4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the Proposed Development and all its component parts. Consultation with An Bord Pleanála confirmed that the Proposed Development will be subject to a dual consenting process, with development relating to the Grid Connection subject to a separate planning application under Section 182A of the Planning and Development Act, 2000, as amended. The current planning application, relating to the Wind Farm Site, is being made to An Bord Pleanála under Section 37E of the Planning and Development Act, 2000, as amended. Further detail in relation to the dual consenting process is provided in Chapter 1 of this EIAR.

The development description for the current planning application as appears in the public notices is as follows:

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

- i. *9 No. wind turbines with an overall ground-to-blade tip height of 185 metres; a rotor blade diameter of 162 metres; and hub height of 104 metres, and associated foundations and hard-standing areas;*
- ii. *A thirty-year operational life from the date of full commissioning of the wind farm and subsequent decommissioning;*
- iii. *A meteorological mast with a height of 30 metres, and associated foundation and hard-standing area;*
- iv. *Junction accommodation works and temporary access roads to facilitate turbine delivery to an existing entrance on L5363.*
- v. *Upgrade of existing entrance on L5363 for provