PROJECT: BORRISBEG RENEWABLE ENERGY DEVELOPMENT	
TITLE: ACCESS ROAD THROUGH BORROW PIT TO T1	
SCALE: 1:1000	STATUS: PLANNING APPLICATION
PAPER SIZE: A1	DRAWN BY: A. ZOLOTAROV; CHECKED AND APPROVED: C. Ó'DUBHTHAIGH
PROJECT PHASE: PLANNING	DATE: 23/10/2023; DATE: 23/10/2023
DRAWING NUMBER: DANU-BBG-D003.2	REVISION: V1

4.3.1.9 River Restoration

The enhancement of a portion of the Eastwood River within the Site will involve the restoration of a previously deepened and straightened channel to appropriate dimensions, pattern and profile and the establishment of a native woodlands buffer. Please see Appendix 6-4 Biodiversity Management and Enhancement Plan for details.

A new meandering channel will be excavated adjacent to the existing channel using dimensions based on the drainage area of the reach along with reference reach data collected in the field. The new channel will include riffle pool sequences to improve instream habitat diversity with the channel. In addition to constructed riffles, a number of structures including cross-banes may be incorporated into the stream design as required. Bank stability will be achieved through the installation of coir fibre matting, and the use of bioengineering techniques such as live staking.

Once the new stream channel has been completed and stabilised, flow will be diverted to the new channel and the old channel will be plugged using clay plugs and back filled with material excavated from the new channel. The following construction methods will be used to construct the new stream channel.

4.3.1.9.1 *Channel excavation and grading*

A new channel will be excavated using a tracked excavator. All work will be conducted in the dry and will proceed from the upstream to downstream. Construction of relocated stream channel shall be conducted so as to prevent the release of sediment to downstream waters. Where possible the new stream channel should be constructed in advance and water redirected into the new channel once complete. The following measures should be employed to ensure that there is no release of sediment to downstream waters:

1. *All stream work to be performed "in the dry" either by pump-around or stream diversion with silt curtain.*
2. *Impervious dikes or sand bags are to be used to isolate work from stream flow.*
3. *The contractor shall not disturb more area than can be stabilised the same working day.*
4. *Maintenance of stream flow operation shall be incidental to the work. This includes pumps and hoses.*
5. *Pumps and hoses shall be of sufficient size to dewater the work area.*
6. *Graded stream banks shall be stabilised, with matting, prior to predicted rain fall events.*
7. *Silt bags and stilling basins shall be used to collect silt and sediment from work area dewatering.*
8. *Work area to be stabilised at the end of each day.*

4.3.1.9.2 *Constructed Riffle*

Constructed riffles have been incorporated into the stream restoration design for the purposes of increasing habitat diversity, providing grade control, and increasing oxygenation within the channel. The following methodology shall be used to install constructed riffles:

1. Variable constructed riffles shall be installed in newly graded channel.
2. Elevation control points shall be designated at the beginning and end of riffle points to establish part of the profile of the channel. Survey of control points shall be required to establish accurate riffle installation within the tolerance specified by the designer.
3. Backfill material, if needed to establish a riffle subpavement and/or to raise the channel bed due to scour/incision, shall be soil or coarse material with type and size and gradation, if applicable, specified by the designer. Backfill shall be placed

such that the addition of the specified thickness of riffle material shall achieve the designated grades.

4. Riffle material shall be comprised of rocks and wood. The rock material shall be of a type, size, and gradation as specified by the designer to be mobile or non-mobile as the conditions in the channel warrant. Rock riffle material may be excavated, stockpiled, and re-used from abandoned channel sections. Otherwise rock riffle material shall be slightly rounded, “river-type” rock, unless other rock characteristics are appropriate for the channel. In addition, logs and woody debris and boulders shall be included with the rock material as specified by the designer.
5. The placement of backfill and/or riffle material shall be done in a manner to create a smooth profile, with no abrupt “jump” (transition) between the upstream pool-glide and the riffle, and likewise no abrupt “drop” (transition) between the riffle and the downstream run-pool. The finished cross section of the riffle material shall generally match the shape and dimensions shown on the riffle typical section with some variability of the thalweg location as a result of the small pools, logs, and boulders.
6. The end of riffle control point may tie into a drainage structure or other in-stream structure (e.g. – cross vane, etc.)
7. The constructed riffle shall be keyed into the stream banks and/or bed as designated by the designer. The "key" shall extend beyond the top of bank at the beginning (crest) of the riffle.

4.3.1.9.3 Cross Vanes

A cross vane is made up of a set of upstream angled lines of boulders, connected by a section of smaller rocks upstream. While water usually covers the lower section during normal flows, the higher sections deflect flow away from the banks of the stream. Flow is diverted over the rock walls and concentrated down the centre of the channel. The scouring associated with high flow velocities in the centre of the channel and the "waterfalling" over the structure itself creates a deep, elongated pool. Please see Figure 4-19 and Plate 4-4 below for details. The purpose of the cross vane is to protect the banks downstream of the vane and to provide grade control to reduce the potential for headcutting in the channel (A headcut is an abrupt vertical drop in the bed of a stream that is an active erosional feature).

Figure 4-19 Typical plan view of cross vane

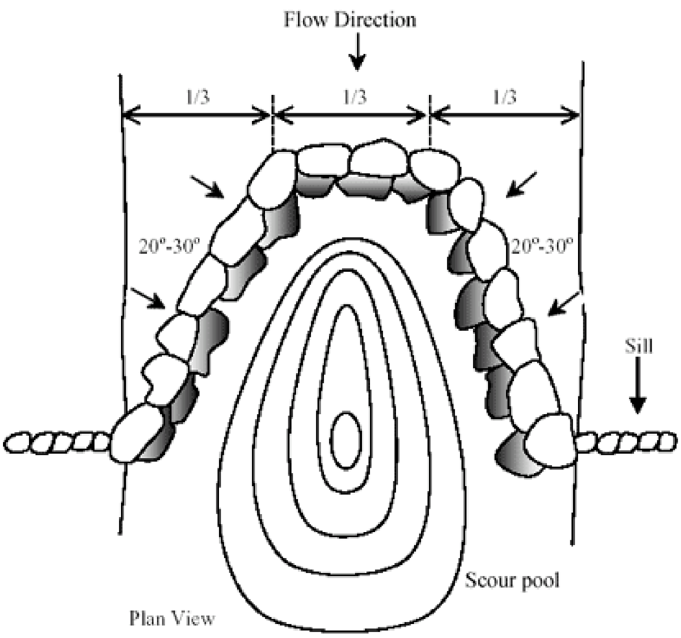


Plate 4-4 Example of cross vane on a restored stream

The following methodology shall be used to install cross vanes:

1. A boulder cross vane is a grade control, in-stream structure that directs stream flow away from the stream banks and in toward the centre of the channel.
2. Elevation control points shall be designated at the upstream invert (centre) of the Cross vane to establish part of the profile. Pool elevation control points or excavation to a specified maximum pool depth shall be designated to establish the remaining profile. Survey of control points shall be required to establish accurate cross vane installation within the tolerance specified by the designer.

3. The vane arm shall intercept the stream bank at a height equal to between ½ bankfull Stage and bankfull stage, (Bankfull is the breakpoint between the active channel of a river and it's floodplain). Elevation control points may be established at the left and Right stream bank/vane arm intercept points. Bankfull is not necessarily the top of the stream bank slope.
4. The cross vane shall be constructed with flat-sided boulders of a size (750mm x 500mm x 500mm approx.)
5. Non-woven filter fabric shall be used to seal the gaps Between the boulders and under the coarse backfill material. There shall be no filter Fabric visible in the finished work; edges shall be folded, tucked, or trimmed as needed.
6. Coarse backfill of the boulder cross vane shall be of a type, size, and gradation as specified by the designer. Coarse backfill shall be placed to a thickness equal to the Depth of the header and footer boulders and shall extend out from the vane arms to the Stream bank and upstream a distance specified by the designer.
7. The invert (centre) of the boulder cross vane shall be constructed first, followed by One vane arm and then the other vane arm. The floodplain sills shall be constructed Last.
8. Boulder cross vane shall be built typically as follows:
    a. Over-excavate stream bed to a depth equal to the total thickness of the header and footer boulders.
    b. Place footer boulders. There shall be no gaps between boulders.
    c. Install filter fabric.
    d. Place coarse backfill behind the footer boulders.
    e. Install header boulders on top of and set slightly back from the footer boulders (such that part of the header boulder is resting on the coarse backfill). Header Boulders shall span the seams of the footer boulders. There shall be no gaps Between boulders. The slope of the vane arm is measured along the vane arm which Is installed at an angle to the stream bank and profile.
    f. Place coarse backfill behind header boulders ensuring that any voids between the Boulders are filled.
9. If any erosion control matting is specified for use in the vicinity of the vane arm Intercept points and floodplain sills all matting edges shall be neatly secured around the boulders.

4.3.1.9.4 Coir Fibre Matting

Coir is the outside hard layer of husk that surrounds the shell of the coconut. It consists mainly of fibres, which have traditionally been used to manufacture rope, carpets, doormats, upholstery stuffing, brushes etc. Coir fibre matting is a biodegradable erosion control fabric that provides good surface protection against erosion while allowing for the germination of seed and promotion of vegetation cover. At a minimum coir fibre matting shall be installed on the outside of all meander bends where shear stress is likely to be highest, and in other locations where erosion control may be necessary. Coir matting can be omitted from the inside of meander bends when the stream channel is constructed in the dry and fully revegetated before flow is diverted to the new channel. The installation of the coir fibre matting shall be accomplished by hand using the following methodology:

1. Coir fibre matting shall be at least 700 grams/m^2 weight.
2. Matting shall be anchored in a trench at top of the stream bank. Stout stakes (38mm x 38mm minimum) shall be used to secure the matting into the toe and top of bank trench.
3. The stream bank shall be prepared by smoothing with shovels to remove large clumps of deposited peat, seeded, and mulched with straw prior to the placement of the matting.
4. The matting shall be installed so as to not be in tension, but be placed neatly, flush against the soil, and with no gaps or wrinkles.
5. Matting overlaps shall be 0.6m in width, and overlaps shall be oriented in a down-slope direction, downstream direction, or otherwise “shingle-style” in accordance with the

direction of the dominant erosive action so that the matting end is protected against movement.

6. The field of the matting over the surface of the stream bank shall be secured with hardwood matting stakes of at least 0.3 cm in length. Matting stakes shall be installed in a triangular grid pattern at 0.6m OC.
7. Matting shall be neatly secured around any projecting stream structures or rocks to prevent any loose or frayed edges.
8. There shall be no loose ends or unsecured matting on the completed work.
9. No matting will be placed on the bed of the channel.

4.3.1.9.5 *Live staking*

Live willow cuttings (live stakes) shall be installed through the coir fibre matting along both sides of the stream channel following the installation of coir fibre matting). The purpose of the live cuttings is to provide bank stability through the establishment of fast-growing native willows. The live stakes will be installed using the following methodology:

1. Cuttings shall be between 60cm and 90cm in length, and between 2cm and 8cm in diameter. They will be cut in the dormant season, i.e., between Nov and Mar. Cuttings will have an angled cut at the bottom end of the stake and a flat cut at the top of the stake to aid with installation.
2. Cuttings shall be installed in a two-row triangular grid pattern at 75cm on centre (o.c.). The first row shall be located on the side of the existing channel with the second row being located on the flat adjacent to the channel.
3. Cuttings shall be fashioned from live, dormant native willow species (Salix cinerea, Salix caprea and Salix aurita).
4. Cuttings shall be sourced locally on-site (or within 20km max of the establishment site if necessary).

The following methodology will be implemented for the handling, preparation, and installation of cuttings to ensure the highest possible survival rate:

1. Cuttings shall be cut and installed on the same day where possible.
2. If same-day installation is not possible, cuttings shall be stored for no more than 1 week with the bottom end of each stake fully submerged in water to prevent drying out of the material.
3. All lateral branches shall be carefully removed from the woody cuttings prior to installation.
4. Cuttings shall be driven into the ground using a “dead blow” plastic hammer.
5. Peat shall be firmly packed around the hole after installation, where required.
6. Cuttings shall be tamped in at a right angle to the ground with between 70%- 80% of the stake installed below the ground surface. Between 20%-30% and two buds (or pruned, lateral branch locations) on the cutting shall be above the ground surface.
7. Split or otherwise damaged cuttings shall not be used.

4.3.1.10 Watercourse / Culvert Crossings

The Site is extensively drained by a network of natural watercourses (streams & rivers) and manmade land drains. All watercourses and manmade drains at the Site drain into the River Suir which flows southerly through the eastern side of the Site.

To facilitate the construction of the Proposed Wind Farm roads, it is required to cross 2 no. natural watercourses, the Eastwood River and the River Suir, and several field drains. The River Suir crossing will be by horizontal directional drilling (HDD) under an existing bridge on the L-70391 to facilitate the connection of the 33kV underground cabling to the proposed 110kV substation, and the Eastwood River will be crossed by installing a new clear span crossing.

4.3.1.10.1 Clear Span Crossing

The crossing of the EPA/OSI mapped Eastwood River will comprise a clear span watercourse crossing. The construction methodology for this crossing has been designed to eliminate the requirement for in-stream works at this location. This watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material. Confirmatory inspections of the proposed new watercourse crossing locations will be carried out by the Project Civil/Structural Engineer and the Project Hydrologist prior to the construction of the crossing. Please see Figure 4-1 for the location of the proposed Clear Span crossing, Figure 4-37 for the design details and section 4.9.1.3 for the construction methodology.

4.3.1.10.2 Horizontal Directional Drilling

To facilitate the connection of the 33kV underground cabling to the proposed 110kV substation, the 33kV cable route will require crossing the River Suir. It is proposed to cross this river using the HDD method as described in section 4.9.1.4 below. Please see Figure 4-1 for the location of this HDD crossing. This crossing methodology will ensure that no instream works are proposed. and Figure 4-38 below for the HDD crossing design.

4.3.1.10.3 Culvert Crossing

All new proposed culverts and proposed culvert upgrades at field drain crossings required for the Proposed Wind Farm will be suitably sized for the expected peak flows in the watercourse.

Some culverts may be installed to manage drainage waters from works areas of the Proposed Wind Farm, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In all cases, culverts will be oversized to allow mammals to pass through the culvert. Culverts will be installed constructed as per the methodology detailed in section 4.9.1.5. All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance. Please see Figure 4-1 for the location of these crossings and Figure 4-39 below for design details.

4.3.1.11 Stone Requirements

The volumes of stone required for the construction of the Proposed Wind Farm, outlined in Table 4-2 below, have been estimated based on the Proposed Wind Farm footprint, the anticipated excavation levels to suitable formation or suitable subgrade, and the proposed final levels for the infrastructure components. Approximately 90,000m^3 of material will be required for the Proposed Wind Farm footprint with an estimated 70,000m^3 to be provided by the onsite borrow pit and the remaining 20,000m^3 to be imported from licenced quarries. There are 15 licenced quarries within 20km of the Site. Please see Figure 4-20 for the location of these quarries.

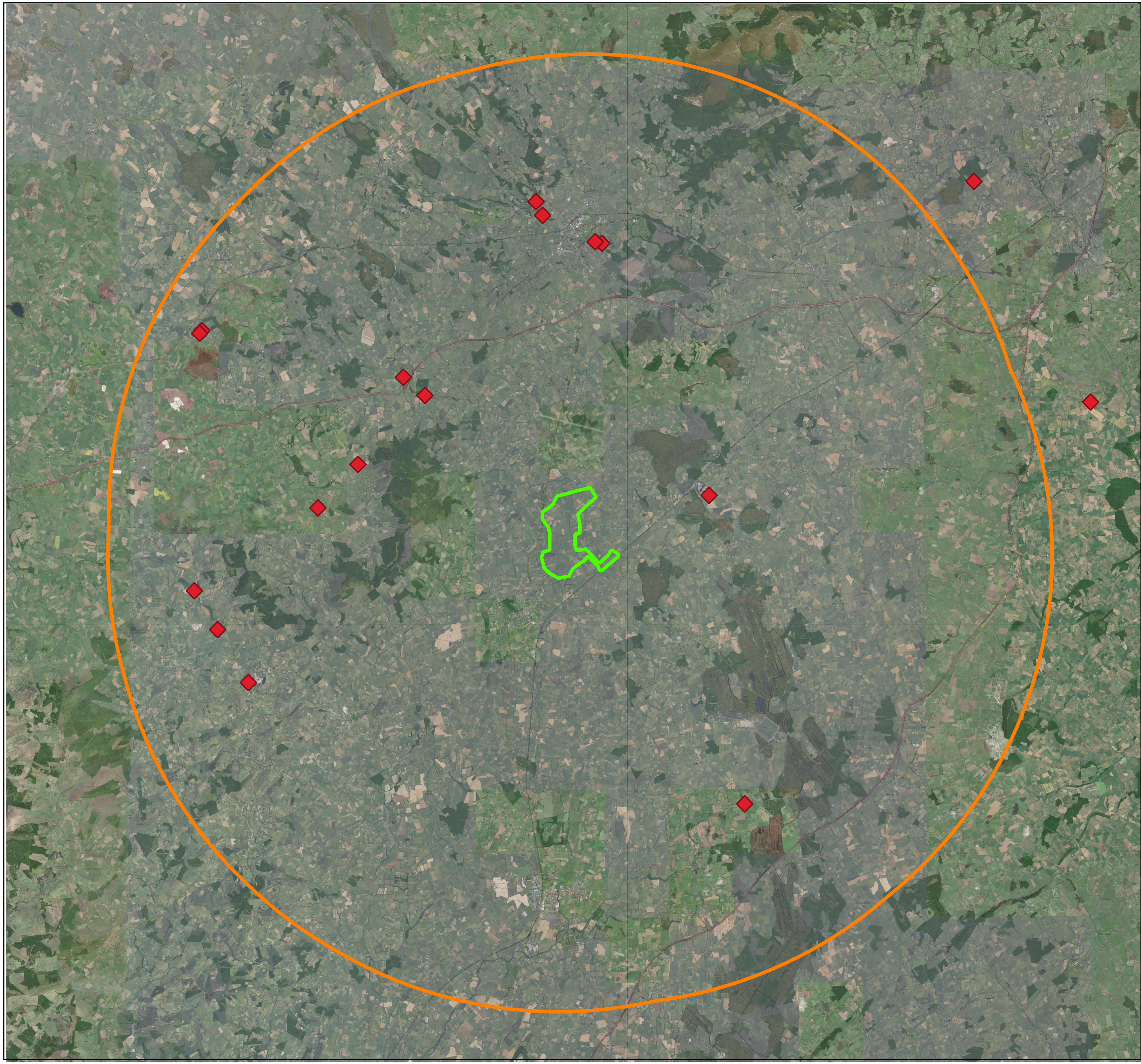
Construction grade fill and higher quality, final surfacing fill will both be required for the construction of the Proposed Wind Farm. Granular fill volumes have been estimated using the following methodology:

- The soil beneath the Proposed Wind Farm infrastructure footprint will be excavated and replaced with construction grade granular fill up to the existing ground level.

- Roads and hardstands will generally comprise approximately 500-600mm of granular fill (constructed in layers and finished with a capping layer). Geotextiles separators will be placed on the subgrade and geogrids will be installed within the road build-up, as required by the site engineer.

Table 4-2 Granular Fill Volumes Required from the Proposed Borrow Pit and Quarries for the Proposed Wind Farm

Project Component	Area (m^2) (approx.)	Stone Fill Required (m^3)
9. Turbines hardstand and cranepad areas	29,151	42,000
Access Roads (new and upgrade)	34,000	17,600
Surface redressing of internal roads x3 over operational lifetime	38,000	17,875
Met Mast including hardstand	246	148
Temporary Construction Compound	4,950	2,970
Security Cabin	30	3
Subtotal (Approx)	78,600	80,000
Totals (m^3) (including 12.5% contingency factor)		70,000
Total (approx)		90,000



Map Legend

- EIAR Study Boundary
- Licenced Quarries

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Drawing Title	
Licencedc Quarries within 20km	
Project Title	
Proposed Borrisbeg Renewable Energy Development	
Drawn By KM	**Checked By** Alan Clancy
Project No. 220310	**Drawing No.** Figure 4-20
Scale 1:170,000	**Date** 2023-09-28

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4.3.1.12 Spoil Management Plan

4.3.1.12.1 *Quantities*

The approximate quantity of spoil requiring management on the Site has been calculated, as presented in Table 4-3 below.

Table 4-3 Approximate Spoil Volumes Requiring Management

Development Component	Spoil Volume(m3) (approx.)
9 no. Turbines Hardstanding Areas and Cranepads	55,000
Access Roads	33,000
Met Mast and Hardstanding Area	373
Temporary Construction Compound	495
River Restoration	4,500
Borrow pit overburden	17,200
Total Spoil to be managed (m3) (including 10% contingency)	**121,600**

Note: A contingency factor of 10% has been applied and is included to the excavated spoil volumes above to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.

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

4.3.1.13 Spoil Management Areas

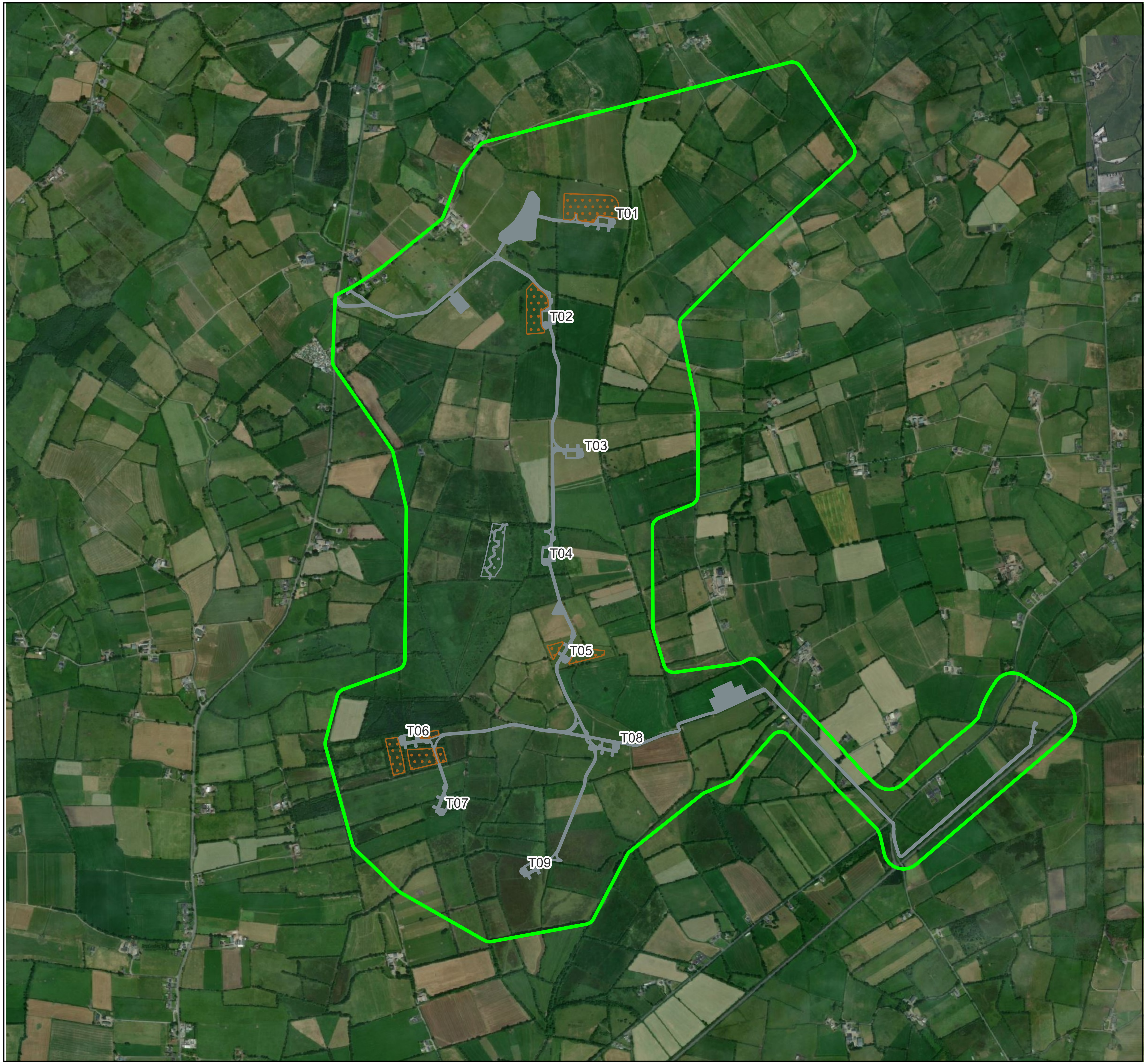
It is proposed to manage any excess overburden generated through construction activities locally within the Site, in identified spoil management areas, as shown in Figure 4-21, and in linear berms along access roads where appropriate (outside the modelled flood zones). The total capacity of the identified spoil management areas within the Site is approx. 85,000m^3 and therefore, in conjunction with backfilling the borrow pit, there is more than enough capacity to manage the total volume of spoil requiring management for both the Proposed Wind Farm and the Proposed Grid Connection (please see section 4.3.2.9 below for details on spoil volumes related to the Proposed Grid Connection infrastructure).

The spoil management areas have been selected based on the locations of spoil generation, areas suitable for spoil management and environmentally constrained areas such as identified site-specific flood modelled zones as detailed in Chapter 9: Hydrology and Hydrogeology.

The following recommendations and best practice guidelines for the placement of spoil in identified spoil management areas and alongside access roads (outside the modelled flood zones) will be adhered to during the construction of the Proposed Project:

1. *At the identified spoil management areas, the vegetative top-soil layer will be removed to allow for spoil to be placed and upon reaching the recommended height, the vegetative topsoil layer will be reinstated.*
2. *The identified spoil management areas will be developed in a phased approach, with the topsoil removed and temporarily stockpiled within the defined area while the spoil it being placed. The stockpiled topsoil will then be reinstated over the placed spoil, and the exercise will continue within the same spoil management area until the area is full.*
3. *The placement of spoil will be restricted to a maximum height of 1.0m, subject to confirmation by the Geotechnical Engineer.*
4. *Where practical, the surface of the placed spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the spoil will be carried out as placement of spoil within the area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed spoil.*
5. *Finished/shaped side slopes of the placed spoil will be not greater than 1 (v): 2 (h) in the dedicated spoil management zones and not greater than 1 (v): 1 (h) alongside access tracks.*
6. *Inspections of the spoil management areas will be made by a Geotechnical Engineer through regular monitoring of the works. The appointed contractor will review work practices at spoil management areas when periods of heavy rainfall are expected so as to prevent excessive dirty water runoff from being generated.*
7. *An interceptor drain will be installed upslope of the identified spoil management areas to divert any surface water away from these areas.*
8. *Silt fences and double silt-fences will be emplaced down-gradient of spoil management areas and will remain in place throughout the entire construction phase, or until reseeding has been established to a sufficient level.*
9. *The surface of the deposited spoil will be profiled to a gradient to be agreed with the Geotechnical Engineer and vegetated or allowed to vegetate naturally as indicated by the Project Ecologist.*
10. *All the above-mentioned general guidelines and requirements will be confirmed by the Geotechnical Engineer prior to construction.*

The plan view of the spoil management areas within the Site are shown in Figure 4-21, along with section drawings of the spoil management areas shown in Figure 4-22.



Map Legend

- EIAR Study Boundary
- Proposed Spoil Management Areas
- Proposed Project Footprint

N

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Drawing Title: Spoil Placement Areas	
Project Title: Borrisbeg Renewable Energy Development	
Drawn By: NS	Checked By: KM
Project No.: 220310	Drawing No.: Figure 4-21
Scale: 1:17,500	Date: 2023-11-17

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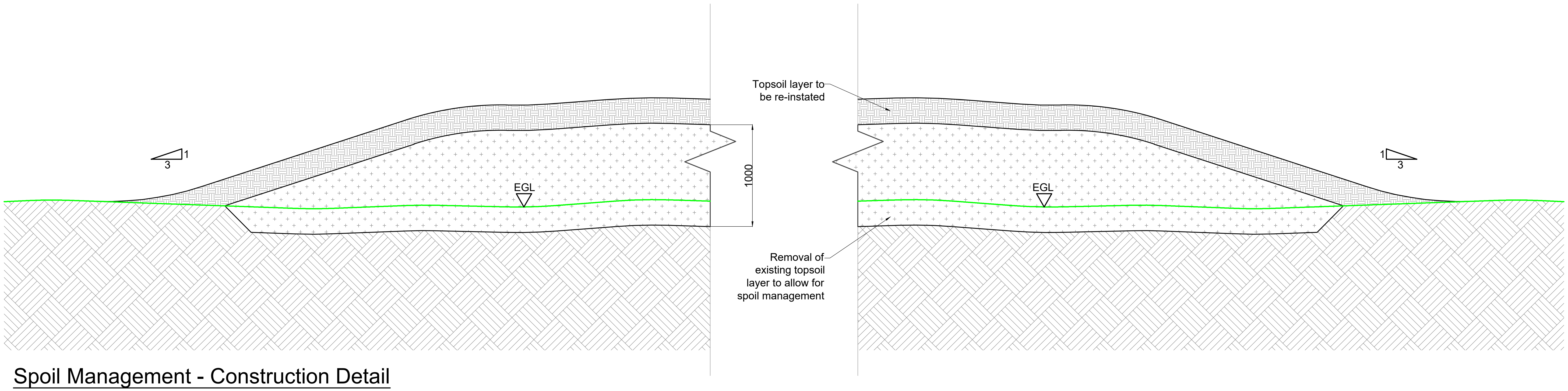
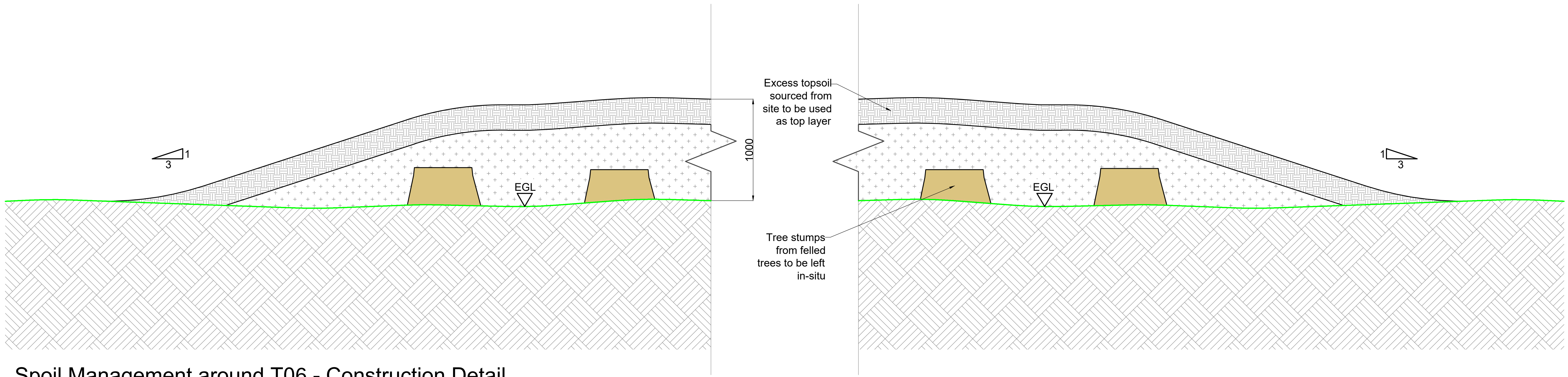


Spoil Management - Construction Detail

Scale 1:40



Spoil Management around T06 - Construction Detail

Scale 1:40

PROJECT TITLE:
Borrisbeg Renewable Energy Development

DRAWING TITLE:
Spoil Management Methodology

PROJECT No.:	DRAWING No.:	SCALE:
220310	Figure 4-22	As shown @ A3

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GO	KD	05.12.2023	P01

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4.3.2 Proposed Grid Connection

As discussed above in section 4.1.1, the Proposed Grid Connection will be subject to a separate planning application under Section 182A of the Planning and Development Act, 2000 (as amended). The Proposed Grid Connection is detailed in Appendix 4-5 of this EIAR.

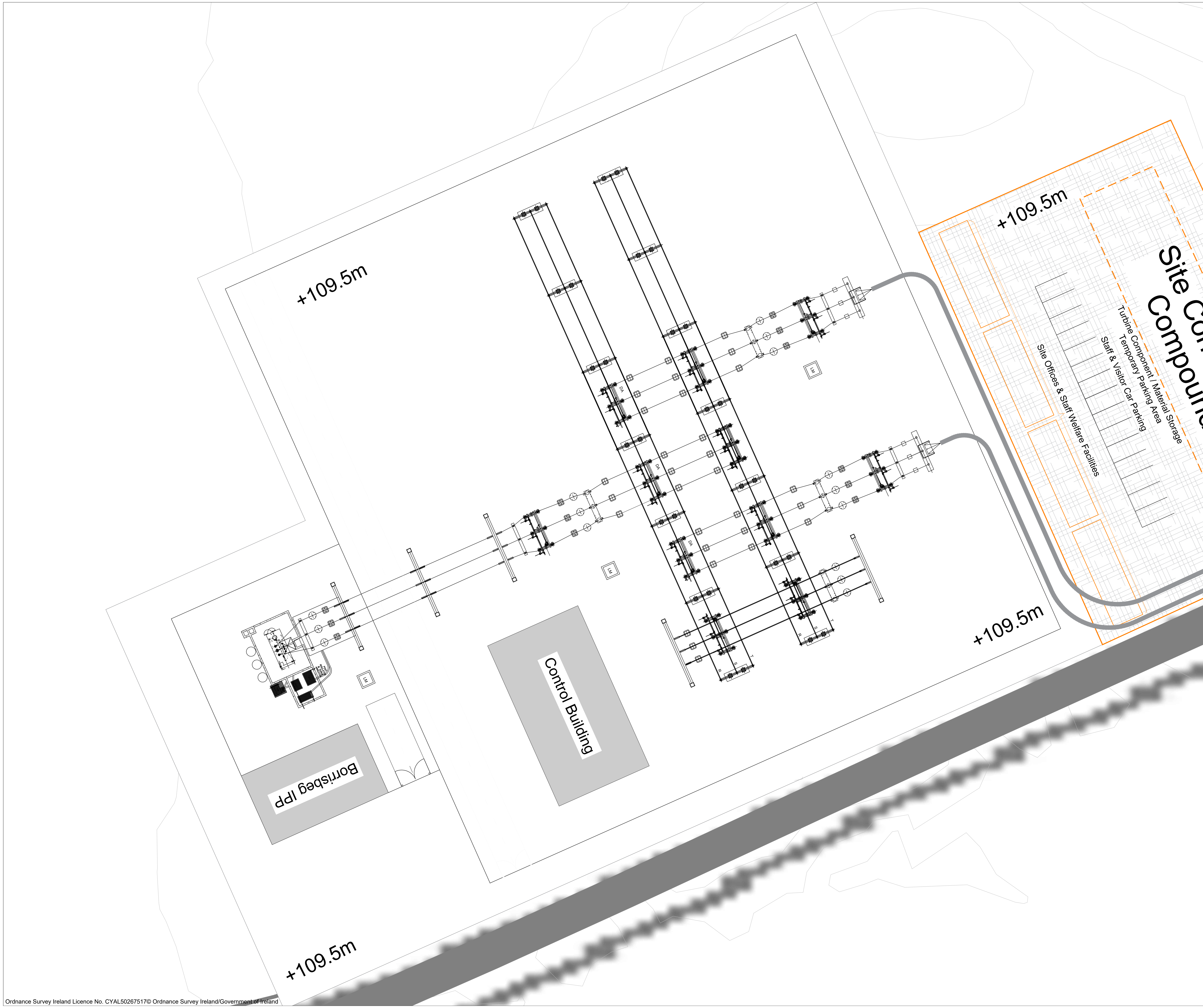
4.3.2.1 Electricity Substation

It is proposed to construct a 110 kV electricity substation within the Site as shown in Figure 4-2. The proposed substation is located at the southeast of the Site, in the townland of Clonmore. The construction and exact layout of electrical equipment in the on-site electricity substation will be to Eirgrid/ ESB Networks specifications. Access to the substation will be off the Local Road L-70391 immediately adjacent to its southern boundary and also through internal wind farm roads which are accessed off the L-3248 in the northwest of the Site. Upon decommissioning of the Proposed Wind Farm, the 110kV substation within Clonmore townland will most likely remain *insitu* and form part of the national grid infrastructure.

The footprint of the proposed on-site 110kV substation compound measures approximately 11,605m^2 in area and will include 2 no. control buildings and the electrical substation components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the on-site 110kV substation to the national grid. The layouts and elevations of the proposed on-site 110kV substation are shown on Figure 4-23 and 4-24.

Further details regarding the connection between the on-site110kV substation and the national electricity grid are provided in Section 4.9.2.3 below.

The on-site 110kV substation compound will include steel palisade fencing (approximately 2.6 metre high or as otherwise required by ESB), and internal fences will also segregate different areas within the main substation. Please see Figure 4-25 for fencing details.



Project Design Drawing Notes

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7. Exact location of cable/joint bay in the road curtilage to be subject to ESB specifications and agreement with Westmeath County Council.

Drawing Legend

- Underground Electrical Cabling Route
- S37 Infrastructure

PROJECT TITLE:

Borrisbeg Renewable Energy Development

DRAWING TITLE:

Onsite 110kV Substation Drawing Layout

PROJECT No.:	DRAWING No.:	SCALE:
220310	Fig 4-23	1:500 @ A3

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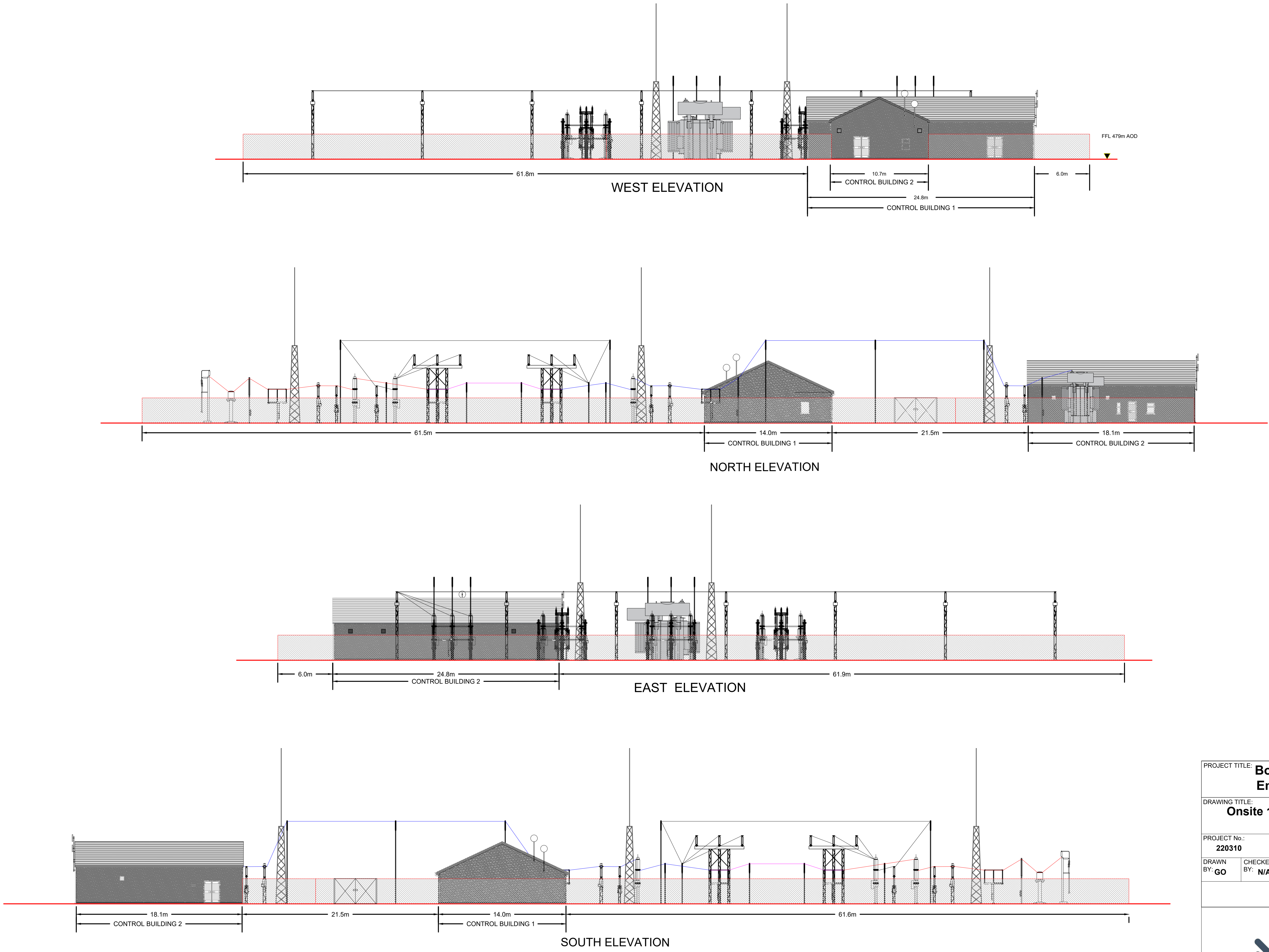

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DRAWING TITLE: **Onsite 110kV Substation Drawing Elevations**	

PROJECT No.:	DRAWING No.:	SCALE:
220310	Fig 4-24	1:200 @ A1

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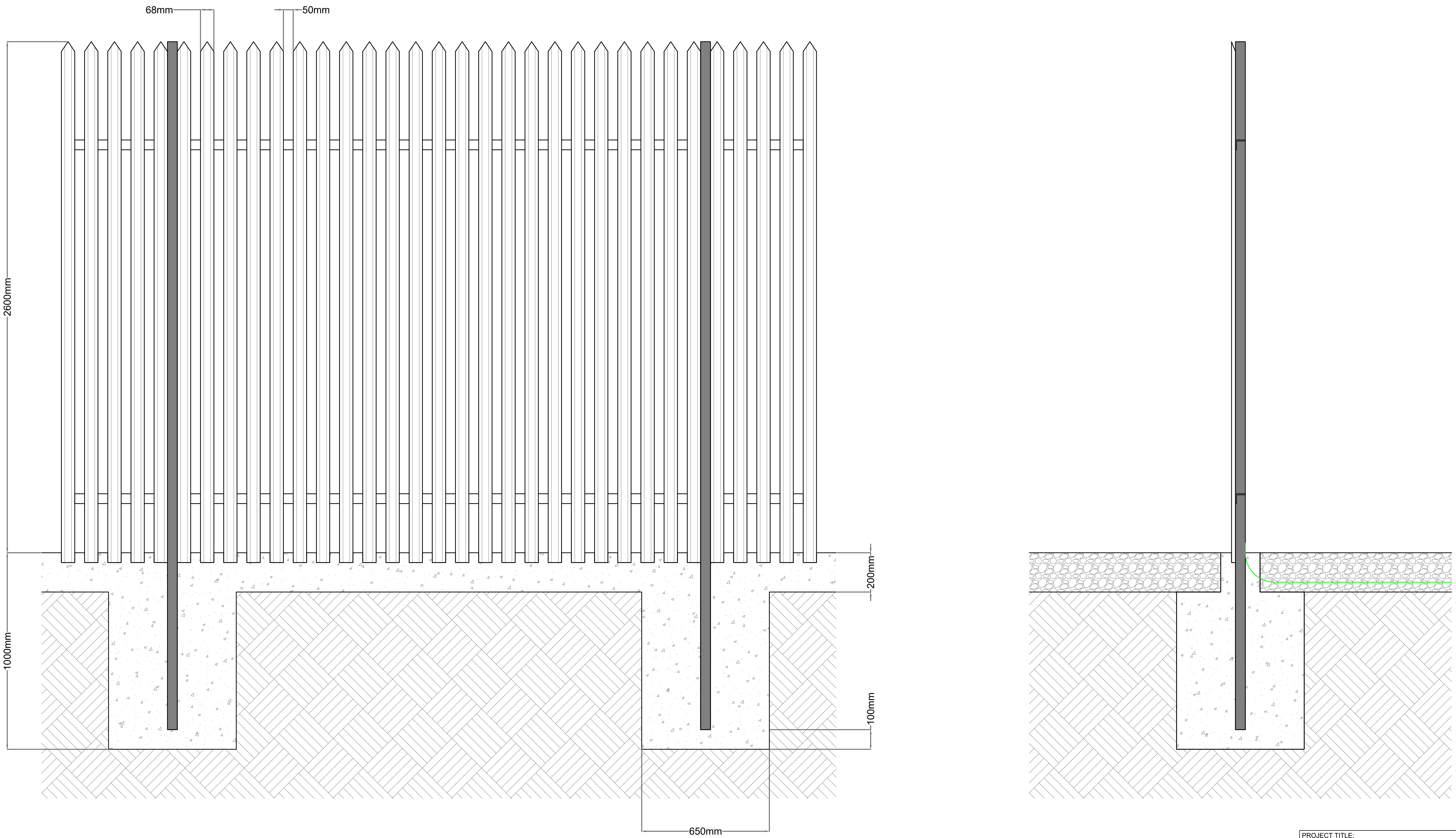

Standard Palisade Fencing
1:20

PROJECT TITLE: **Borrisbeg Renewable Energy Development**			
DRAWING TITLE: **Standard Palisade Fencing**			
PROJECT No.: 220310		DRAWING No.: Figure 4-25	SCALE: 1:20 @ A3
DRAWN BY: GO	CHECKED BY: N/A	DATE: 15.11.2023	REVISION.: P01

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4.3.2.2 Wind Farm Control Buildings

Two substation control buildings will be located within the substation compound. The Independent Power Producer (IPP) Control Building will measure approximately 19 metres by 11 metres and approximately 7 metres in height. The Transmission Asset Owner (TSO) Control Building will measure approximately 18 metres by 11 metres and approximately 7.5 metres in height. The layouts of the control buildings are shown on Figure 4-26 and Figure 4-27.

The substation control buildings will include staff welfare facilities for the operational phase of the project. Bottled water will be supplied for drinking, if required. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the Proposed Grid Connection there will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement of the Proposed Grid Connection does not necessitate a potable source. It is proposed to either harvest rainwater from the roofs of the buildings or, alternatively, install a groundwater well adjacent to the substation in accordance with the Institute of Geologists Ireland, *Guide for Drilling Wells for Private Water Supplies* (IGI, 2007). The well will be flush to the ground and covered with a standard manhole. A pump house is not required as an in-well pump will direct water to a water tank within the roof space of the control building.

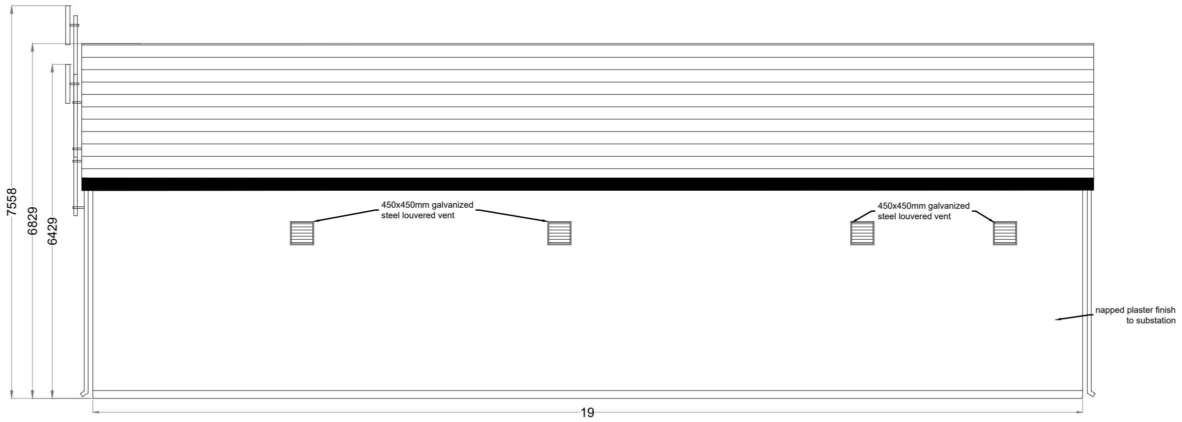
It is not proposed to treat wastewater on-site. Wastewater from the staff welfare facilities in the control buildings will be managed by means of a sealed underground storage tank, with all wastewaters being tankered off site by permitted waste collector to a licenced wastewater treatment plant.

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.

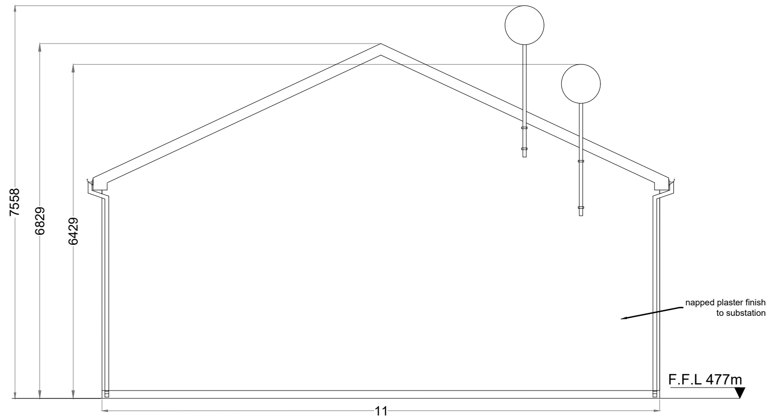
The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. Full details of the proposed tank alarm system can be submitted to the Planning Authority in advance of any works commencing on-site. The wastewater 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 substation underground storage tank.

4.3.2.3 Substation Temporary Construction Compound

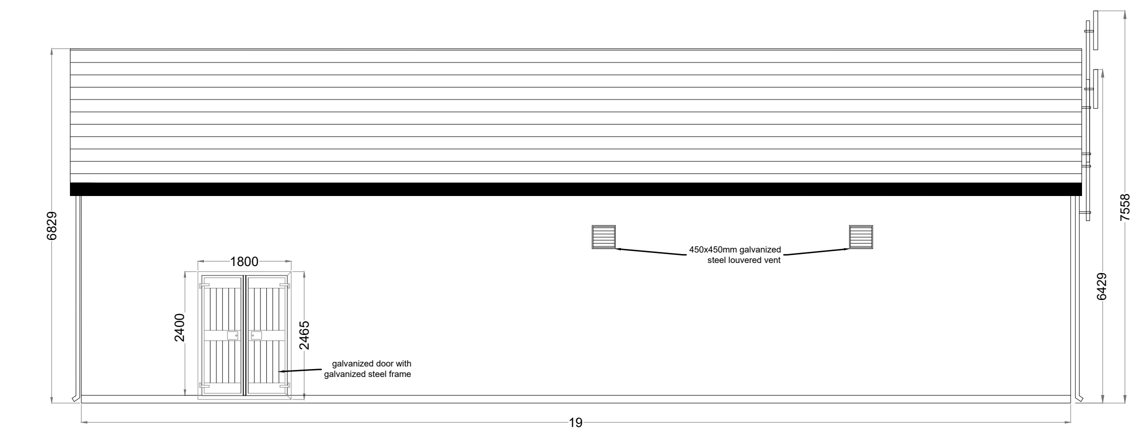
The 110kV substation will require its own separate temporary construction compound. This temporary construction compound will measure approximately 2,539m^2 in area will be located adjacent to the substation. See Figure 4-28 below for details. This construction compound will include a bunded refuelling and containment area for the storage of lubricants, oils and site generators etc, and full retention oil interceptor, waste storage area, temporary site offices, staff facilities and car-parking areas for staff and visitors. Temporary port-a-loo toilets and 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 wastewaters being tankered off site by a permitted waste collector to wastewater treatment plants. There will also be a water supply on site for hygiene purposes, by way of a temporary storage tank.



North Elevation



East Elevation



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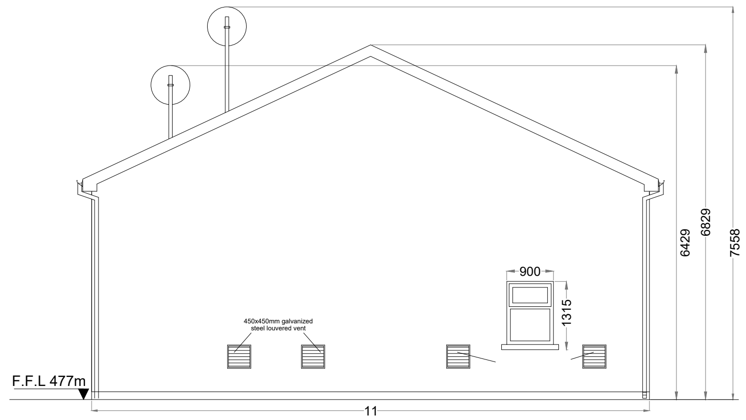

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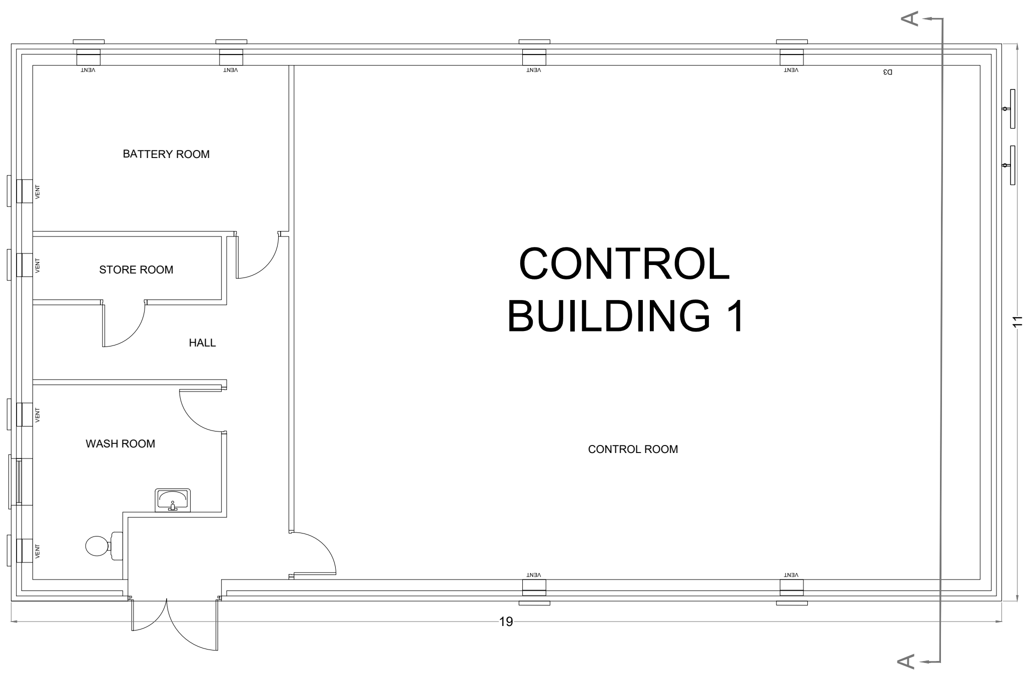

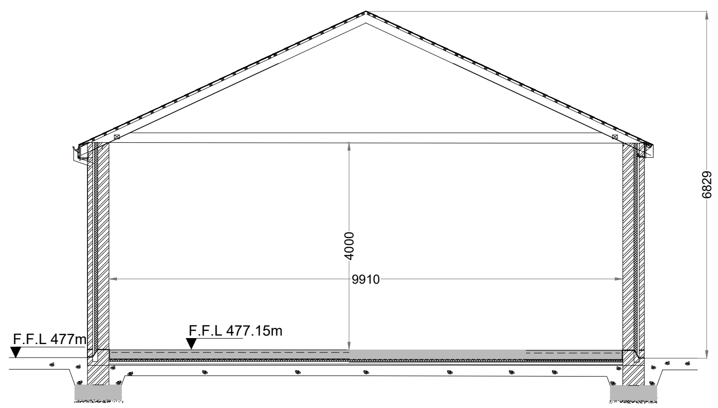

SECTION A-A

PROJECT TITLE: **Borrisbeg Renewable Energy Development**			
DRAWING TITLE: **Control Building 1 Elevations & Section**			
PROJECT No.: 220310	DRAWING No.: Fig 4-26	SCALE: 1:100 @ A2	
DRAWN BY: GO	CHECKED BY: N/A	DATE: 09.11.2023	REVISION.: D1

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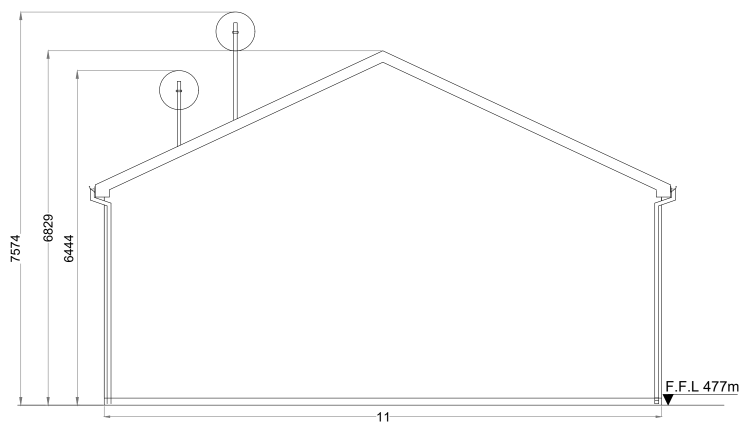

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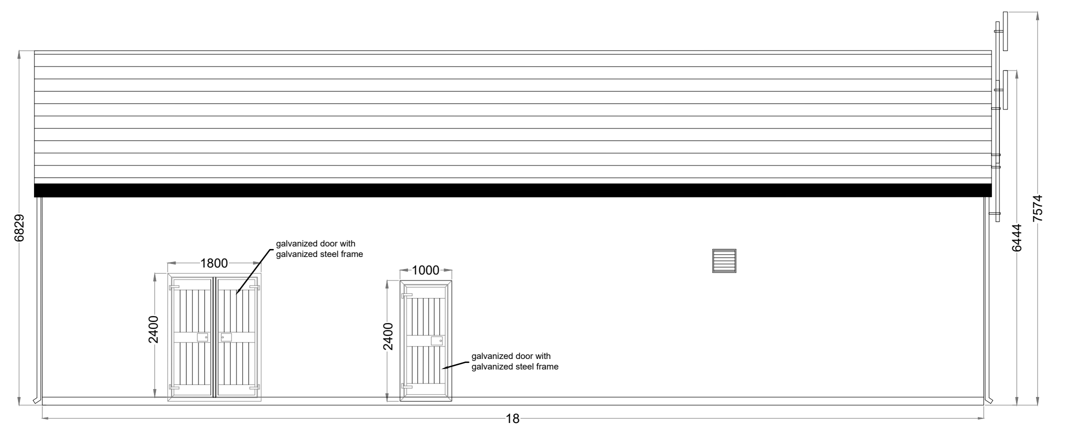

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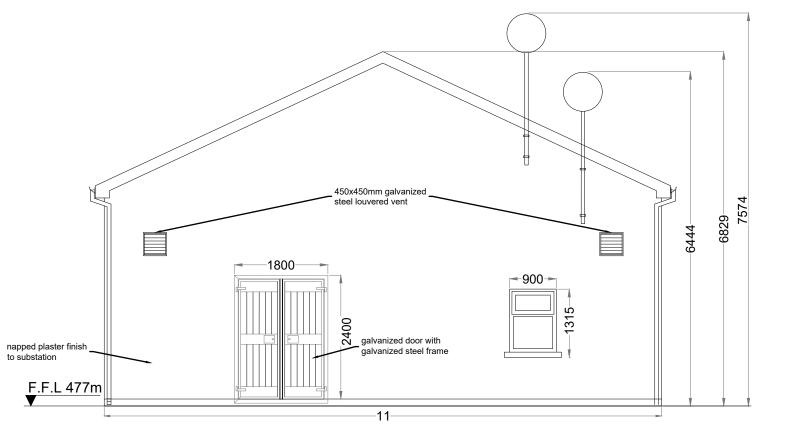

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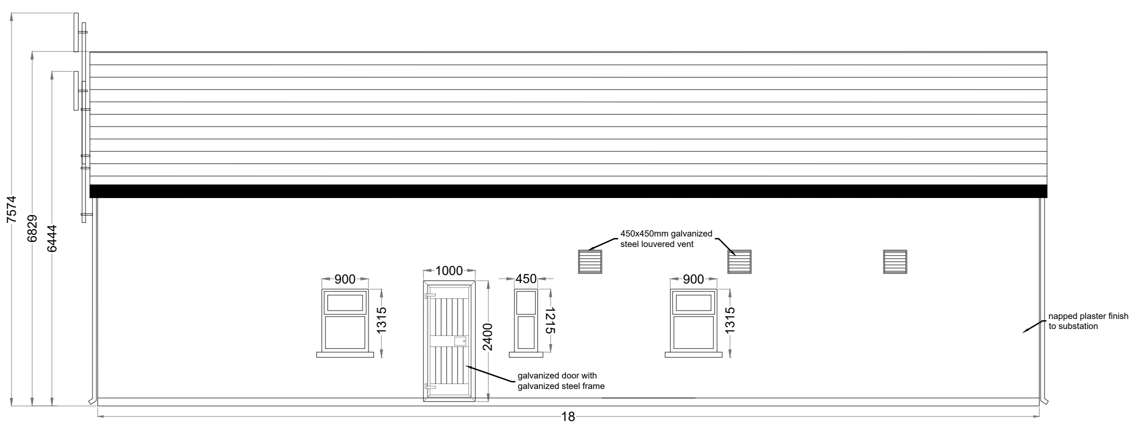

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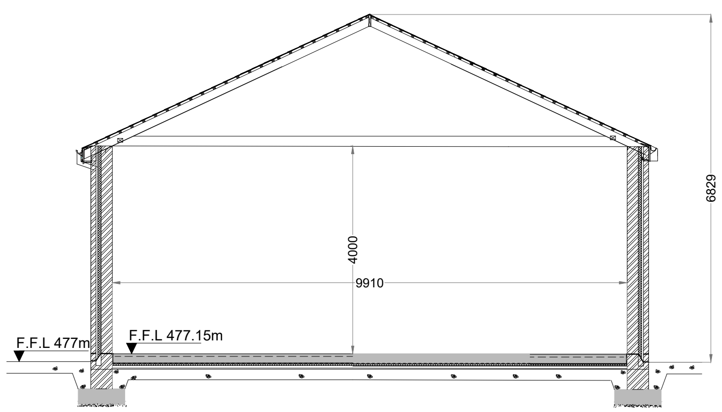
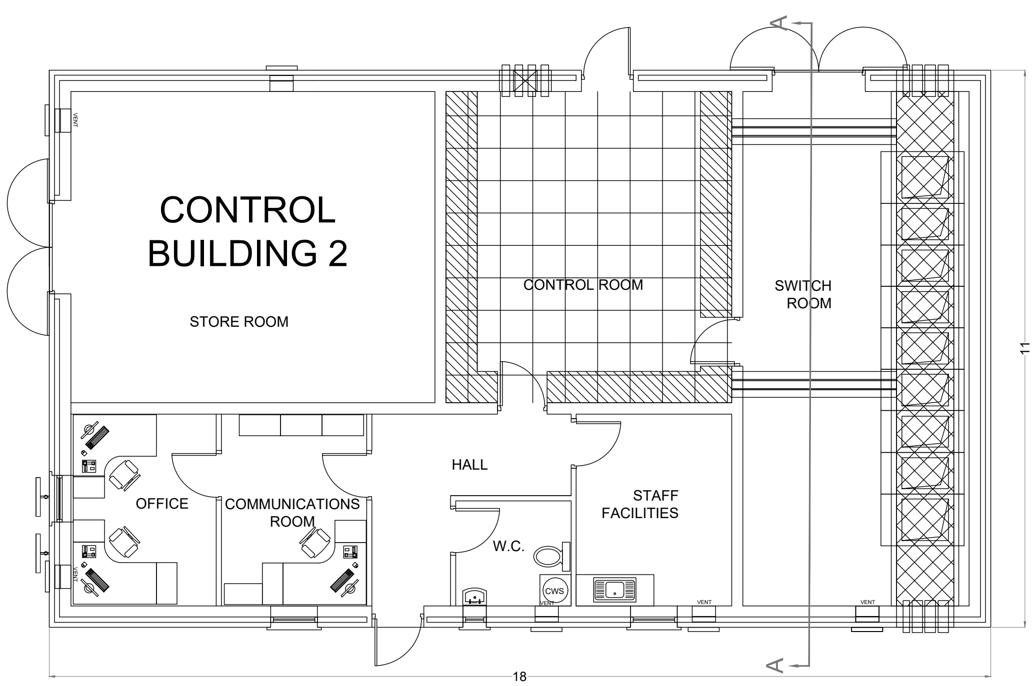


SECTION A-A



PROJECT TITLE:	**Borrisbeg Renewable Energy Development**
DRAWING TITLE:	**Control Building 2 Elevations & Section**

PROJECT No.:	DRAWING No.:	SCALE:
220310	Fig 4-27	1:100 @ A2

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
GO	N/A	09.11.2023	D1

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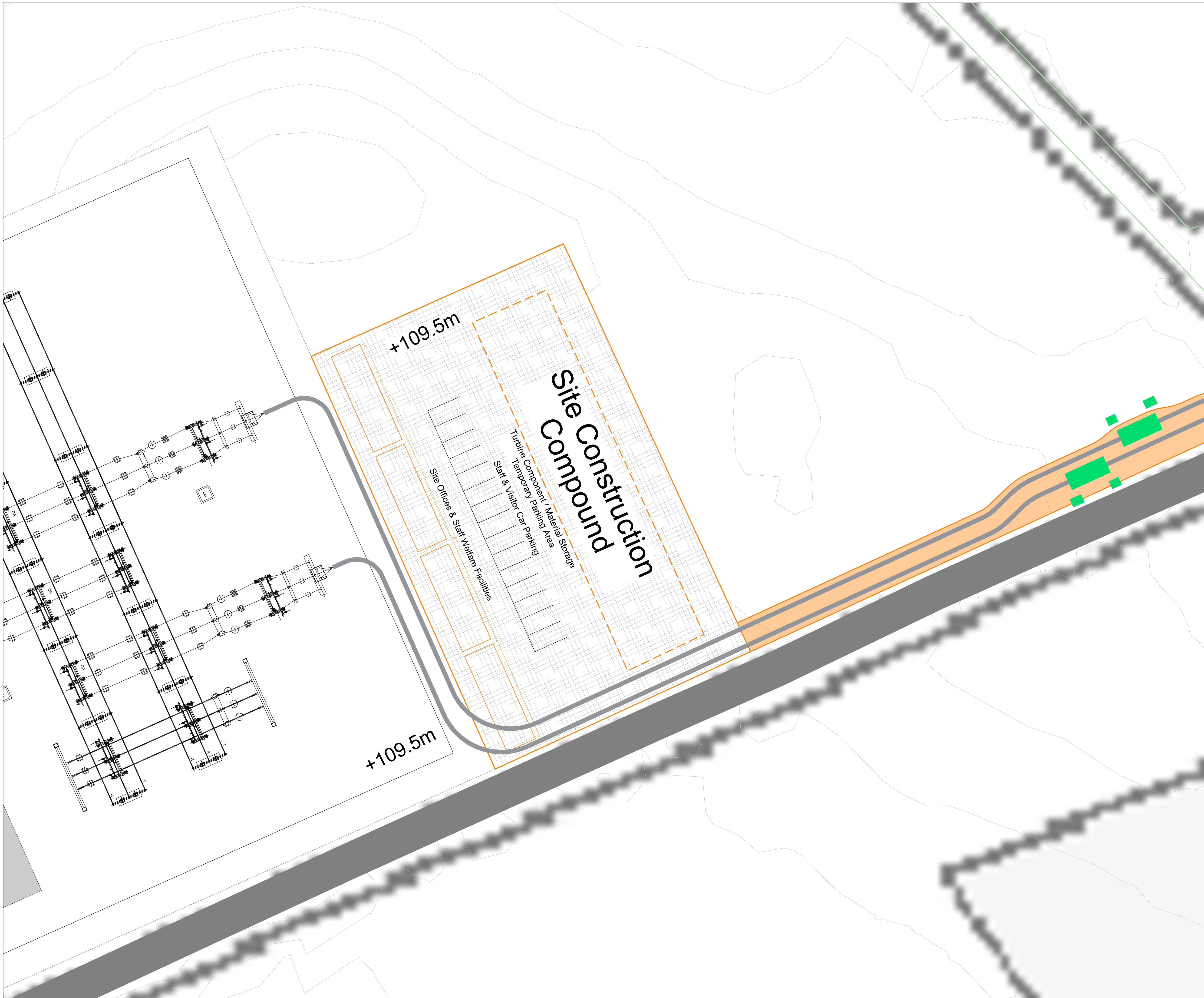

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7. Exact location of cable/joint bay in the road curtilage to be subject to ESB specifications and agreement with Westmeath County Council.

Drawing Legend

- Underground Electrical Cabling Route
- Joint Bay
- Cabling Construction Track
- S37 Infrastructure
- Hedges

PROJECT TITLE:
Borrisbeg Renewable Energy Development

DRAWING TITLE:
Temporary Construction Compound for Grid Connection

PROJECT No.:	DRAWING No.:	SCALE:
220310	Fig 4-28	1:500 @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
GO	N/A	12.12.2023	P01

OS SHEET No.: 4341, 4342, 4399, 4400, 4457, 4458

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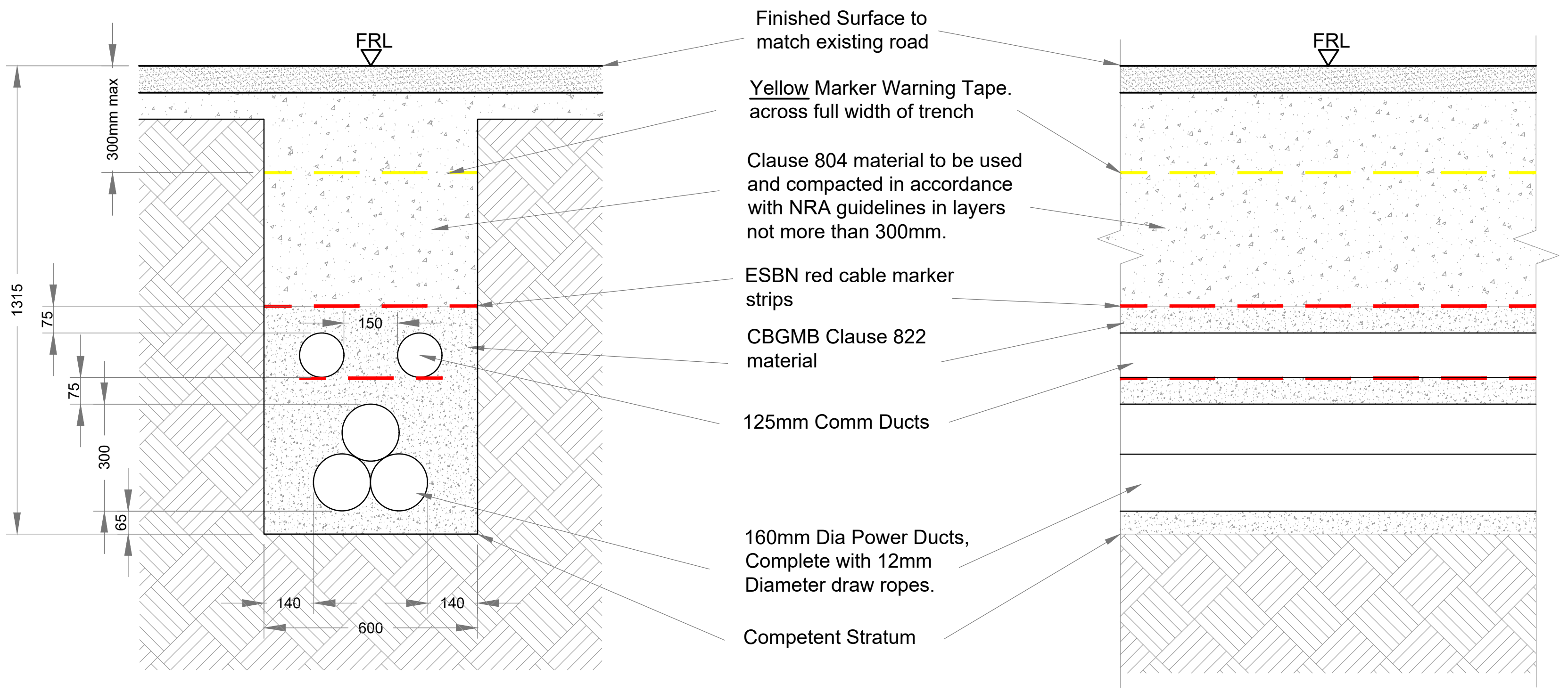
4.3.2.4 Underground Electrical Cabling

It is proposed to construct an underground cabling connection between the proposed permanent 110kV substation and the existing 110kV Ikerrin to Thurles overhead line (OHL). The grid connection cabling route will be c.2km in length running through a mix of local road (L7039) and new access track across agricultural land. This underground cabling route crosses 2 no. watercourses, one within the L7039 which will be crossed via a Directional Drilling method and the second crossing will be crossed within agricultural land via a clear span culvert i.e., no instream works are proposed (see section 4.9.1.4 and 4.9.2.6.2 below). Four joint bays (section 4.9.2.5 below) are required along the route. The existing OHL will be broken with 2 no. new end masts (lattice-type towers) to facilitate the connection to the proposed onsite substation via the underground electricity cabling. The underground cabling route includes two parallel cable trenches, and once constructed, electricity on the Ikerrin-Thurles 110kV OHL will be transmitted through the proposed substation, hence the ‘loop-in/loop-out’ nature of the proposed substation.

The methodology for construction of the Proposed Grid Connection underground electrical cabling is presented in Section 4.9.2 below. The underground electrical cabling route is illustrated in Figure 4-2 and 4-3. The 110kV grid connection cabling trench cross sections are shown in Figure 4-29.



Standard 110kV Trench Detail

SCALE 1:20

PROJECT TITLE: Borrisbeg Renewable Energy Development			
DRAWING TITLE: 110kV Trench Detail			
PROJECT No.: 220310		DRAWING No.: Figure 4-29	SCALE: 1:20 @ A3
DRAWN BY: GO	CHECKED BY: N/A	DATE: 05.12.2023	REVISION.: P01

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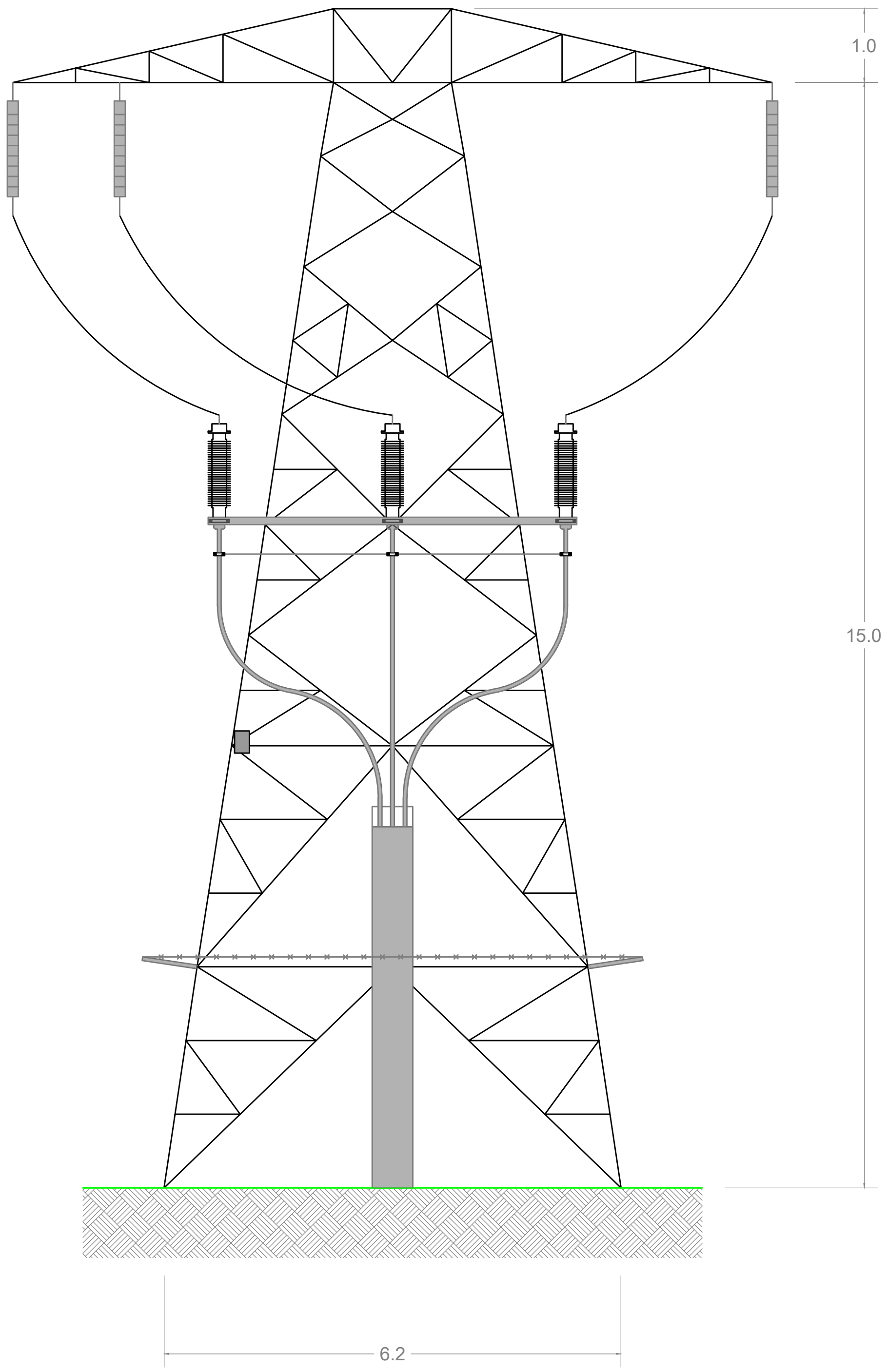
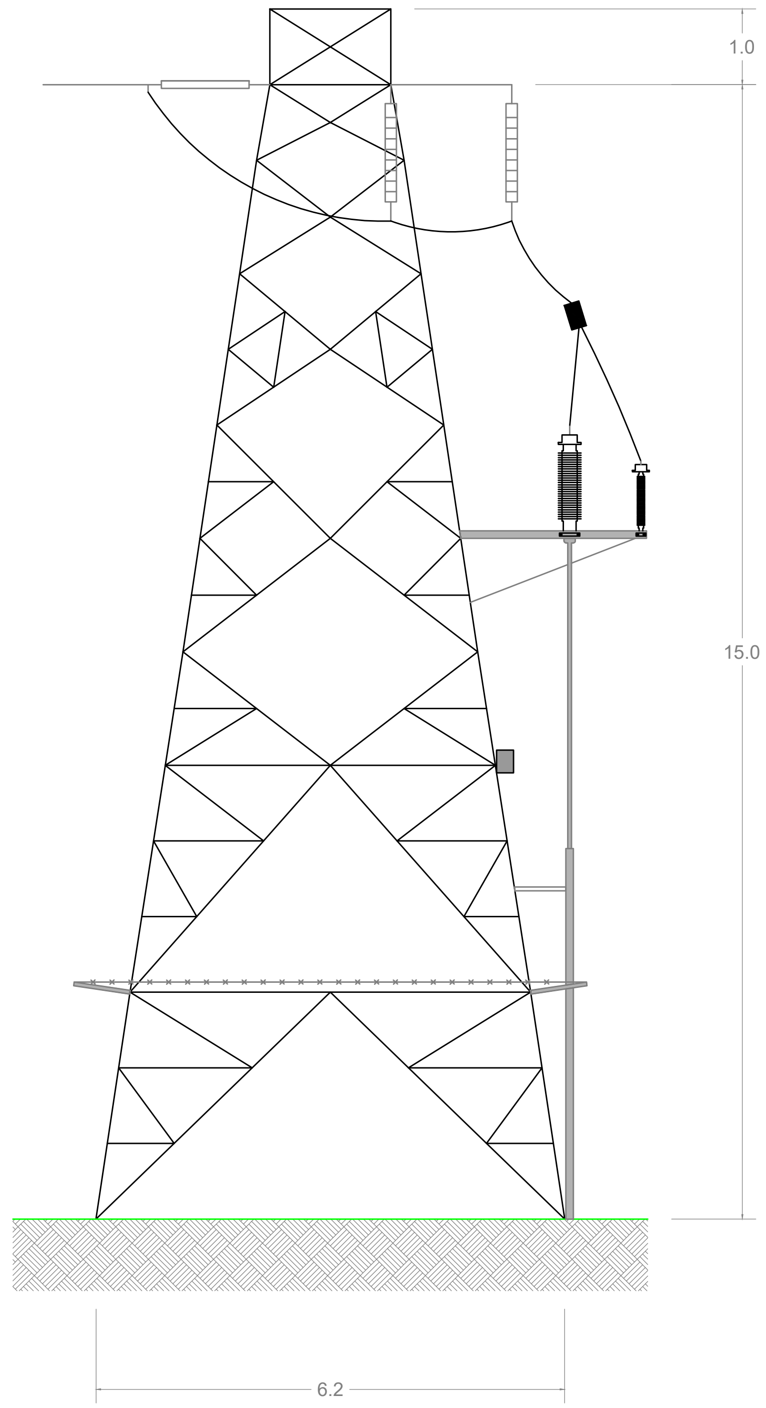
4.3.2.5 End Masts

It is proposed to connect the on-site 110kV substation to the existing 110kV Ikerrin to Thurles overhead line (OHL). Two proposed end masts (lattice type towers) will be located immediately beneath the existing OHL. Please see Figure 4-2 for location details and Appendix 4-5. The existing OHL conductor will be terminated at these masts to facilitate a new OHL loop connection following the proposed c.2km underground grid connection route leading to the on-site 110kV substation. Please see section 4.9.2.3 for the construction methodology for the new loop in tower structures. Please see Figure 4-30 for details.



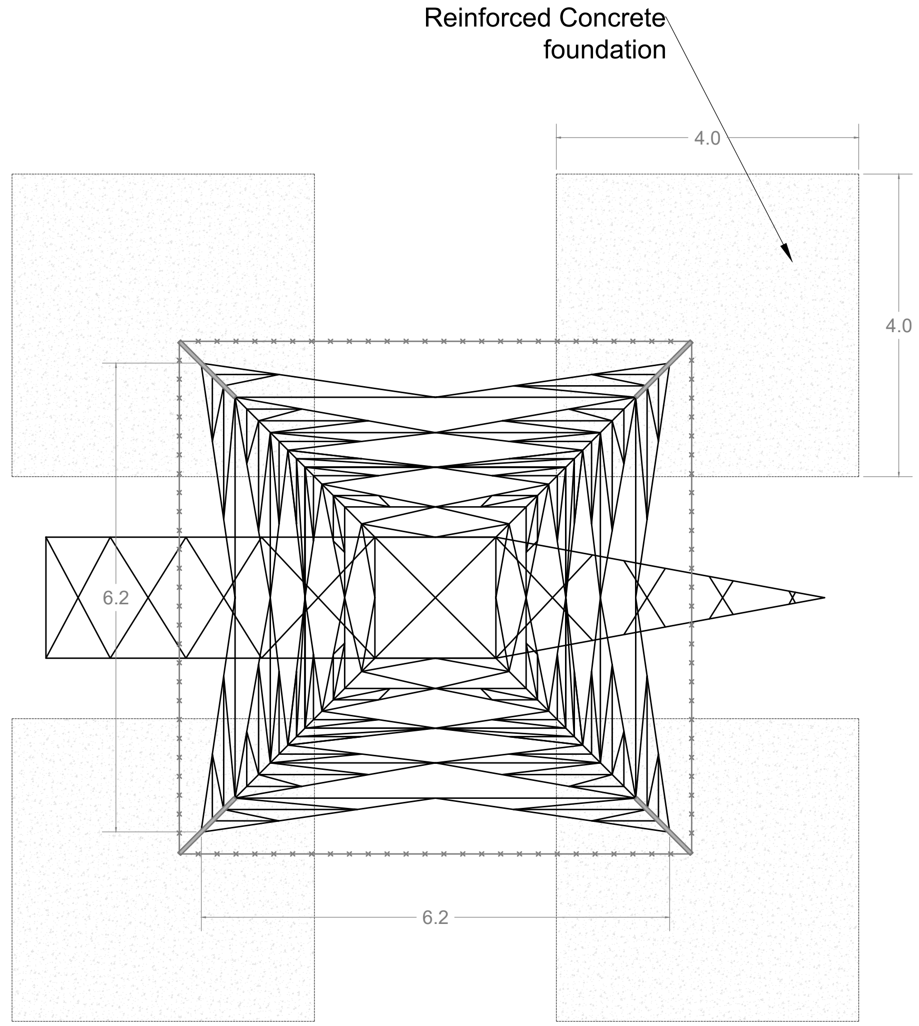
Standard 110kV End Mast - Elevation

Scale 1:100



Standard 110kV End Mast - End View

Scale 1:100



Standard 110kV End Mast - Plan

Scale 1:100

PROJECT TITLE: **Borrisbeg Renewable Energy Development**

DRAWING TITLE: **110kV End Mast**

PROJECT No.:	DRAWING No.:	SCALE:
220310	Figure 4-30	1:100 @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
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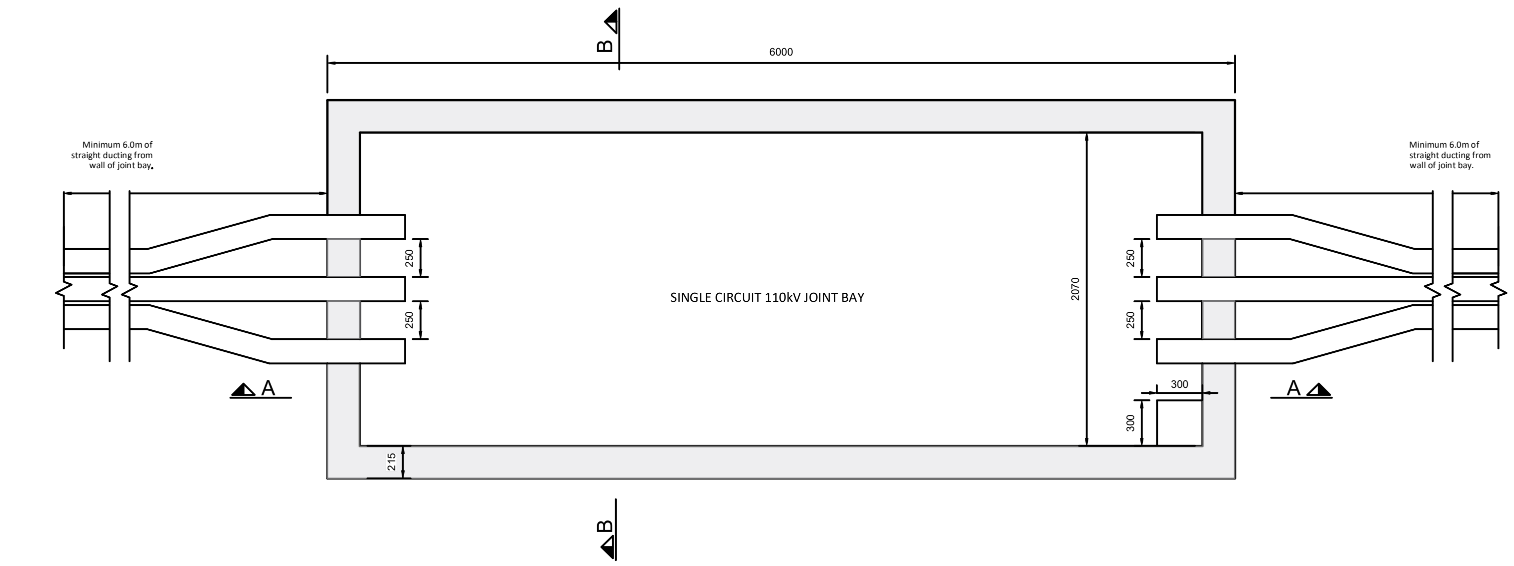
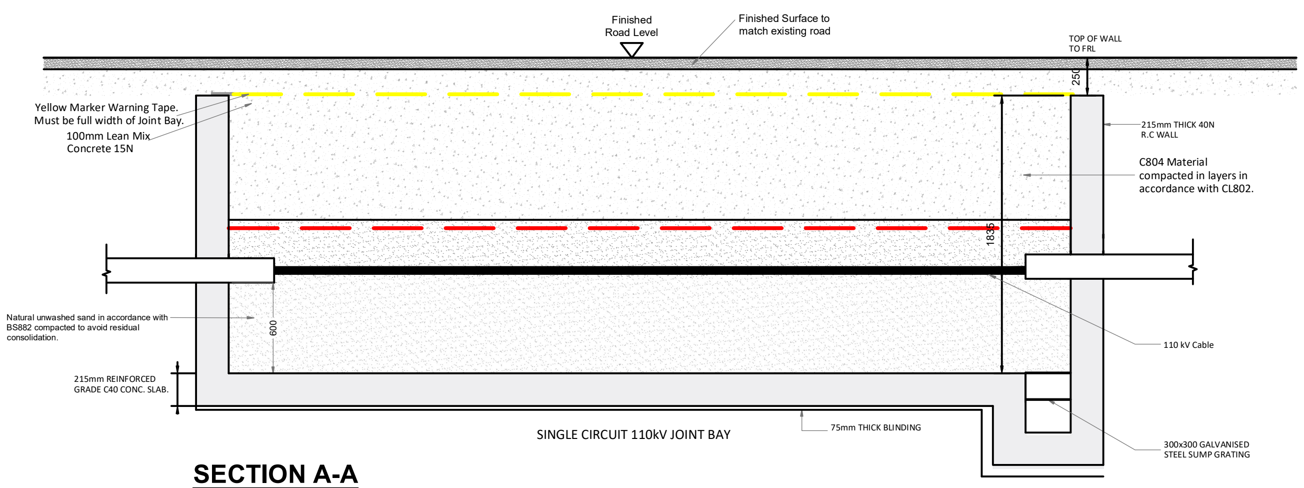
4.3.2.6 Joint Bays

Four joint bays, in groups of two are proposed along the proposed underground grid connection cable route, approximately 1000 metres apart or as otherwise required by ESB/Eirgrid and electrical requirements. Two joint bays are proposed to be located in a new track adjacent to the L7039-1 third class road northeast of the proposed 110kV substation. The two remaining joint bays are proposed to be located in a new track in an agricultural field. Therefore, public access/traffic will not be impacted during the placement or maintenance of the proposed joint bays. Please see Figure 4-31 for details and section 4.9.2.5 for construction methodology.



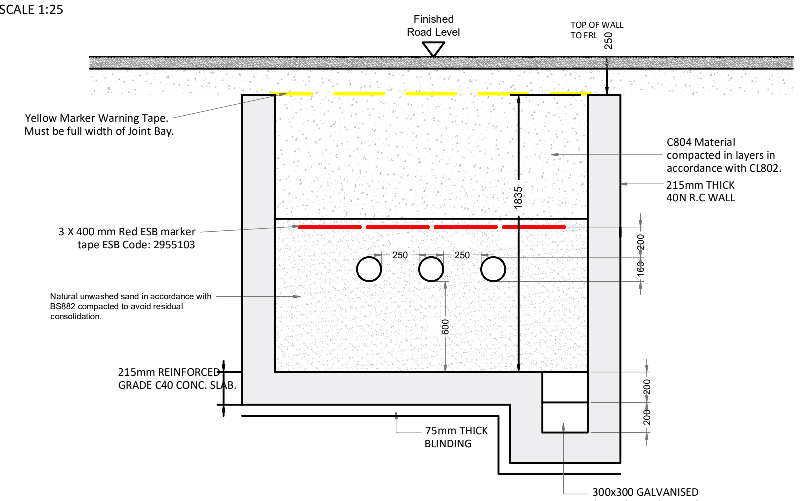
110kV JOINT BAY DETAIL

SCALE 1:25



SECTION A-A

SCALE 1:25



SECTION B-B

SCALE 1:25

PROJECT TITLE:
Borrisbeg Renewable Energy Development

DRAWING TITLE:
110kV Joint Bay Detail

PROJECT No.:	DRAWING No.:	SCALE:
220310	Figure 4-31	As shown @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
GO	N/A	05.12.2023	P01

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4.3.2.7 Watercourse Crossings

There are two identified watercourse crossings along the proposed Grid Connection underground electrical cabling route, both of which are referenced on EPA/OSI mapping. The construction methodology for the 2 no. EPA/OSI mapped crossings has been designed to eliminate the requirement for in-stream works on these locations requiring a crossing to be constructed to traverse the watercourse with the cabling ducts. A general description of the various construction methods employed at watercourse crossings are described in section 4.9.1.3 below. An illustration of the proposed crossing methodology at the two locations is included in Grid Connection Infrastructure drawings in Appendix 4-5.

4.3.2.7.1 *Watercourse Crossing No 1-Directional Drilling*

At grid route watercourse crossing no. 1 located in the L7039 road, it is proposed to cross the Clonmore watercourse via the Directional Drilling (DD) method. This method comprises this drilling under obstacles such as bridges, culverts, railways, water courses, etc. to install cable ducts under the obstacle. The DD method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, for the directional drilling at watercourse/culvert crossings. The launch and reception pits will be approximately 0.55m wide, 2.5m long and 1.5m deep. The pits will be excavated with a suitably sized excavator. Please see section 4.9.1.4 and 4.9.2.6.2 for the construction methodology. The directional drilling method is illustrated on Figure 4-40.

4.3.2.7.2 *Watercourse Crossing 2- Clear Span Watercourse Crossing*

At watercourse crossing no. 2 located in agricultural land at the Strogue watercourse, it is proposed to construct a clear-span watercourse crossing. This watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material. Confirmatory inspections of the proposed new watercourse crossing locations will be carried out by the Project Civil/Structural Engineer and the Project Hydrologist prior to the construction of the crossing. Please see section 4.9.1.3 and section 4.9.2.6.1 for further details and Figure 4-41 for an illustration.

4.3.2.7.3 *Culvert Crossings*

All new proposed culverts and proposed culvert upgrades at field drain crossings required for the Proposed Grid Connection will be suitably sized for the expected peak flows in the watercourse. Culverts will be installed constructed as per the methodology detailed in section 4.9.1.5 and 4.9.2.7. All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance. Please see Figure 4-43 for details.

4.3.2.8 Sand and Stone Requirements

The volumes of granular fill (sand and stone) required for the construction of the Proposed Grid Connection will be locally sourced from licenced quarries. Please see Table 4-4 for required volumes and Figure 4-20 which illustrates licenced quarries within 20km range of the Site that could potentially provide stone and concrete. Traffic movements generated by the Proposed Project are discussed in in Section 15.2 of Chapter 15, Material Assets. Sand and Stone volumes have been estimated using the following methodology:

- The soil beneath the substation, temporary construction compound and end masts will be excavated and replaced with construction grade granular fill up to the existing ground level.

- Roads will generally comprise approximately 500-600mm of granular fill (constructed in layers and finished with a capping layer). Geotextiles separators will be placed on the subgrade and geogrids will be installed within the road build-up, as required by the site engineer.

Table 4-4 Stone and Granular Fill requirements for the Proposed Grid Connection

Project Component	Area (m^2) (approx.)	Stone Fill Required (m^3)
Permanent 110kV Substation	12,782	7,770
Temporary substation construction compound	2,539	1,523
Access Roads- reinstatement of L-7039 and new road in agricultural lands, cable route and 2 no. end masts	8,500	4,857
Total Approx (m^3) (including 12.5% contingency factor)		16,000

4.3.2.9 Spoil Management Plan

4.3.2.9.1 *Quantities*

The approximate quantity of spoil requiring management for the Proposed Grid Connection is presented in Table 4-5 below.

Table 4-5 Approximate Spoil Volumes Requiring Management

Development Component	Spoil Volume(m3) (approx.)
Permanent 110kV Substation and temporary construction compound	13,500
Grid Connection cabling Route and 2 no. end masts	3,600
Total Spoil to be managed m^3 (including 10% contingency factor)	18,810

Note: A contingency factor of 10% has been applied and is included to the excavated spoil volumes above to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.

4.3.2.9.2 *Spoil Management Areas*

The spoil volume requiring management for the Proposed Grid Connection will be managed within the Site in the areas illustrated on Figure 4-21 and in alongside new access roads (outside the modelled flood zones). Refer to section 4.3.1.13 above for recommendations and best practice measures for the placement of spoil withing the Site. Some of the Grid Connection underground electrical cabling route materials will go to an appropriate licenced facility as required. This is dependent on the road makeup at locations along the underground electrical cabling route.

4.4 Site Activities

4.4.1 Environmental Management

All proposed activities on the Site will be provided for in a Construction and Environmental Management Plan (CEMP). A CEMP has been prepared for the Proposed Project and is included in Appendix 4-3 of this EIAR. The CEMP sets out the key environmental considerations to be considered by the contractor during construction of the Proposed Project. The CEMP includes details of drainage, spoil management and waste management, and details the mitigation and monitoring 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. In the event planning permission is granted for the Proposed Project, the CEMP will be updated prior to the commencement of the development, to address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned and will be submitted to the Planning Authority for approval.

4.4.2 Refuelling

Wherever possible, vehicles will be refuelled off-site, particularly for regular road-going vehicles. On-site refuelling of machinery will be carried out at designated refuelling areas at various locations throughout the Site. Heavy plant and machinery will be refuelled on-site by a fuel truck that will come to the Site as required on a scheduled and organised basis. Other refuelling will be carried out using mobile double skinned fuel bowser. The fuel bowser will be parked on a level area on-site when not in use. All refuelling will be carried out outside designated watercourse buffer zones. Only designated trained and competent operatives will be authorised to refuel plant on-site. Mobile measures such as drip trays and fuel absorbent mats will used during refuelling operations as required. All plant and machinery will be equipped with fuel absorbent material and pads to deal with any event of accidental spillage.

4.4.3 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in concrete delivery trucks. The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching.

Before leaving the Site, washing of the delivery truck will be minimised and restricted to designated wash out areas. Wash out will be restricted to the concrete lorry's chute only. Concrete trucks will be washed out fully at the off-site 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 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 4-5 and 4-6 below.

Plate 4-5 Concrete washout area

Plate 4-6 Concrete Wash Out Area

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

4.4.3.1 Concrete Pouring

Given the scale of the turbine foundation concrete pours the pours will be planned approximately 1 week 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 (including drains and ditches) 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.
- 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 or equivalent.
- Disposing of any potential, small surplus of concrete after completion of a pour in suitable locations away from any watercourse or sensitive habitats.

4.4.4 Dust Suppression

In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the Site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and temporary construction compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, as 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.

4.4.5 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. It is not anticipated that vehicle or wheel washing facilities will be required as part of the construction phase of the Proposed Project as site roads will be formed before 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.

A road sweeper will be available if any section of the public roads requires cleaning due to construction traffic associated with the Proposed Project.

4.4.6 Waste Management

The CEMP, Appendix 4-3 of this EIAR, provides a waste management plan (WMP) which outlines the best practice procedures during the construction phases of the project. The WMP outlines the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of the Proposed Project. Disposal of waste will be seen as a last resort. The WMP was produced in line with the EPA's 2021 document '*Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects' 2021*[4].

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

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

Prior to the commencement of the development, a Construction Waste Manager will be appointed by the Contractor. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary permits/licenses and authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the development adheres to the management plan.

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

4.5 Site Access and Transportation

4.5.1 Site Entrances

The location of construction phase and operational phase Site access points are shown in Figure 4-1 and Figure 4-32. A Traffic Management Plan is included in Chapter 15 and the Appendix 4-3 CEMP of this EIAR. In the event planning permission is granted for the Proposed Project, an updated Traffic Management Plan will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned.

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[4] *EPA 2021 Best practice guidelines for the preparation of resource & waste management plans for construction & demolition projects. Available at: https://www.epa.ie/publications/circular economy/resources/CDWasteGuidelines.pdf*

Temporary Turbine Component Entrance

A temporary entrance will be constructed on the L-3248, adjacent to the N62 in the northwest of the Site. This entrance will facilitate the delivery of the turbine components and will be manned for the duration of the turbine component delivery phase. This new entrance measures approx.. 1,349m^2 and was subject to autotrack assessment to identify the turning area required, as described in Chapter 15, Section 15.2 of the Traffic and Transport Assessment. Appropriate sightlines will be established to the north and south of the proposed turbine component entrance for the safe egress of traffic.

General Construction Entrance

The main construction entrance will be constructed off the L-3248, approximately 70m northeast of the N62. This entrance will be used as the main entrance for construction traffic and staff vehicles. Appropriate sightlines will be established to the north and south of the proposed Site entrance for the safe egress of traffic during the operational phase. An existing farm entrance adjacent to this new entrance will be closed permanently. This new main construction entrance on the L-3248 will continue to provide operational phase access to the Proposed Project and agricultural use access in lieu of the existing field gate being closed permanently. On completion of the construction phase, the Site entrance will be reduced in size and gated for security.

Secondary Site Entrance

A secondary site access will be established to the southeast of the site with the upgrade of the L-70391 Local Road which is within the Site and upgrade of the junction between the L- L-70391 and the 7039. This entrance was subject to autotrack assessment to identify the turning area required, as described in Section 15.2 of the Traffic and Transport Assessment. Appropriate sightlines will be established to the north and south of this entrance for the safe egress of traffic. The proposed works will result in the widening of 460m of the L-70391 road and resurfacing of the of the entire L-70391 (approx. 1.1km total length). This secondary Site entrance will also facilitate the construction of the Proposed Grid Connection, with the proposed substation located immediately adjacent to the L70391 and will provide operational access for maintenance of the Proposed Project and existing public access to lands involved in the Proposed Project.

4.5.2 Turbine Component Transport Route

There are a range of ports within the island of Ireland that have proven capability to accept and store large wind turbine components. These ports include Cork, Foynes, Galway and Dublin ports. Furthermore, subsequent access to the national motorway network during transportation from these ports has been demonstrated. The facilities within the ports and access to and from the ports is continually being upgraded as part of general improvements. It is on this basis that it is not foreseen that this project will require any material change to the port selected should the project be consented and enter into the construction phase.

For the purpose of this EIAR, Dublin Port has been selected and assessed to facilitate turbine delivery to the Site. It is proposed that the large wind turbine components will be delivered from the Dublin Port to the Site via the M7, exiting at Junction 22 onto the N62 heading southwards for approximately 9.4km before reaching the proposed new turbine component entrance at the northwest of the Site. The proposed route is shown on Figure 4-33. All deliveries of turbine components to the Site will follow this route.

A turbine with the maximum blade length of 81.5 metres has been used in assessing the traffic impact of the Proposed Project. The blade transporter for such a turbine blade would have a total vehicle length of 86.9 metres, including the blade which overhangs the back of the vehicle. The total length of the tower transporter is 46.7 metres with the axles located at the front and rear of the load with no overhang.

The vehicles used to transport the nacelles will be similar to the tower transporter. All other vehicles requiring access to the Site will be smaller than the large turbine component transport vehicles. The turbine delivery vehicles have been modelled in the swept path assessments for the Proposed Site, as detailed in Chapter 15: Material Assets of this EIAR.

4.5.2.1 Turbine Delivery Route Accommodation Works

A route assessment was undertaken covering the proposed turbine delivery route, with the route and assessment locations shown in Figure 15-2a of Chapter 15 Material Assets.

Dublin Port is the proposed point of arrival for the large turbine components for the Proposed Project. The port is a well-established point of arrival for wind turbine components of similar scale into the State on a regular basis, as is the road network between the port and the national road network. It is proposed that the abnormal loads will be transported from Dublin Port northwards on the M50 before circulating Dublin. The route then exits the M50 at junction 9 onto the N7. The route then travels southwest on the N7 / M7 to junction 22 located to the south of Roscrea. The extent of the Turbine Delivery Route from Dublin Port is shown in Figure 4-33.

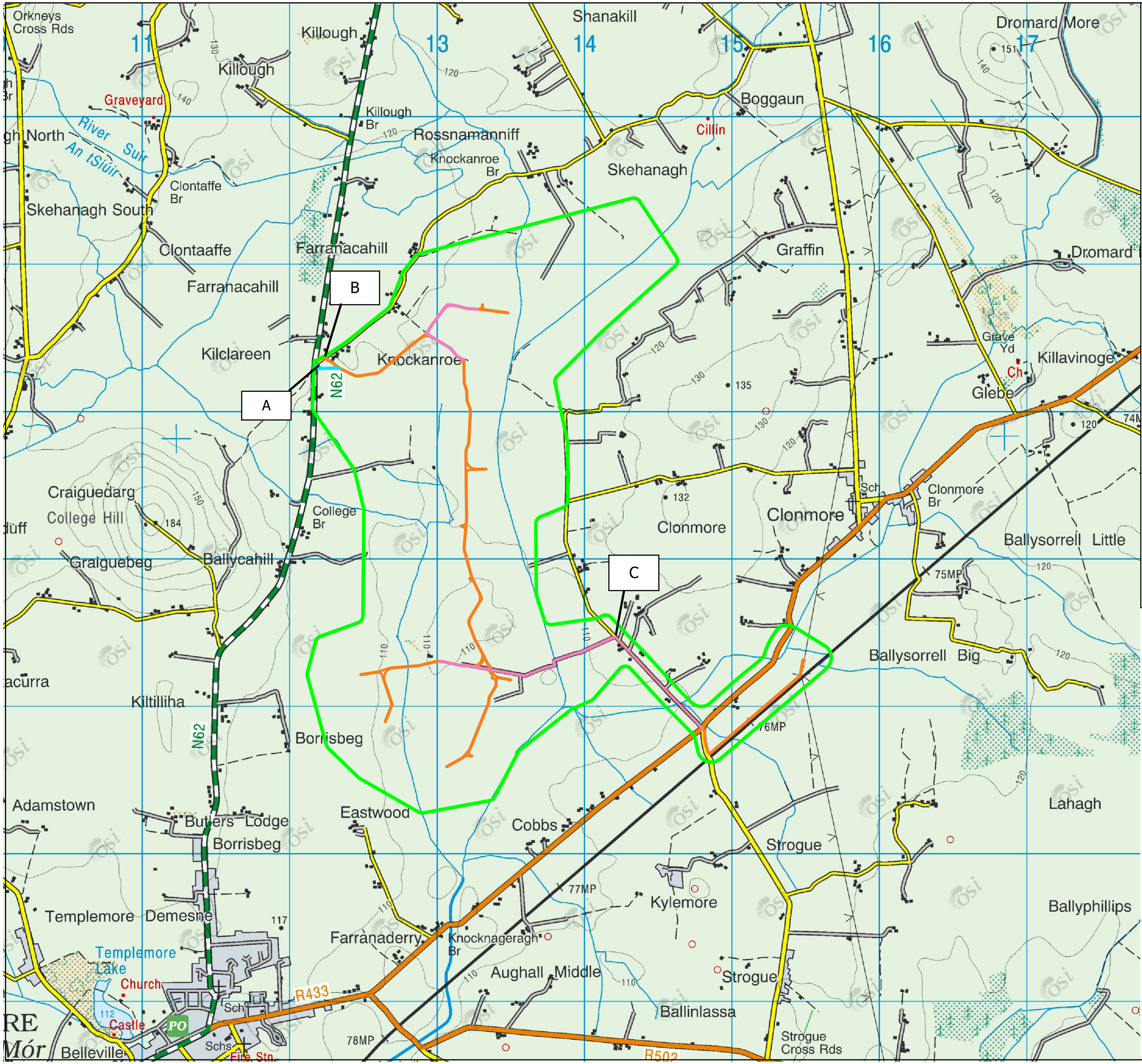
It is noted that a dry run involving a vehicle adapted to replicate the geometry of the extended transport vehicles will be undertaken over the entire turbine delivery route prior to the construction stage of the Proposed Project.

A swept path analysis was undertaken using Autotrack in order to establish the locations where the wind turbine transporter vehicles will be accommodated, and the locations where some form of remedial measure may be required.

To facilitate the transportation of turbine components off the M7 and onto the N62 which runs along the western boundary of the Site, minor accommodating works are required at junction 22 off the M7 which involves the temporary stoning up of the verges. All works are minor, temporary and contained within the road carriage. Once the abnormal loads have been delivered, these areas will be reseeded.

4.5.3 Construction Materials Transport Route

Construction materials will be delivered to the Site via selected haul routes that will be determined based on the source of the construction material. Quarries within a 20km range of the Site that could potentially provide stone and concrete are illustrated on Figure 4-20. Traffic movements generated by the Proposed Project are discussed in Section 15.2 of Chapter 15, Material Assets.



Map Legend

- EIAR Study Boundary
- Temporary Abnormal Entrance
- Proposed New Roads
- Existing Roads

Site Entrances

A- Temporary Turbine Component Entrance
B- General Construction Entrance
C- Secondary Site Entrance

N

Drawing Title: Entrances at the Site	
Project Title: Borrisbeg Renewable Energy Development	
Drawn By: NS	Checked By: KM
Project No.: 220310	Drawing No.: Figure 4-32
Scale: 1:25,000	Date: 2023-11-23

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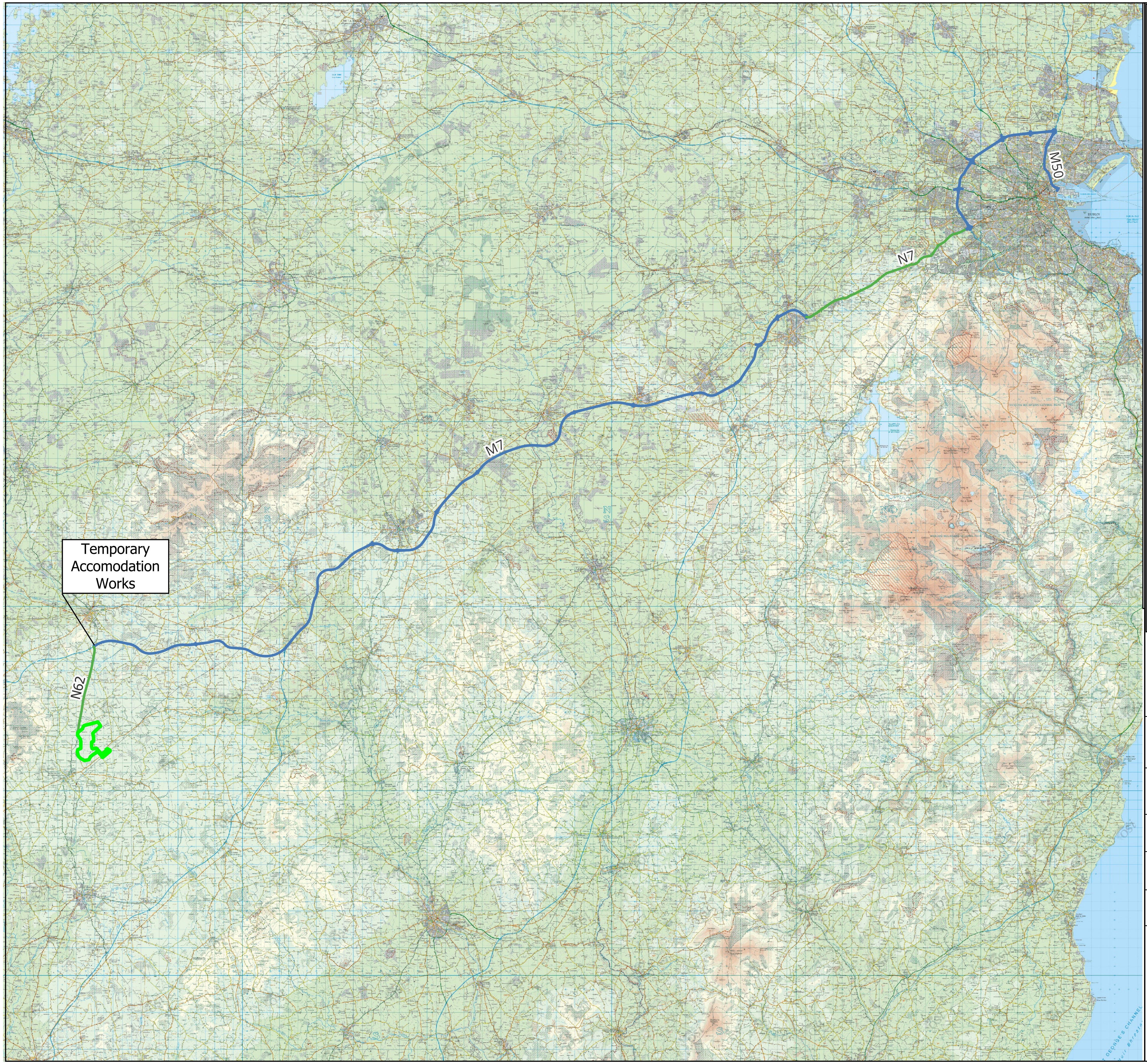

Map Legend

- EIAR Study Boundary
- Motorway
- National Roads

N

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Drawing Title	Turbine Delivery Route
Project Title	Borrisbeg Renewable Energy Development
Drawn By: NS	Checked By: KM
Project No.: 220310	Drawing No.: Figure 4-32
Scale: 1:400,000	Date: 2023-11-23

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4.5.3.1 Traffic Management

The need to transport turbine components on the public roads is not an everyday occurrence in the vicinity of the Site. However, the procedures for transporting abnormal size loads on the country's roads are well established. Escort vehicles, traffic management plans, test runs, road marshals and convoy escorts from the Garda Traffic Corps will be used to transport the components from the delivery port to the Site.

A detailed Traffic Management Plan (TMP) will be provided specifying details relating to traffic management and included in the Construction Environmental Management Plan (CEMP) prior to the commencement of the construction phase of the Proposed Project. The TMP will be agreed with the local authority and An Garda Síochána prior to construction works commencing on-site.

The deliveries of turbine components to the Site will be made in convoys of three to five vehicles 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.

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.

Prior to the construction of the Proposed Project a test 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 test run, the Traffic Management Plan will be reviewed and updated with the haulage company when the final transport arrangements are known, delivery dates confirmed and escort proposals in place. The plan will then be submitted to Tipperary County Council for agreement in writing 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.

4.6 Site Drainage

4.6.1 Introduction

The drainage design for the Proposed Project has been prepared by Hydro Environmental Services Ltd (HES). The drainage design has been prepared based on experience of the project team on other wind farm sites and the 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 important to establish the most appropriate drainage proposals for the Proposed Project.

The drainage design for the Proposed Project has been planned with the intention of having no significant negative impact on the water quality of the Site and its associated rivers, 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 Project is included in Chapter 9: Hydrology and Hydrogeology.

No routes of any natural drainage features will be altered as part of the Proposed Project. Turbine locations and associated new roadways were designed to avoid natural watercourses with existing roads to be used wherever possible. There will be no direct discharges to any natural watercourses or land drains, 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 and drains. Buffer zones of 50m around the existing natural drainage features have been used to inform the layout of the Proposed Project.

4.6.2 Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the Proposed Project. Turbine locations have been selected to avoid natural watercourses. It is proposed that 2 no. new clear span watercourse crossings are required (1 no. for the Proposed Wind Farm and 1 no. for Proposed Grid Connection) while 16 drain crossings will be required or upgraded for the Proposed Project The drains are typically field drains which run along hedgerows and field headlands.

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

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

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

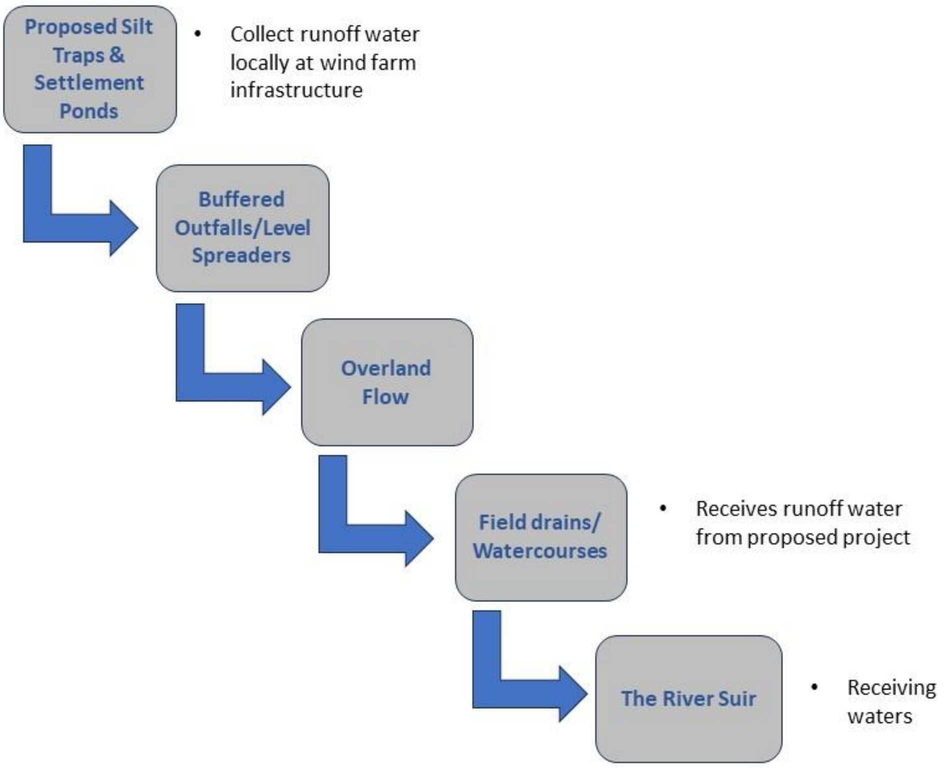
4.6.3 Drainage Design Principles

The key principles of drainage design that will be implemented and adhered to as part of the Proposed Project are as follows:

- Keep clean water clean by intercepting it where possible, upgradient of works areas, and divert it around the works areas for discharge as diffuse overland flow or for rewetting of land.
- Collect potentially silt-laden runoff from works areas via downgradient collector drains and manage via series of avoidance, source, in-line, treatment and outfall controls prior to controlled diffuse release as overland flow or for rewetting of land.
- No direct hydraulic connectivity from construction areas to watercourses or drains connecting to watercourses.
- Where possible, maintain 50-metre watercourse buffer zones for the wind turbines.
- No alteration of natural watercourses.
- Maintain the existing hydrology of the Site.
- Blocking of existing manmade drainage as appropriate.
- Daily inspection and recording of surface water management system by on-site Environmental Clerk of Works and immediate remedial measures to be carried out as required and works temporarily ceased if a retained stormwater/sediment load is identified to have the potential to migrate from the Site.
- Use of siltbuster or equivalent system if required.

Drainage water from any works areas of the 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. A schematic line drawing of the proposed drainage design is presented in Figure 4-34 below.

Figure 4-34 Proposed Project Drainage Process Flow



4.6.4 Drainage Design

A drainage design for the Proposed Project, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 4-1a to this EIAR. The drainage design employs the various measures further described below and is cognisant of the following guidance documents:

- Forestry Commission (2011): Forests and Water UK Forestry Standard Guidelines, Fifth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte Forest (2013): Operations and Water Protection Guidelines;

- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Scottish Natural Heritage, 2019 Good Practice During Wind Farm Construction
- UK Guidance Note 2020 GPP1 - General Guide to Prevention of Pollution (UK Guidance Note);
- UK Guidance Note 2018 GPP5 – Works or Maintenance in or Near Watercourses
- Construction Industry Research and Information Association (CIRIA) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- Construction Industry Research and Information Association (CIRIA) 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

4.6.4.1 Interceptor Drains

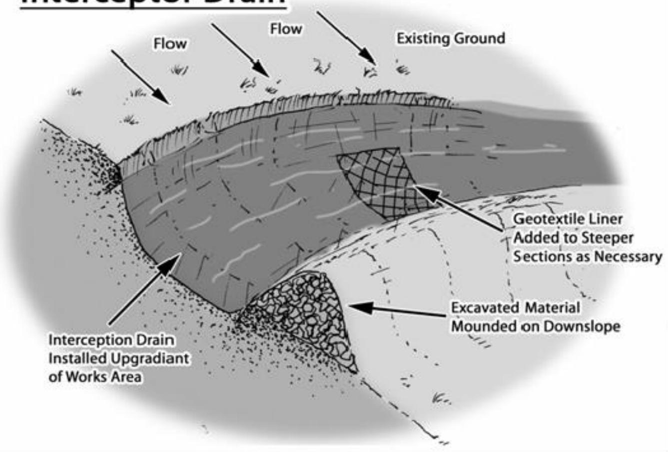
Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the Site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert 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 could be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbines 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 to 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. Figure 4-35 below shows an illustrative drawing of an interceptor drain.

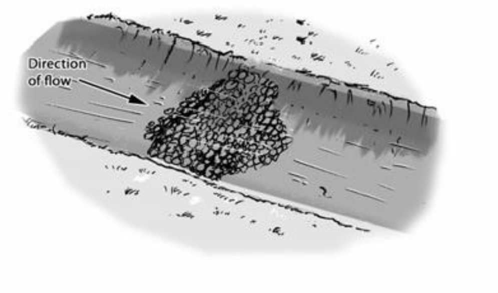
The velocity of flow in the interceptor will be controlled by check dams (discussed further below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel. Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader (discussed below). Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

Drainage Design Measures

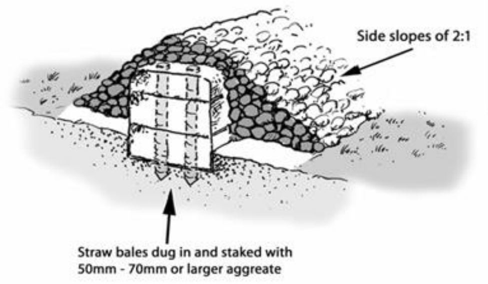
Interceptor Drain



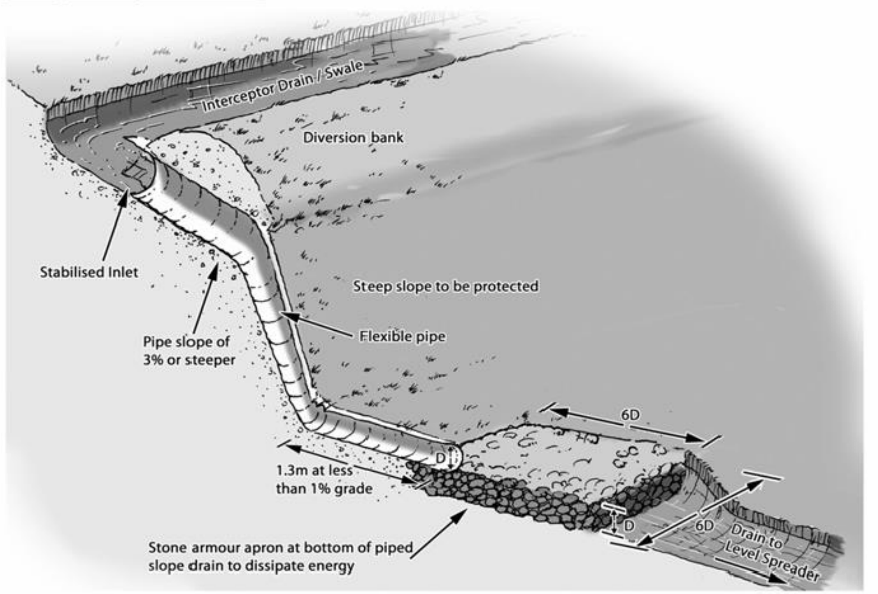
Check Dam (Stone Dam in Drain)



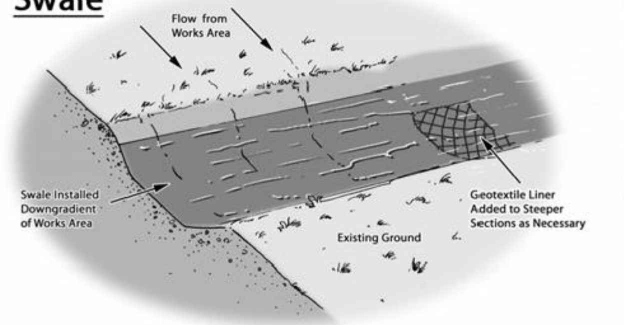
Check Dam
(Straw Bale & Stone Dam - Cross Section)



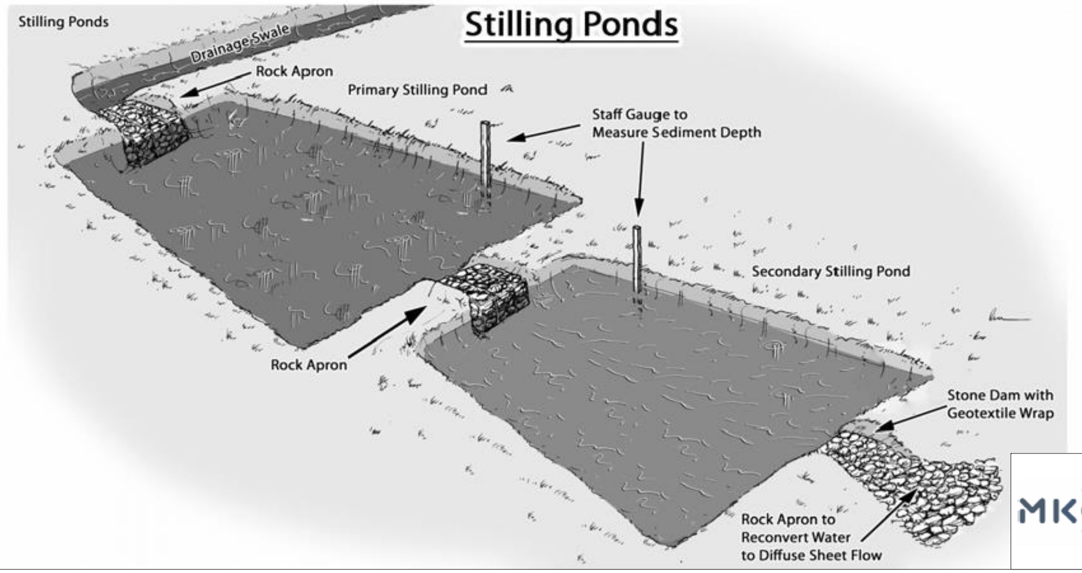
Slope Pipe Drain



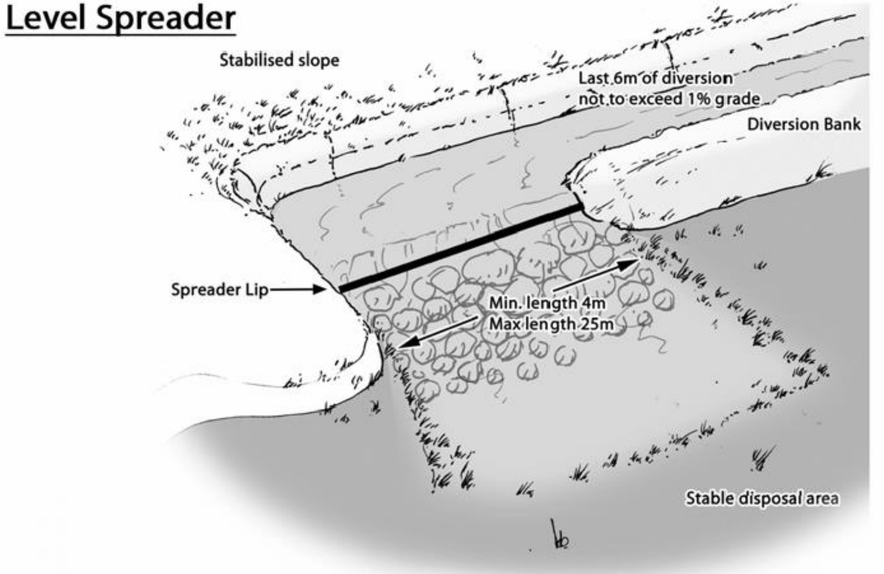
Swale



Stilling Ponds



Level Spreader



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MAP TITLE: **Drainage Design Measure Illustrations**		MAP NO.: **Figure 4-35**	SCALE: **NTS**
PROJECT TITLE: **Borrisbeg Renewable Energy Development**			DATE: **06-11-2023**
DRAWING BY: **Natalia Stolarska**	CHECKED BY: **Karen Mulryan**	ISSUE NO.: **220310**	

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4.6.4.2 Swales

Drainage swales are shallow drains that will be used to intercept and collect run off from construction areas of the Site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the Proposed Project during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above. Figure 4-35 shows an illustrative example of a drainage swale.

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

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

4.6.4.3 Check Dams

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

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

The proposed check dams will be made up of straw bales or stone, or a combination of both depending on the size of the drainage swale it is being installed in. Where straw bales are to be used, they will be secured to the bottom of the drainage swale with stakes. Clean 4–6-inch stone will be built up on either side and over the straw bale to a maximum height of 600mm over the bottom of the interceptor drain. In smaller channels, a stone check dam will be installed and pressed down into place in the bottom of the drainage swale with the bucket of an excavator. Figure 4-35 shows illustrative examples of check dams.

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

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

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

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.

The water carried in interceptor drains will not have come in contact with works areas of the Site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be reconcentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. Figure 4-35, above, shows an illustrative example of a level spreader.

The slope in the channel leading into the spreader will be less than or equal to 1%. The 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 (discussed below) 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 Piped Slope Drains

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

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

The rock apron at the outlet will consist of 6-inch stone to a depth equal to the diameter of the pipe, a length six times the diameter of the pipe. The width of the rock apron will be three times the diameter of the pipe where the pipe opens onto the apron and will fan out to six times the diameter of the pipe over its length. Figure 4-35 above, shows a diagrammatic example of a piped slope drain and rock apron.

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

Piped slope drains will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and blockages. Stake anchors or fill over the pipe will be checked for settlement, cracking, and stability. Any seepage holes where pipe emerges from the drain at the top of the pipe will be repaired promptly.

4.6.4.6 Vegetation Filters

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

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

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

4.6.4.7 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 handle runoff from roads and hardstanding areas of the Proposed Project 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. Figure 4-35, above, shows an illustrative example of a stilling pond system.

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.

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.

4.6.4.8 Siltbuster

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

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

The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile. Figure 4-36 shows an illustrative diagram of the Siltbuster.

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

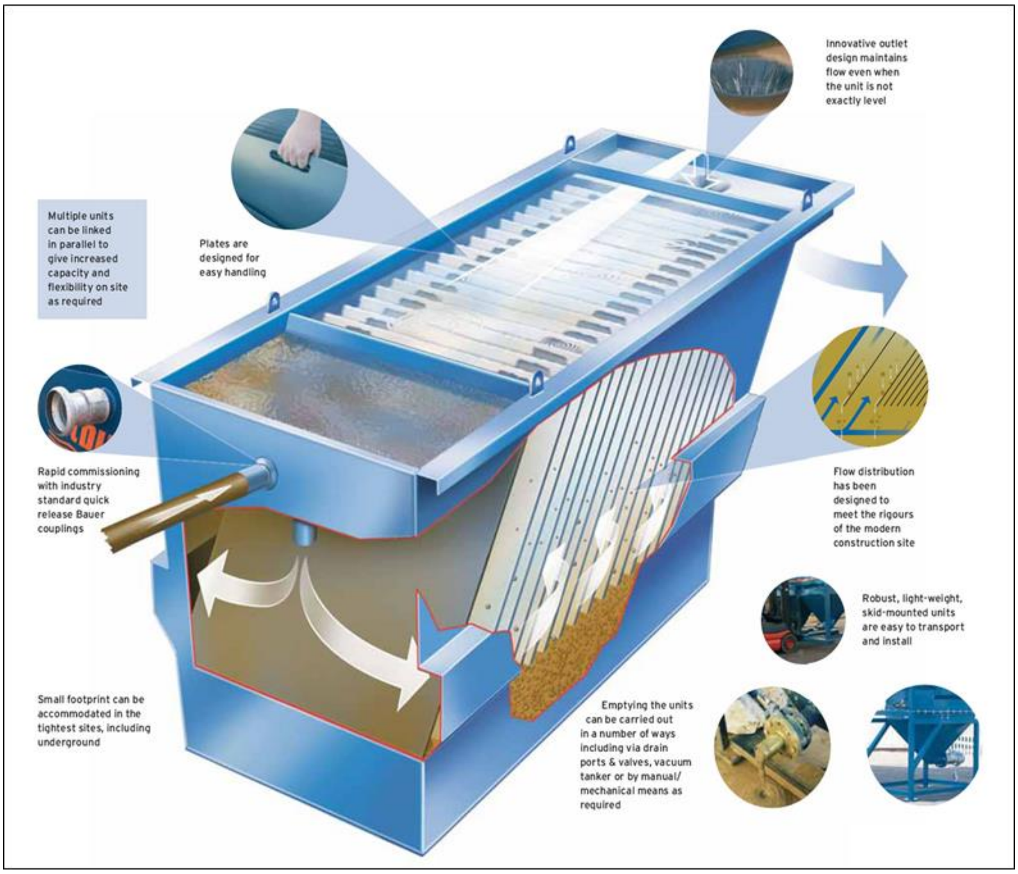


Figure 4-36 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

4.6.4.9 Silt Bags

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

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

The dewatering silt bag that will be used will be approximately 3 metres in width by 4.5 metres (see Plate 4-7 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. Silt Bag with water being pumped through.

Plate 4-7 Silt Bag with water being pumped through.

4.6.4.10 Sedimats

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

4.6.4.11 Culverts

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

Some culverts may be installed to manage drainage waters from works areas of the Proposed Project, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

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

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

4.6.4.12 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone of a stream, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the Proposed Project. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the drainage design drawings included in Appendix 4-1a.

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

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

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

4.6.4.13 Tree Felling Drainage

Tree felling will be required within and around Proposed Project footprint to allow for the construction of the proposed turbines, access roads, underground cabling, and the other ancillary infrastructure. The felling will not be undertaken simultaneously with construction groundworks. Keyhole felling to facilitate construction works will take place prior to groundworks commencing.

During tree felling there is a potential to generate silts and sediments in surface water runoff due to tracking of machinery and disturbance of the ground surface etc, however mitigation is provided in Chapter 9 Hydrology and Hydrogeology with regard surface water quality protection for this activity which is summarised below. Also, prior to the commencement of tree felling for subsequent road construction the following key temporary drainage measures will be installed:

- All existing dry forestry drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using forestry check dams/silt traps;
- Clean water diversion drains will be installed upgradient of the works areas;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing forestry drains that have surface water flows and also along existing forestry roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone.

To protect watercourses, the following measures will be adhered to during all keyhole/tree felling activities.

- All relevant measures, best practice methods and requirements set out in Chapter 9 of the EIAR will be adhered to including Forestry & Water Quality Guidelines, Forest Harvesting & the Environment Guidelines and the Forest Protection Guidelines.
- The extent of all necessary tree felling will be identified and demarcated with markings on the ground in advance of any felling commencing.
- All roads and culverts will be inspected prior to any machinery being brought on Site to commence the felling operation. No tracking of vehicles through watercourses will occur. Vehicles will only use existing road infrastructure and established watercourse crossings.
- Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt traps will be constructed to ensure collection of all silt within felling areas. These temporary silt traps will be cleaned out and backfilled once felling works are complete. This ensures there is no residual collected silt remaining in blocked drains after felling works are completed. No direct discharge of such drains to watercourses will occur from within felling areas.
- New collector drains and sediment traps will be installed during ground preparation to intercept water upgradient of felling areas and divert it away. Collector drains will be excavated at an acute angle to the contour (0.3%-3% gradient), to minimise flow velocities.
- All silt traps will be sited outside of buffer zones and have no direct outflow into the aquatic zone. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of away from all aquatic zones.
- All new collector drains will taper out before entering the aquatic buffer zone to ensures the discharging water gently fans out over the buffer zone before entering the aquatic zone.
- Machine combinations, such as mechanical harvesters or chainsaw felling will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance.
- Mechanised operations will be suspended during and immediately after heavy rainfall.
- Where brash is required to form brash mats, it is to be laid out at harvesting stage to prevent soil disturbance by machine movement.
- Brash which has not been pushed into the soil may be moved within the Site to facilitate the creation of mats in more demanding locations.
- Felling of trees will be pointed directionally away from watercourses.
- Felling will be planned to minimise the number of machine passes in any one area.
- Extraction routes, and hence brash mats, will be aligned parallel to the ground contours where possible.
- Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone. Straw bales and check dams to be emplaced on the down gradient side of timber storage sites.
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but removing of natural debris deflectors will be avoided.

4.6.5 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 Project, would be transported to one of the on-site designated spoil management areas or used for landscaping and reinstatement of other areas elsewhere on-site.

4.6.6 Site Drainage Management

4.6.6.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures detailed above, will be brought on-site in phases as they are required during the construction phase. A sufficient number of straw bales, clean drainage stone, terram, stakes, etc. will be kept on-site at all times to implement the drainage design measures as necessary. The drainage measures detailed in the above will be installed prior to, or at the same time as the works they are intended to drain.

4.6.6.2 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the Proposed Project will also take account of weather forecasts, and predicted rainfall. 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.

4.6.6.3 Reactive Site Drainage Management

The final drainage design prepared for the Proposed Project prior to commencement of construction will 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 (ECoW) or supervising hydrologist on-site. The ECoW 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 ECoW 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.

4.6.7 Drainage Maintenance

An inspection and maintenance plan for the drainage system on-site will be prepared in advance of commencement of any works on the Proposed Project. 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 ECoW or the Project Hydrologist. The drainage inspection and maintenance plan are 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 Proposed 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 Proposed 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.

Silt traps will be inspected weekly during the construction phase of the Proposed 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 Proposed Project. The Project Hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system.

4.7 Community Gain Proposal

4.7.1 Background

The Proposed Wind Farm has the potential to have significant benefits for the local economy, by means of job creation, landowner payments and commercial rate payments. An important part of a renewable energy development, which Buirios Ltd has been at the forefront of developing, is its Community Benefit Package. The concept of directing benefits from wind farms to the local community is promoted by the National Economic and Social Council (NESC) and the Wind Energy Ireland (WEI) among others. While it may be simpler and easier to put a total fund aside for a wider community area, Buirios Ltd. is endeavouring to develop new ways to direct increased gain towards the local community with particular focus on those living closest to the Proposed Wind Farm.

The applicant company has given careful consideration to the issue of community gain arising from the Proposed Wind Farm, if permitted and constructed. Community gain from significant development proposals, including wind farms, whilst a relatively recent approach, is now a common consideration for developers and, indeed, planning authorities. This approach recognises that, with any significant wind farm proposal, the locality in which the Proposed Wind Farm is situated is making a significant contribution towards helping achieve national renewable energy and climate change targets, and the local community should derive some benefit from accommodating such a development in their locality.

Community gain proposals can take a number of forms, generally depending on the nature and location of the Proposed Wind Farm and the nature and make-up of the local community. The nature of the community gain proposal will be subject to discussions with and input from the local community. In some instances, funds are paid by the developer, either annually or as a one-off payment, to a community fund that is administered as agreed by the community. These funds may then be used for a variety of projects, such as environmental improvements, local amenities and facilities, voluntary and sporting groups and clubs, educational projects and energy efficiency improvement works. Likewise, based on the Renewable Energy Support Scheme (discussed below) direct payments could be made to households within a certain catchment e.g. €1,000 annual payment to households within 1km of the proposed turbines.

4.7.2 Renewable Energy Support Scheme

The Renewable Electricity Support Scheme (RESS) is a Government of Ireland initiative that provides support to renewable electricity projects in Ireland. RESS is a pivotal component of the Programme for Government and the Climate Action Plan 2021 and 2023 and is a major step in achieving Ireland's target of at least 80% renewable electricity by 2030. One of the key objectives of RESS is to provide an Enabling Framework for Community Participation through the provision of pathways and supports for communities to participate in renewable energy projects.

RESS 1 was the first Renewable Electricity Support Scheme run by the Government of Ireland and concluded in 2020. RESS 2 was run in 2022 and concluded in June 2022. The successful projects in RESS 2 represent a potential increase of nearly 20% in Ireland's current renewable energy generation capacity. They will be delivered between 2023 and 2025. A public consultation was opened in 2022 to refine the Terms and Conditions developed for RESS 2 with a limited and specific set of changes for RESS 3. This consultation closed in December 2022. The RESS 3 auction concluded in September 2023. Of 31 projects that submitted a valid offer, 23 were provisionally successful.

Each of the RESS processes outline a set of requirements relating to the distribution of funds, including community benefit funds. If the proposed development utilises the RESS model, then any community benefit stipulations outlined in the finalised RESS model will have to be incorporated into the operation of the wind farm and will be of enduring benefit to the local community. The Programme for Government commits to holding RESS auctions at frequent intervals throughout the lifetime of the scheme. The RESS Terms and Conditions, published by the Department of Communications, Climate Action and Environment make some high-level provisions for how this type of benefit fund will work. Any project which wants to export electricity to the national grid must abide by these broad principles. These include the following:

1. *a minimum of €1,000 shall be paid to each household located within a distance of a 1 kilometre radius from the Project;*
2. *in respect of Onshore Wind RESS 2 Projects, a minimum of €1,000 shall be paid to each household located within a distance of a 1 kilometre radius from the Onshore Wind RESS3Project. The 1 kilometre distance specified is measured from the base of the nearest turbine of the RESS 3 Project to the nearest part of the structure of the household, the location of which is identified in the An Post's GeoDirectory;*
3. *a minimum of 40% of the funds shall be paid to not-for-profit community enterprises whose primary focus or aim is the promotion of initiatives towards the delivery of the UN Sustainable Development Goals, in particular Goals 4, 7, 11 and 13, including education, energy efficiency, sustainable energy and climate action initiatives;*
4. *a maximum of 10% of the funds may be spent on administration. This is to ensure successful outcomes and good governance of the Community Benefit Fund. The Generator may supplement this spend on administration from its own funds should it be deemed necessary to do so; and*
5. *The balance of the funds shall be spent on: (i) initiatives successful in the annual application process, as proposed by clubs and societies and similar not-for-profit entities; and (ii) in respect of Onshore Wind RESS 3 Projects, on "near neighbour payments" for households located outside a distance of 1 kilometre from the RESS 3 Project but within a distance of 2 kilometres from such RESS 3 Project. The distance specified is from the base of the nearest turbine to the nearest part of the structure of the occupied residence, the location of which is identified in the An Post's GeoDirectory.*

4.7.3 Community Benefit Fund

Based on the current RESS guidelines it is expected that for each megawatt hour (MWh) of electricity produced by the wind farm, the Proposed Wind Farm will contribute €2 into a community fund for the first 15 years of operation of the Wind Farm. If this commitment is changed in upcoming Government Policy, the fund would be adjusted accordingly.

The Community Benefit Fund belongs to the local community. The premise of the fund is that it should be used to bring about significant, positive change in the local area. To make this happen, the first task will be to form a benefit fund development working group that clearly represents both the close neighbours to the project as well as nearby communities. This group will then work on designing the governance and structure of a community entity that would administer the Community Benefit Fund.

The types of projects and initiatives that could be supported by such a Community Benefit Fund could include youth, sport and community facilities, schools, educational and training initiatives, and wider amenity, heritage, and environmental projects.

Should the Proposed Project be developed under the current RESS T&C's, it would attract a community contribution in the region of almost €400,000/year for the local community (estimated based on an average energy yield). The value of this fund would be directly proportional to the electricity generated by the wind farm. Under the current RESS T&Cs, the following is the recommended breakdown of the fund:

- **Direct payments** – to those living closest to the Proposed Wind Farm. A minimum €1,000 payment per annum for houses within 1km of the Proposed Project.
- **Support for local groups** – A minimum of 40% per year would be available for local groups, clubs and not for profit organisations that provide services in the local area. This would include services for the elderly, local community buildings, and the development of sporting facilities such as all-weather playing pitches etc.
- **Administration costs** – a maximum of 10% per year will be made available for the administration and governance costs of the fund.
- **Energy Efficiency** – The remaining balance of this community benefit fund would be available for the development of energy initiatives to benefit people living in the local area. This is to be provided to not-for-profit community enterprises each year.

Should the Proposed Project not be developed under RESS, the Applicant is committing that for each megawatt hour (MWh) of electricity produced by the wind farm, the project will contribute €1 into a community fund for the entire operational life of the Proposed Project. This would equate to an estimated annual fund of almost €200,000 (using the same formula as above), which across the 30-year operational lifespan would result in funding in the order of €6 million to the local community which is a substantial contribution. The number and size of grant allocations will be decided by a Community Fund liaison committee with various groups and projects benefiting to varying degrees depending on their funding requirement. Please see Appendix 2-3 Borrisbeg Renewable Energy Development Community Report for details.

4.8 Construction Management

4.8.1 Construction Timing

It is estimated that the construction phase of the Proposed Project will take approximately 18-24 months from commencement of civil works to the commissioning of the wind turbines. The commencement of works where the removal of vegetation is required, or where works take place in sensitive breeding habitats will be scheduled to occur outside the bird breeding season (1st of March to 31st of August) to avoid any potentially significant effects on nesting birds. Construction may commence from September to March so that construction activities are ongoing by the time the next bird breeding season comes around and can continue throughout that bird breeding season.

Construction activities will be carried out during normal daytime working hours (i.e., 0700 – 1900hrs Monday to Saturday). However, to ensure that optimal use is made of good weather period or at critical periods within the programme (i.e., concrete pours) or to accommodate delivery of large turbine components along public routes it could be necessary on occasion to work outside of these hours. Any such out of hours working will be agreed in advance with the Local Authority.

4.8.2 Construction Sequencing

The construction phase can be broken down into three main overlapping phases and will take approximately 18-24 months to complete 1) civil engineering works - 10 months, 2) electrical works including grid connection works - 9-12 months, and 3) turbine erection and commissioning - 8 months. The main task items under each of the three phases are outlined below.

Civil Engineering Works

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

Electrical Works

- Upgrade existing site entrances
- Construct new Site roads to temporary compound.
- Clear and hardcore area for temporary Site offices. Install same
- Clear and Hardcore area for substation footprint
- Construct bases/plinths for substation building.
- Install external electrical equipment at substation.
- Install transformer at compound.
- Erect stock proof and palisade fencing around substation area.
- Install internal collector network and communication cabling.
- Construct grid connection cabling.

Turbine and Meteorological Mast Erection

- Commission erection crane(s) and deliver components to turbine hardstands.
- Erect towers, nacelles and blades.
- Complete electrical installation.
- Grid connection.
- Install meteorological mast.
- Commission and test turbines.
- Complete Site works, reinstate Site.
- Remove temporary Site offices. Provide any gates, landscaping, signs etc. which may be required.

The phasing and scheduling of the main construction task items are outlined in Table 4-6 below, where the 1st of January has been selected as an arbitrary start date for construction activities.

Table 4-6 Indicative Construction Schedule

			Year 1				Year 2			
ID	**Task Name**	**Task Description**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
1	Site Health and Safty									
2	Grid Connection	Construct grid connection to Athlone 110kV substation								
3	Site Compounds	Site Compounds, site access, fencing, gates								
4	Site Roads	Construction/upgrade of roads, construct underpasses install drainage measures, install water protection measures								
5	Substation and Electrical Works	Constuction substation, underground cabling between turbines								
6	Turbine Hardstands	Excavate/pile for turbine bases where required								
7	Turbine Foundations	Fix reinforcing steel and anchorage system, erect shuttering, concrete pour								
8	Backfilling and Landscaping									
9	Turbine Delivery and Erection									
10	Substation Commissoning									
11	Turbine Commisioning									

4.8.3 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. The proposed procedures for the implementation of the mitigation measures outlined in such a CEMP and their effectiveness and completion is typically audited by the ECoW on behalf of the Project Developer, in an objective manner. The basis for auditing is presented in Section 10 of the CEMP which effectively lists all mitigation measures prescribed in any of the planning documentation. The first assessment is a simply Yes/No question, '*has the mitigation measure been employed on-site or not*'. Following confirmation that the mitigation measure has been implemented, the effectiveness of the mitigation measures has to be the subject of regular review and audit during the full construction stage of the project. If some remedial actions are needed to improve the effectiveness of the mitigation measure, then these are notified to the site staff immediately during the audit site visit, and in writing by way of the circulation of the findings of the audit. Depending on the importance and urgency of rectifying the issue, the construction site manager is given a timeframe by when the remedial works need to be completed.

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

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

The Contractor will be responsible for implementing the mitigation measures specified in 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 ECoW or supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation. The system of auditing ensures that the mitigation measures are maintained for the duration of the construction phase, and into the operational phase where necessary.

4.9 Construction Methodologies

4.9.1 Proposed Wind Farm

4.9.1.1 Turbine and Met Mast Foundations

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

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

An embankment approximately 600 mm high will be constructed around the perimeter of each turbine foundation base and a fence will be erected to prevent construction traffic from driving into the excavated hole and to demarcate the working area. All necessary health and safety signage will be erected to warn of deep excavations etc. Access to and from excavated bases will be formed by excavating a pedestrian walkway to 1:12 grade.

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

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

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

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

4.9.1.2 Site Roads and Hardstand Areas

4.9.1.2.1 *New Site Access Road*

The construction methodology for the proposed new access roads and turbine hardstands is outlined as follows:

- Establish alignment of the new road from the construction drawings and mark out the centrelines with ranging rods or timber posts;
- The proposed new roads will remain at the same level as existing ground levels in order to ensure natural flow paths over the floodplain and avoid backup of the water.
- All drainage measures prescribed in the detailed drainage design for the Proposed Project will be implemented around the works area;
- The road layout has been designed to avoid crossings of natural watercourses where possible;
- Where existing culverts are to be upgraded or extended, the works will be carried out to follow a method statement to be prepared in consultation with Inland Fisheries Ireland;
- The access tracks will be of single-track design with a width of 5m with localised widening at bends and changes in direction. (depending on the location within the Site)
- All spoil excavated will be managed on-site. It will be placed within the identified spoil management areas within the Site, which will be located outside the site-specific flood modelled zone (100-yr and 1000-yr events). Some topsoil may be temporarily stockpiled locally for reuse for landscaping purposes.
- The subsoil will be excavated down to a suitable formation layer of competent stratum;
- The road will be constructed using well-graded granular fill (imported or site-won), spread and compacted in layers typically of 200mm and a suitable capping layer to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be subject to

detailed design by Project Engineer in consultation with the Construction Manager based on the characteristics of the material and the compaction plant to be used;

- The new access roads will be constructed with a camber to aid drainage of surface water;
- Excavations side slopes shall not generally be greater than 1(V): 2 (H). Design slopes will be informed by the Geotechnical Engineer;
- At bends or steep inclines from the road, reflective snow poles will be erected to warn traffic on dark mornings and evenings that there is a turn in the road or a sharp incline beyond the road.
- The hardstands at turbines T3, T4, T7, T8 and T9 will have finished ground levels with a freeboard of 0.5m above Q1000cc (FFL = H1000cc+ 0.5m) design flood levels and then graded down to align with the adjoining roads sited at existing ground levels.

4.9.1.2.2 Upgrading of Existing Site Access Road

As discussed in section 4.3.1.2, the Proposed Wind Farm makes use of the existing road network insofar as possible. It is proposed to upgrade approximately 930m of existing site roads and tracks and approximately 1.1km of the L-70391.The road widening will be undertaken as follows:

- If it is considered that the current road formation level is adequate to support required bearing, then no upgrade or widening works will be completed;
- Otherwise, where required, the subsoil in the existing road verge will be excavated down to a suitable formation layer.
- All spoil excavated will be managed on-site. It will be placed within the identified spoil management areas within the Site, which will be located outside the site-specific flood modelled zone (100-yr and 1000-yr events). Some topsoil may be temporarily stockpiled locally for reuse for landscaping purposes.
- All drainage measures prescribed in the detailed drainage design for the Proposed Project will be implemented around the works area;
- Well-graded imported granular fill will be spread and compacted in layers up to 200mm to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used.
- These layers of granular fill will be brought to the same level as the top of the existing road surface.
- Where required, a layer of geogrid will be installed directly onto the top of the granular fill layer and the existing road surface;
- A layer of finer well graded stone for the running surface will be laid on the geogrid and compacted;
- The upgraded roads will remain at the same level as existing ground levels in order to ensure natural flow paths over the floodplain and avoid backup of the water.
- Upon completion the upgraded roads will be a single-track design with a width of 5m with localised widening at bends and changes in direction. (depending on the location within the Site)
- Prior to any works commencing on the upgrade of existing roads, the requirement for additional roadside drainage will be considered by the Project Hydrologist in line with the proposals outlined in the CEMP.

4.9.1.3 Clear-Span Watercourse Crossing

It is proposed to construct a clear-span watercourse crossing at one location within the Site where new or upgrade crossing is required. The location of this crossings is shown on the layout drawings included in Appendix 4-1 and Figure 4-37 below. The clear-span watercourse crossing methodology presented below will ensure that no instream works are necessary. The standard construction methodology for the installation of a clear-span watercourse crossing is as follows:

- The access road on the approach either side of the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of each watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- A foundation base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the opposite side of the watercourse for excavation and foundation installation will require the installation of a temporary pre-cast concrete or metal bridge across the watercourse to provide temporary access for the excavator. Plant and equipment will not be permitted to track across the watercourse.
- Once the foundation base has been completed, the pre-cast concrete box culvert will be installed using a crane which will be set up on the bank of the watercourse and will be lifted into place from the bank with no contact with the watercourse.
- Where the box culvert is installed in sections, the joints will be sealed to prevent granular material entering the watercourse,
- Once the crossing is in position stone backfill will be placed and compacted against the structure up to the required level above the foundations.
- Underground cabling ducting will be contained within the road make-up of the proposed crossing.

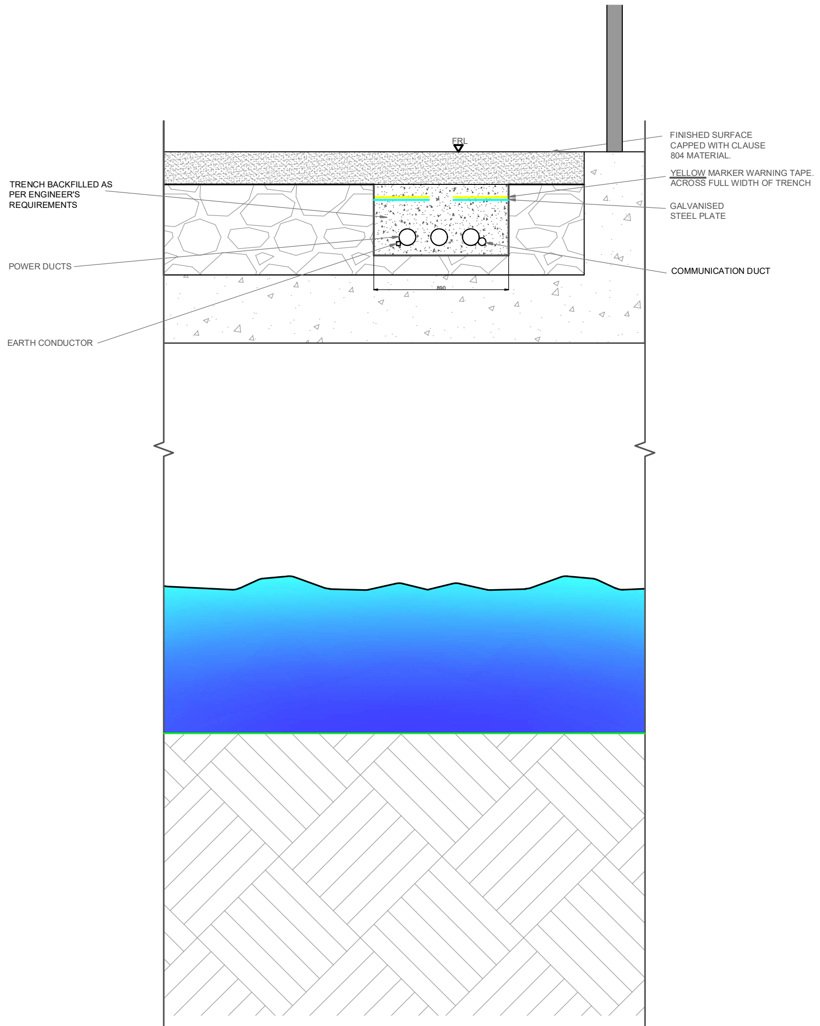
A standard design drawing of a pre-cast concrete, clear span crossing is shown in Figure 4-37.

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

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

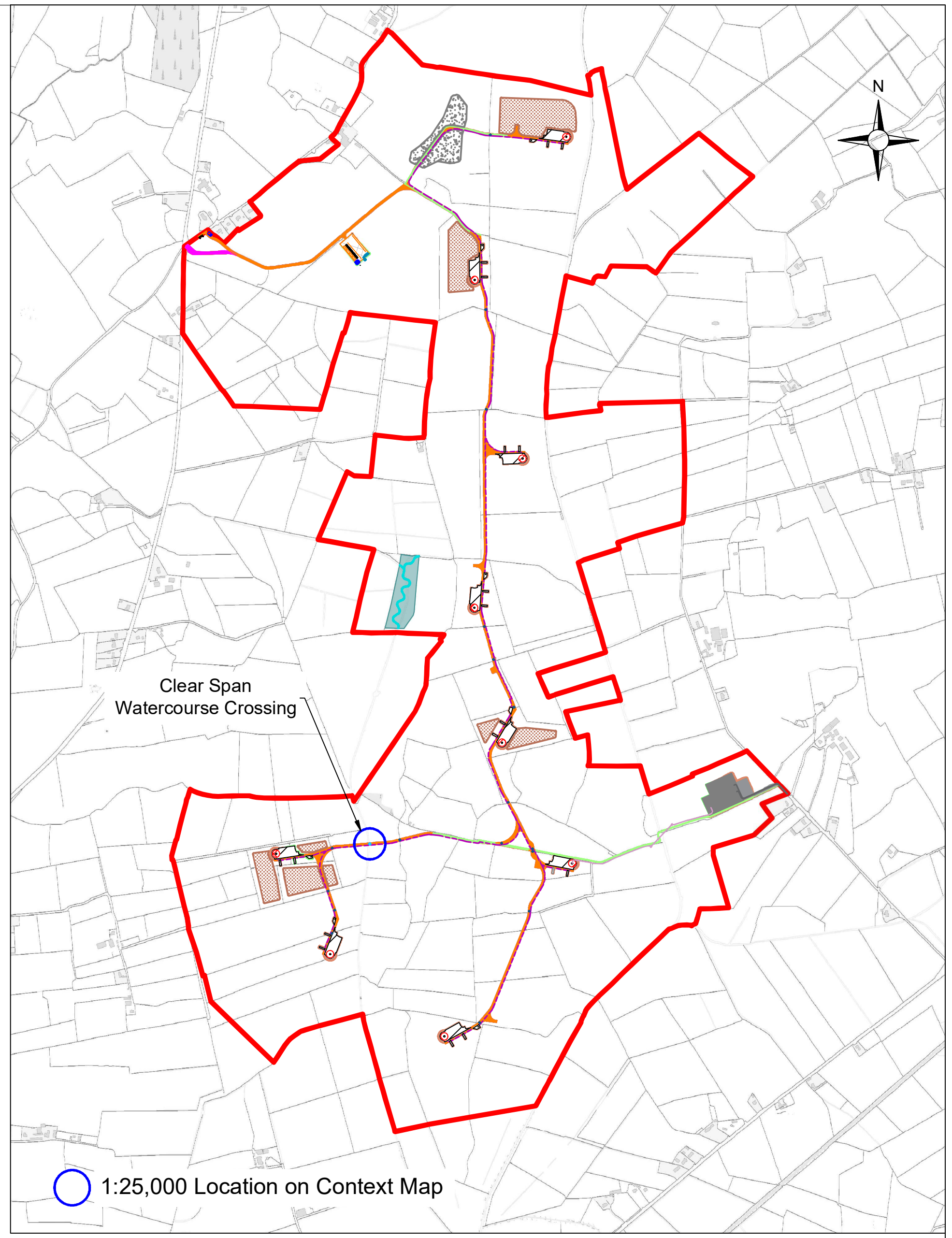
NOTES:

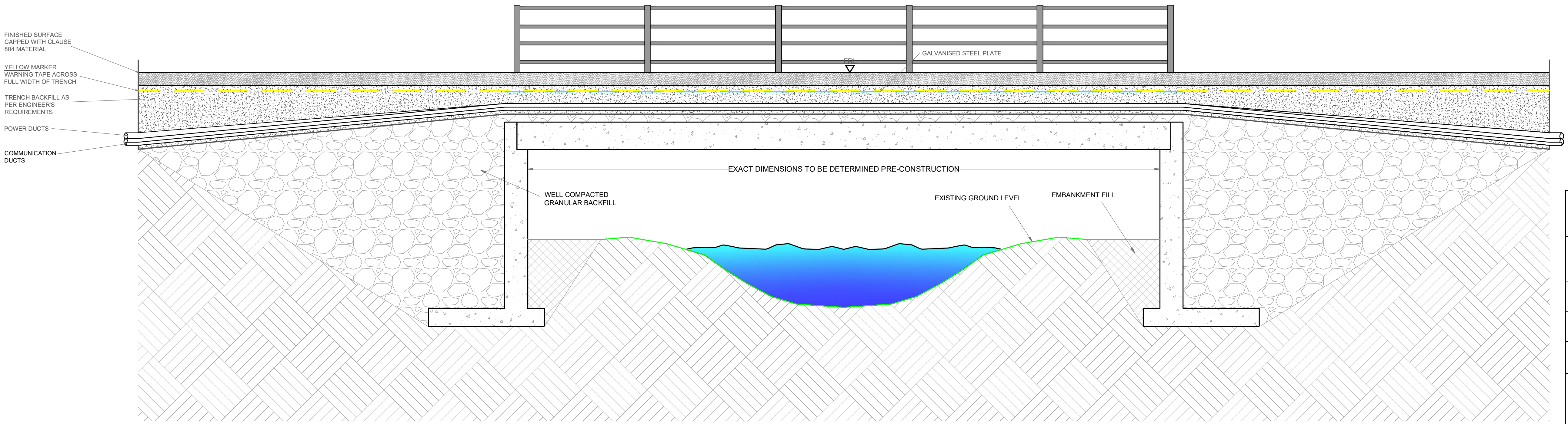
1. One circuit shown, no. of circuits to be determined by electrical design.
2. Crossings to be sized appropriately for 1 in 100yr flooding.
3. New culvert crossings to use 900mm pipes, or to be sized to engineer's requirements.
4. The cabling may be placed on either side of the roads, on both sides of the road or within the road.
5. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.



Clear Span Watercourse Crossing - 33kV - Cross Section

SCALE: 1:50





Clear Span Watercourse Crossing - 33kV - Longitudinal Section

SCALE: 1:75

PROJECT TITLE: Borrisbeg Renewable Energy Development			
DRAWING TITLE: Standard 33kV Clear Span Watercourse Crossing			
PROJECT No.: 220310	DRAWING No.: Figure 4-37		SCALE: As shown @ A3
DRAWN BY: GO	CHECKED BY: KD	DATE: 05.12.2023	REVISION.: P01

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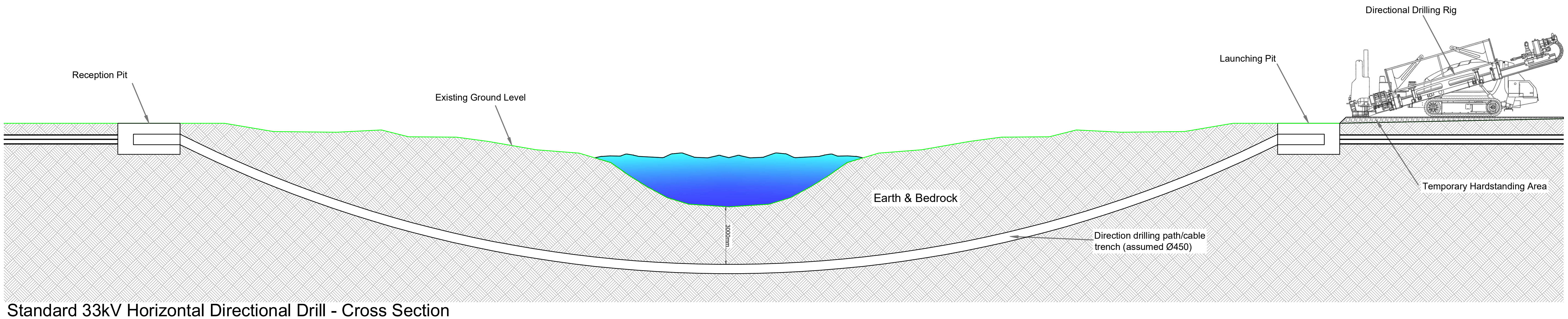
4.9.1.4 Horizontal Directional Drilling

To facilitate the connection of the 33kV underground cabling to the proposed 110kV substation, the 33kV cable route will require crossing the River Suir via the Horizontal Directional Drilling (HDD) method. This method comprises this drilling under obstacles such as bridges, culverts, railways, water courses, etc. to install cable ducts under the obstacle. The DD method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, for the directional drilling at watercourse/culvert crossings. The launch and reception pits will be approximately 0.55m wide, 2.5m long and 1.5m deep. The pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

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

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

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. Sufficient controls and monitoring will be put in place during drilling to prevent frack-out, such as the installation of casing at entry points where reduced cover and bearing pressure exits. The directional drilling methodology is further detailed in Figure 4-38.



Standard 33kV Horizontal Directional Drill - Cross Section

SCALE: 1:200

PROJECT TITLE: Borrisbeg Renewable Energy Development			
DRAWING TITLE: Standard 33kV HDD Cross Section			
PROJECT No.: 220310	DRAWING No.: Figure 4-38		SCALE: 1:200 @ A3
DRAWN BY: GO	CHECKED BY: KD	DATE: 16.11.2023	REVISION.: P01

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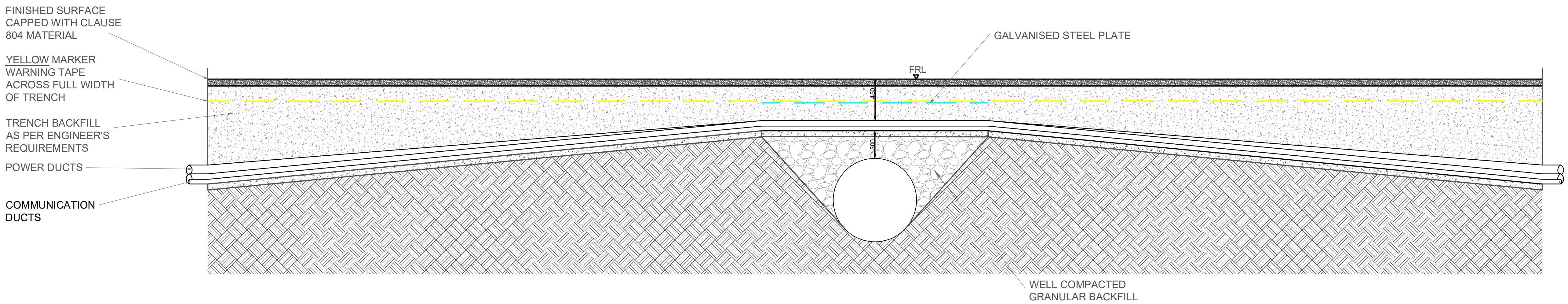
4.9.1.5 Culvert Crossing

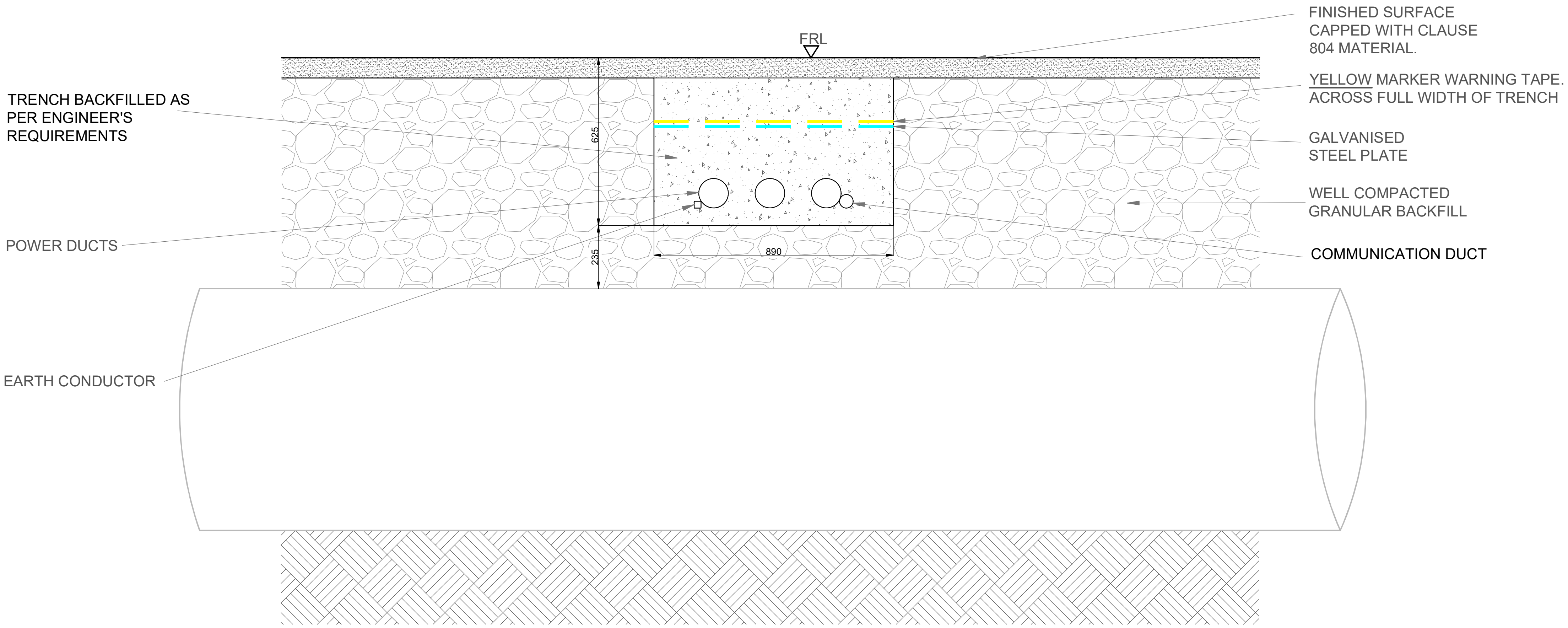
All new proposed culverts and proposed culvert upgrades at field drain crossings required for the Proposed Wind Farm will be suitably sized for the expected peak flows in the watercourse. Some culverts may be installed to manage drainage waters from works areas of the Proposed Wind Farm, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base but will have a minimum 900m diameter. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

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

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance. Please see Figure 4-39 for details.



Culvert Crossing - 33kV - Longitudinal Section
SCALE 1:50



Culvert Crossing - 33kV - Cross Section
SCALE 1:20

NOTES:

1. One circuit shown, no. of circuits to be determined by electrical design.
2. Crossings to be sized appropriately for 1 in 100yr flooding.
3. New culvert crossings to use 900mm pipes, or to be sized to engineer's requirements.
4. The cabling may be placed on either side of the roads, on both sides of the road or within the road.
5. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

PROJECT TITLE: **Borrisbeg Renewable Energy Development**		
DRAWING TITLE: **Standard 33kV Culvert Crossing**		
PROJECT No.: 220310	DRAWING No.: Figure 4-39	SCALE: As shown @ A3
DRAWN BY: GO / CHECKED BY: KD	DATE: 05.12.2023	REVISION.: P01

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4.9.1.6 Temporary Construction Compound

As discussed in section 4.3.1.5, there are two proposed construction compounds; one in the northwest of the Site and forms part of the Section 37E application (Proposed Wind Farm) and one adjacent to the proposed 110kV substation which will be subject to a separate Section 182A application (Proposed Grid Connection). Both compounds will be constructed in the same manner as follows:

1. *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;*
2. *The compound platform will be established using a similar technique as the construction of the substation platform as discussed below in section 4.9.2.1;*
3. *A layer of geo-grid will be installed where deemed necessary by the designer and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for Site offices and storage containers;*
4. *A limited amount of fuel will have to be stored in appropriately bunded containers and a designated area for oil storage will be constructed within the compound.*
5. *A waste storage area will be provided within the compound;*
6. *The compound will be fenced and secured with locked gates if necessary; and,*
7. *Upon completion of the Proposed Project, the temporary construction compounds will be decommissioned and allowed to vegetate naturally.*

4.9.1.7 Underground Electrical (33kV) and Communication Cabling

The transformer in each turbine is connected to the on-site substation through a network of buried electrical cables. The ground is trenched using a mechanical excavator. The top layer of soil (or road surface) is removed and saved so that it is replaced on completion. The cables will be bedded with suitable material. The cables will be laid at a depth of approximately 1.2m below ground level; a suitable marking tape is installed between the cables and the surface (see Plate 4-8 below illustrating an example of a single cable trench). On completion, the ground will be reinstated as previously described above. The route of the cable ducts will follow the access tracks as illustrated on the Wind Farm layout drawings included as Appendix 4-1 of the EIAR. The cabling may be located on either side of the road and/or within the road footprint.

Plate 4-8 Typical Cable Trench View

4.9.1.8 Borrow Pit

The estimated volume to be extracted from the borrow pit for the construction of the Proposed Wind Farm is up to 70,000 m^3. This figure presented are the anticipated maximum volumes; however, the actual volumes to be removed from the borrow pit will be confirmed at the time of construction and following detailed pre-construction site investigation works.

The borrow pit will be excavated and backfilled as follows:

1. *The area to be used for the borrow pit will be marked out at the corners using ranging rods or timber posts. An unrecorded crop mark located approx. 20 m northeast of the borrow pit location will be closed off with fencing and signage for the duration of the construction phase. Please see Chapter 13 for details. Drainage runs, and associated settlement ponds will be installed around the perimeter;*
2. *The initial borrow pit excavation will involve removal of soil to the top of bedrock. These materials will be stored temporarily in selected spoil management areas, see Figure 4-21 for details;*
3. *All drainage measures prescribed in the detailed drainage design for the Proposed Project will be implemented around the works area;*
4. *The bedrock material will be extracted by breaking and blasting (section 4.9.8.1.1 and 4.9.8.1.2 above) from the borrow pit and stockpiled or used as required;*
5. *The use of material won from the borrow pit will be sequential with new road construction or turbine foundation formations;*
6. *Temporary stockpiling of aggregates will be required to accommodate the cut and fill operations within the borrow pit, and the progression of access roads and turbine excavations;*
7. *As the borrow pit excavation progress and become deeper, surface water and groundwater ingress will be removed via pumping to settlement ponds, and re-distribution locally across natural vegetated areas. Where required, additional specialist water treatment measures will be employed to ensure no deterioration in downstream water quality occurs;*

8. *When extraction ceases within the borrow pit, the borrow pit will be backfilled with excavated spoil and its associated drainage measures will be removed. The access track through the borrow pit providing access to T1 will be completed; and,*
9. The extraction area of the borrow pit will have to be permanently secured and a stock-proof fence will be erected around the borrow pit to prevent access to these areas as well as the installation of appropriate health and safety signage.

Two extraction methods have been assessed for breaking out the useful rock below: rock breaking and blasting.

4.9.1.8.1 Rock Breaking

Weathered or brittle rock can be extracted by means of a hydraulic excavator and a ripper attachment. This is a common extraction methodology where fragmented rock is encountered as it can be carefully excavated in layers. In areas where stronger rock is encountered and cannot be removed by means of excavating then a rock breaking methodology may be used. Rock breaking equipment comprises a large hydraulic 360-degree excavator with a rock breaker attachment. Given the power required to break out tight and compact stone at depth, the machines are generally large and in the 40-60 tonne size range. Even where rock might appear weathered or brittle at the surface, the extent of weathering can quickly diminish with depth resulting in strong rock requiring significant force to extract it at depths of only a few metres.

A large rock breaking excavator progressively breaks out the solid rock from the ground in the borrow pit area. A smaller rock breaker, in the 30-40 tonne size range, then breaks the rocks down to a size that can then be fed into a crusher.

The extracted, broken rock is loaded into a mobile crusher using a wheeled loading shovel and crushed down to the necessary size of graded stone required for the on-site civil works. The same wheeled loader takes the stone from the crusher conveyor stockpile and stockpiles it elsewhere within the borrow pit, away from the immediate area of the crusher, until it is required elsewhere within the Site.

4.9.1.8.2 Rock Blasting

Where blasting is used as an extraction method, a mobile drilling rig is used to drill vertical boreholes into the area of rock that is to be blasted.–A drilling rig will drill the necessary number of boreholes required for a single blast in approximately 3 to 4 days. The locations, depth and number of boreholes are determined by the blast engineer. This is a specialist role fulfilled by the blasting contractor.

The blast engineer will arrange for the necessary quantity of explosive to be brought to site to undertake a single blast. The management of explosives on-site and the actual blasting operation will be agreed in advance with and supervised by An Gardaí Siochána. The blast engineer sets the explosives in place in the boreholes, sets the charges, and fires the blast.

A properly designed blast should generate rock of a size that can be loaded directly into a mobile crusher, using the same wheeled loader outlined above. The same method is used for processing the rock generated from a blast, as would be used to process rock generated by rock breaking. Generally, the drilling rig will recommence drilling blast holes for the next blast as soon one blast finished. The potential impacts and control measures associated with noise and vibration from this extraction method are assessed in Chapter 12: Noise and Vibration. Any blasting will be carried out in accordance with the *Guidance on the Safe Use of Explosives in Quarries* (Safety and Health Commission for the Mining and

Other Extractive Industries, 2002)[5] and the British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*[6].

4.9.2 Proposed Grid Connection

4.9.2.1 On-site Electricity Substation and Control Buildings

Please see Appendix 4-5 and Figure 4-23 and 4-24 above for details. It will be constructed by the following methodology:

1. The area of the on-site substation will be marked out using ranging rods or wooden posts and the soil and overburden stripped and removed to a nearby spoil management area for later use in landscaping. Any excess material will be sent to one of the designated spoil management areas.
2. 2 no. control buildings will be built within the on-site substation compound;
3. 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;
4. 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;
5. The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
6. The roof slabs will be lifted into position using an adequately sized mobile crane;
7. 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.
8. The electrical equipment will be installed and commissioned.
9. Perimeter fencing will be erected.
10. The construction and components of the substation will be built to Eirgrid specifications.

4.9.2.2 Underground Electrical (110kV) and Communication Cabling

The underground cabling works will consist of the installation of ducts in an excavated trench to accommodate electrical and fibre communications cables to facilitate a loop connection between the proposed 110kV on-site substation and the existing110kV Ikerrin to Thurles OHL. Please see Appendix 4-5 and Figure 4-29 above for details.

The underground electrical cabling will be laid beneath the surface of private roads (existing and proposed) and the public road using the following methodology:

1. Before works commence, updated surveying will take place along the proposed cable route, with all existing culverts and services identified. All relevant bodies i.e., ESBN, Tipperary County Council etc. will be contacted and all up to date information for all existing services sought.
2. When the cable is located on public roads, a traffic management plan will be prepared prior to any works commencing. A road opening licence will be obtained

[5] https://www.hsa.ie/eng/Publications_and_Forms/Publications/Mines_and_Quarries/Guidance%20on%20the%20Safe%20Use%20of%20Explosives%20in%20Quarries.pdf
[6] https://www.thenbs.com/PublicationIndex/documents/details?Pub=BSI&DocID=305965

where required and all plant operators and general operatives will be inducted and informed as to the location of any services.

3. A tracked 360-degree excavator will then proceed to dig out the proposed trench, typically to a depth of 1300mm, within which the ducts will be laid.
4. The cable ducts will be concrete surrounded where they pass under the public road and under drains or culverts.
5. Trench supports will be installed, or the trench sides will be benched or battered back where appropriate and any ingress of ground water will be removed from the trench using submersible pumps, fitted with appropriate silt filtration systems, to prevent contamination of any watercourse.
6. Once the trench has been excavated, a base-layer will be laid and compacted, comprising Clause 804, or 15 Newton CBM4 concrete as required.
7. The ducting will be installed as per specification, with couplers fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions, the ends of the ducts will be shimmed up from the bed of the trench, to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected. Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
8. Four pre-cast concrete joint bay chambers typically 2.5m x 6m x 1.75m will be installed below finished ground level, approximately 1000 metres apart or as otherwise required by ESB/Eirgrid and electrical requirements. Please see section 4.9.2.5 below for details.
9. As the works progress, the as-built location of the ducting will be recorded using a total station or GPS.
10. As per the associated base-layer (Clause 804 material or 15 Newton CBM4 concrete) will be installed and compacted as per approved detail, with care not to displace the ducting.
11. Spacers will be used to ensure that the correct cover is achieved at both sides of the ducting.
12. The remainder of the trench will be backfilled in two compacted layers with approved engineer's specified material.
13. Yellow marker warning tape will be installed across the width of the trench, at 300mm depth,
14. The finished surface is to be reinstated, as per original specification. Off-road cabling may be finished with granular fill to facilitate access to the trench for any potential maintenance that is required during the operational phase of the Proposed Project.
15. Marker posts will then be placed at regular intervals (generally at joint bays and any change in direction) to denote the location of the underground cabling.

4.9.2.3 Connection Point to National Grid

It is proposed to connect the proposed on-site 110kV substation to the existing 110kV Ikerrin to Thurles overhead line (OHL). Two proposed end masts (lattice type towers) will be located immediately beneath the existing OHL. The existing OHL conductor will be terminated at these masts to facilitate a new OHL loop connection following the proposed c.2km underground grid connection route leading to the on-site 110kV substation. See Appendix 4-5 and Figure 4-30 for details. The following section outlines the construction methodology for the new loop in tower structures which will be constructed underneath the existing 110kV Ikerrin to Thurles OHL:

1. The Steel lattice tower sites are scanned for underground services such as cables etc.
2. A foundation c.4m x 4m x 4m is excavated and the formation levels (depths) will be checked by the on-site foreman See Plates 4-9 and 4-10. The excavated material

will be temporarily stored close to the excavation and excess material will be used as berms along the site access roads.

3. 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.
4. Concrete trucks will pour concrete directly into each excavation in distinct stages.
5. A third pour for the leg of the tower 1m x 1m and will be 300mm over ground level.
6. 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.
7. Once the concrete is set after the five days the shuttering is removed.
8. 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..
9. The existing overhead line will be de-energised by ESB so work can commence on the construction of the towers.
10. 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.
11. 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.
12. 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.
13. A physical barrier (Heras Fence Site Boundary) will be put in place to restrict plant from coming too close to the OHL.
14. The towers will be constructed lying flat on the ground beside the recently installed tower base.
15. The conductor will be moved off centre using a stay wire and weights to anchor the stay wire to ground.
16. The tower section will be lifted into place using the crane and guide ropes.
17. The body sections will be bolted into position.
18. 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 small section of conductor in between the two towers will be removed and utilised as connector wire for the new towers.. Plate 4-11 for a constructed tower.

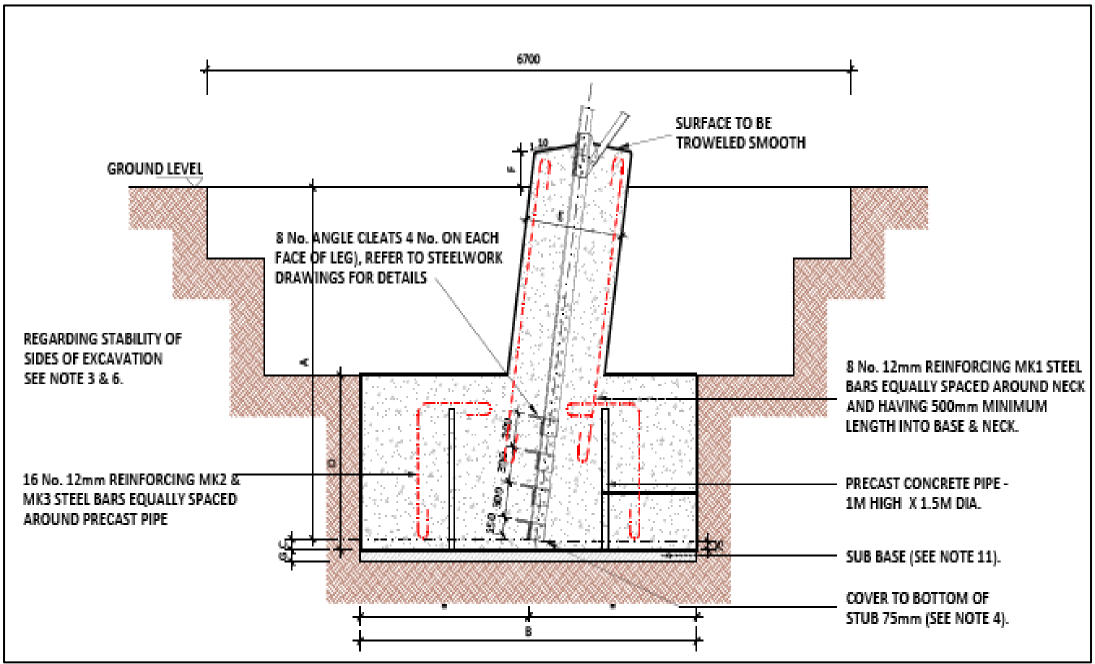


Plate 4-9 Steel lattice tower foundation

Plate 4-10 Steel lattice tower foundation complete (example image)

Plate 4-11 Completed End Mast Tower (example image)

4.9.2.4 Existing Underground Services

Any underground services encountered along the cable route will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300 mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations an additional layer of marker tape will be installed between the communications duct and top-level yellow marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35N concrete surrounding the proposed ducting, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate, as detailed in Appendix 4-5: Grid Connection Infrastructure.

4.9.2.5 Joint Bays

Joint bays are typically pre-cast concrete chambers where lengths of cable will be joined to form one continuous cable. They are typically 2.5m x 6m x 1.75m pre-cast concrete structures installed below finished ground level. Four joint bays, in groups of two are proposed along the proposed underground grid connection cable route, approximately 1000 metres apart or as otherwise required by ESB/Eirgrid and electrical requirements. Two joint bays are proposed to be located in a new track adjacent to the L7039-1 third class road northeast of the proposed 110kV substation. The two remaining joint bays are proposed to be located in a new track in an agricultural field. Therefore, public access/traffic will not be impacted during the placement or maintenance of the proposed joint bays.

During construction the joint bay locations will be completely fenced off once they have been constructed, they will be covered until cables are being installed. Once the cabling is installed the joint bays will be permanently backfilled with the existing surface re-instated and there will be no discernible evidence of the joint bay on the ground.

In association with joint bays, Communication Chambers are required at every joint bay location to facilitate jointing of the communication cabling. Earth Sheath Link Chambers are also required approximately every second joint bay along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground electrical cabling, installed in a flat formation, so that the circulating currents and induced voltages are eliminated or reduced. Earth Sheath Link Chambers and Communication Chambers are located in proximity to Joint Bays. Earth Sheath Link Chambers and Communication Chambers will be pre-cast concrete structures with a steel access cover at finished surface level. The locations of the joint bays and chambers are shown on the Grid Connection Infrastructure drawings in Appendix 4-5. Please see Figure 4-31 above for a standard joint bay.

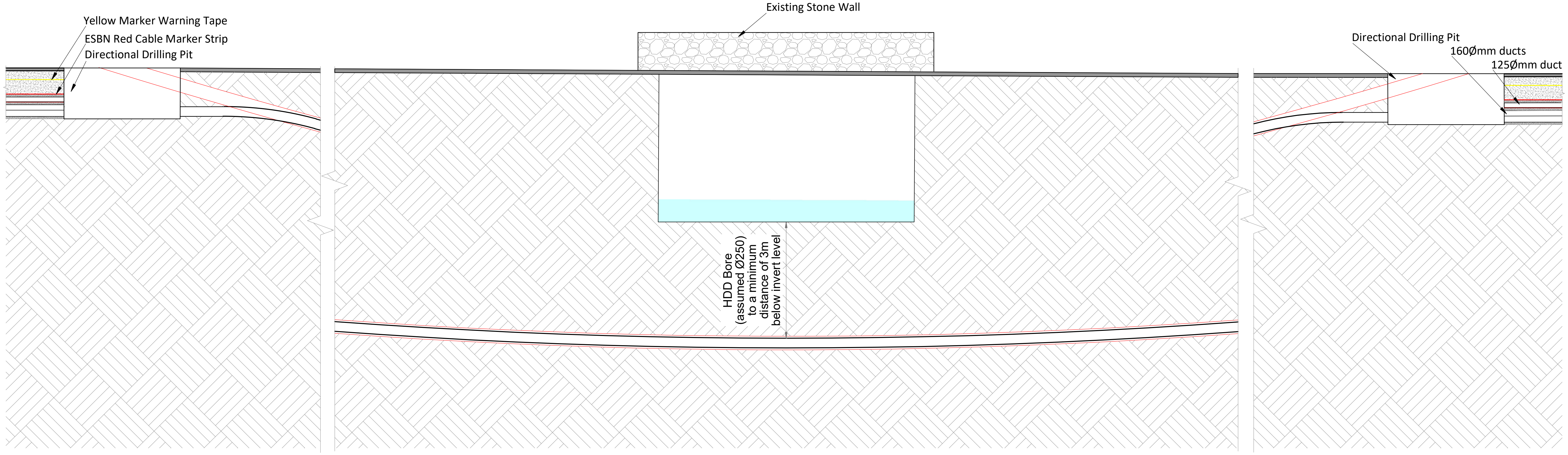
The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers within the underground cabling route corridor assessed is subject to approval by ESBN and Eirgrid.

4.9.2.6 Watercourse Crossings

4.9.2.6.1 *Horizontal Directional Drilling*

At grid route watercourse crossing no. 1 located in the L7039 road, it is proposed to cross the Clonmore watercourse via the Horizontal Directional Drilling (HDD) method. as described in section 4.9.1.4, this method comprises drilling under obstacles such as bridges, culverts, railways, water courses, etc. to install cable ducts under the obstacle. The DD method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, for the directional drilling at watercourse/culvert crossings. The launch and reception pits will be approximately 0.55m wide, 2.5m long and 1.5m deep.

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. Sufficient controls and monitoring will be put in place during drilling to prevent frack-out, such as the installation of casing at entry points where reduced cover and bearing pressure exits. The directional drilling methodology for the underground grids connection cabling route is further detailed in Figure 4-40 below.



Standard Horizontal Directional Drill Under Exisitng Watercourse Crossing

SCALE 1:100

PROJECT TITLE: Borrisbeg Renewable Energy Development			
DRAWING TITLE: Standard 110kV HDD Under Existing Watercourse Crossing			
PROJECT No.: 220310	DRAWING No.: Fig 4-40	SCALE: 1:100 @ A3	
DRAWN BY: GO	CHECKED BY: N/A	DATE: 15.11.2023	REVISION.: P01

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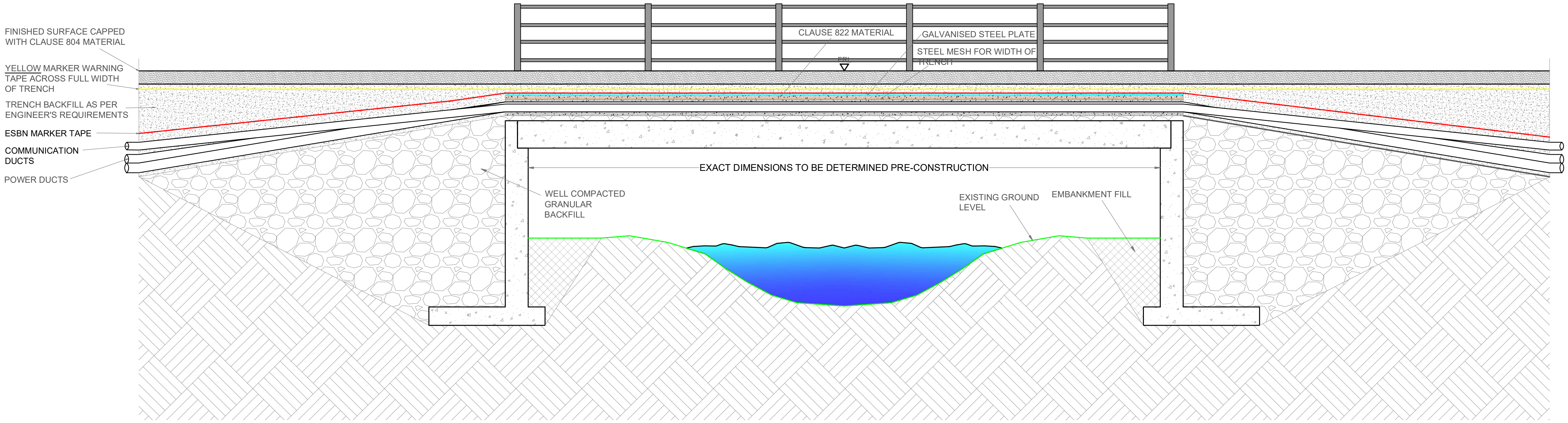
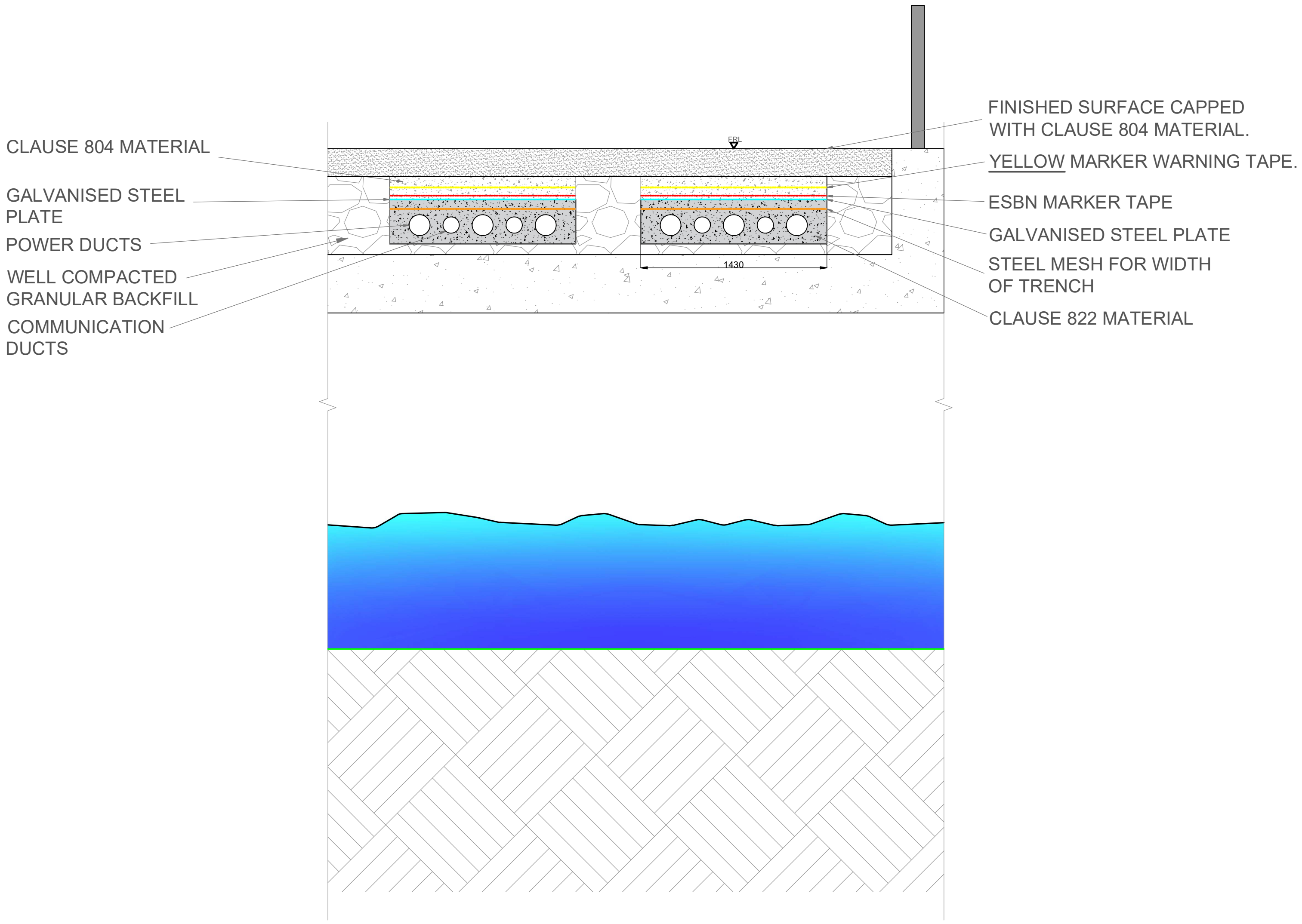
4.9.2.6.2 Clear Span Watercourse Crossing

At watercourse crossing no. 2 located in agricultural land at the Strogue watercourse, it is proposed to construct a clear-span watercourse crossing. This watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material. Confirmatory inspections of the proposed new watercourse crossing locations will be carried out by the Project Civil/Structural Engineer and the Project Hydrologist prior to the construction of the crossing. Refer to section 4.9.1.3 for the detailed construction methodology. Please see Figure 4-41 below.



Clear Span Watercourse Crossing - 110kV - Longitudinal Section

SCALE: 1:75



Clear Span Watercourse Crossing - 110kV - Cross Section

SCALE: 1:50

NOTES:

1. Crossings to be sized appropriately for 1 in 100yr flooding.
2. New culvert crossings to use 900mm pipes, or to be sized to engineer's requirements.
3. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

PROJECT TITLE: **Borrisbeg Renewable Energy Development**			
DRAWING TITLE: **Standard 110kV Clear Span Watercourse Crossing**			
PROJECT No.: 220310	DRAWING No.: Figure 4-41		SCALE: As shown @ A3
DRAWN BY: GO	CHECKED BY: N/A	DATE: 05.12.2023	REVISION.: P01

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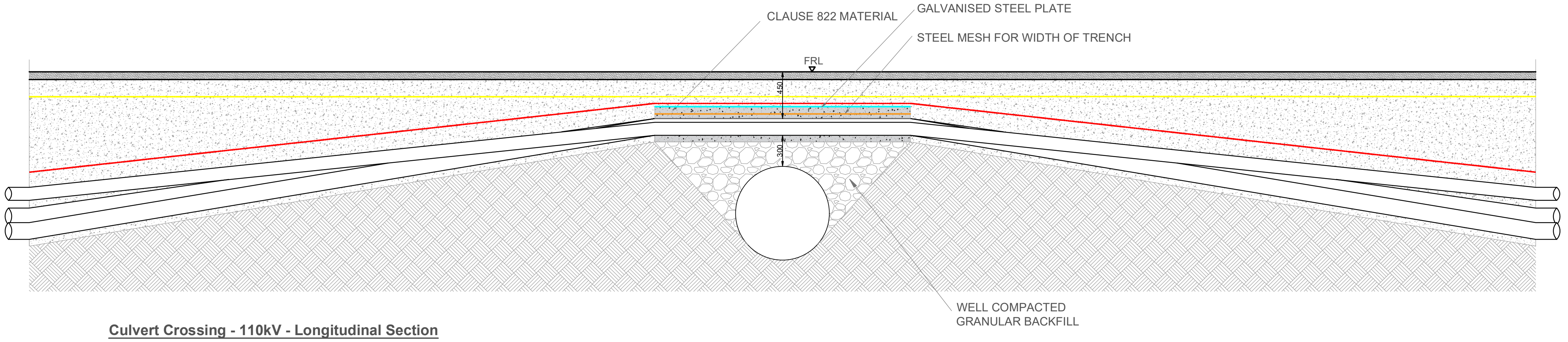
4.9.2.7 Culvert Crossing

All new proposed culverts and proposed culvert upgrades at field drain crossings required for the Proposed Grid Connection, will be suitably sized for the expected peak flows in the watercourse. Some culverts may be installed to manage drainage waters from works areas of the Proposed Grid Connection, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The culverts will be constructed or upgraded as per the methodology described in section 4.9.1.5. All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance. Please see Appendix 4-2 and Figure 4-42 below.

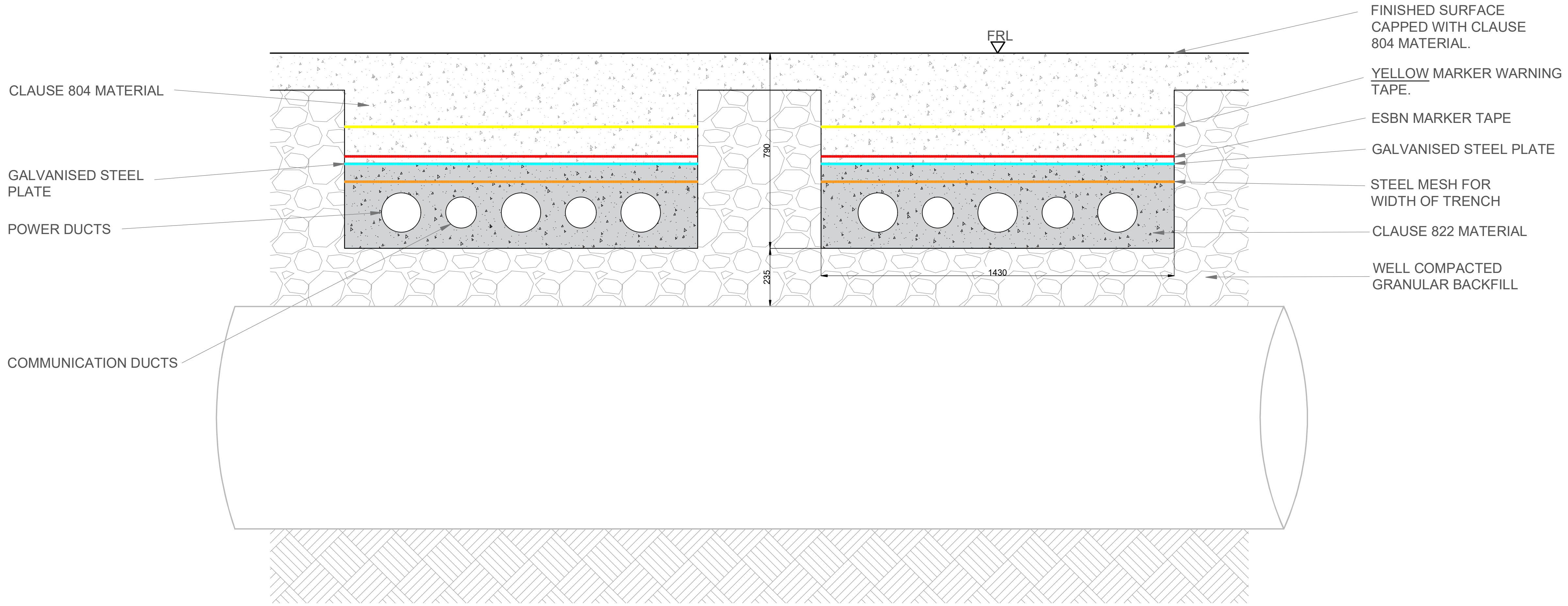


Culvert Crossing - 110kV - Longitudinal Section

SCALE 1:50

NOTES:

1. Crossings to be sized appropriately for 1 in 100yr flooding.
2. New culvert crossings to use 900mm pipes, or to be sized to engineer's requirements.
3. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.



Culvert Crossing - 110kV - Cross Section

SCALE 1:20

PROJECT TITLE: **Borrisbeg Renewable Energy Development**		
DRAWING TITLE: **Standard 110kV Culvert Crossing**		
PROJECT No.: 220310	DRAWING No.: Figure 4-42	SCALE: As shown @ A3
DRAWN BY: GO / CHECKED BY: N/A	DATE: 05.12.2023	REVISION.: P01

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4.10 Operation

As part of the Proposed Wind Farm planning application, permission is being sought for a 30-year operation period commencing from the date of full operational commissioning of the proposed turbines. During the operational period, on a day-to-day basis the wind turbines will operate automatically, responding by means of meteorological equipment and control systems to changes in wind speed and direction.

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

4.10.1 Maintenance

Each turbine will be subject to a routine maintenance programme involving several checks and changing of consumables, including oil changes. The meteorological mast will be subject to a routine maintenance programme involving several checks and changing of instrumentation when required. 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. Maintenance of the site roads will involve filling potholes and maintaining road edge markers. Drainage maintenance will typically involve cleaning of drainage ditches when required to prevent water backing up.

The electricity substation and site tracks will also require periodic maintenance. The Substation would be operational 24 hours per day, 7 days a week throughout the year. Substations can be operated remotely and manually. Supervisory operational and monitoring activities will be carried out remotely using a SCADA system, with the aid of computers connected via a telephone modem link. The following maintenance procedures will also be adhered.

- Periodic service and maintenance works which include some vehicle movement.
- For operational and inspection purposes, substation access is required.
- Servicing of the substation equipment will be carried out in accordance with the manufacturer's specifications, which would be expected to entail the following:
    - Six-month service – three-week visit
    - Annual service – six-week visit
    - Weekly visits as required.

Occasional technical problems may require maintenance visits by technical staff. During the six-month and annual service visits, some waste (lubricating and cooling oils, packaging from spare parts or equipment, unused paint, etc.) will arise. This will be recorded and removed from the site and reused, recycled or disposed of in accordance with the relevant legislation in an authorised facility.

It is estimated that 1-2 daily visits will be made to the Site for authorised persons and vehicles to undertake minor routine maintenance and inspection, if and when required. Although the level of activity required for the maintenance of the both the Proposed Wind Farm and Proposed Grid Connection infrastructure is minimal, the impacts associated with traffic volumes for this period are assessed in Chapter 15 Material Assets: Traffic and Transport.

4.10.2 Monitoring

Section 8 of the CEMP sets out a programme of monitoring required for the operational phase of the project. The CEMP should be consulted for detailed information on the monitoring requirements during the operational phase, however a summary of the key information is provided below:

- Monthly water sampling and laboratory analysis will be undertaken for the first six months during the operational phase.
- The drainage system will be monitored in the operational phase until such a time that all areas that have been reinstated become re-vegetated and the natural drainage regime has been restored.
- Post-construction bird monitoring will be carried out in accordance with the Bird Monitoring Plan provided in Appendix 7-8.
- Post-construction bat monitoring will be carried out in accordance with the Bat Report recommendations in Appendix 6-2.
- Post-construction linear habitat restoration monitoring following the main growing season (i.e., in September) in a given year for the first five years of growth.
- Monitoring for shadow flicker at properties where any exceedance of the shadow flicker limit has been predicted as outlined in Chapter 5.
- Post turbine commissioning noise monitoring will be commenced within 6 months of commissioning the wind farm.

4.11 Decommissioning

The proposed wind turbines are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the equipment may be replaced with a new technology, subject to planning permission being obtained, or the Wind Farm will be decommissioned fully.

Upon decommissioning of the Proposed Wind Farm, the wind turbines and the meteorological mast would be disassembled. All above ground turbine and mast components would be separated and removed off-site for recycling. Turbine and mast foundations would remain underground and would be covered with earth and allowed to revegetate. Leaving the 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 temporary environment nuisances such as noise, dust and/or vibration. Site roadways will be used during the operational phase by farm machinery and will provide a useful means of extracting the commercial forestry crop which exists on at the Site and therefore will be retained post decommissioning to facilitate these activities.

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

The Grid Connection infrastructure will remain in place as it will be part of the Electricity Grid under the ownership and control of the ESB and EirGrid.

A Decommissioning Plan has been prepared (Appendix 4-4). The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agree with the competent authority at that time. The potential for effects during the decommissioning phase of the Proposed Wind Farm has been fully assessed in the EIAR.

As noted in the Scottish Natural Heritage report (SNH) *Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms* (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the Proposed 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".*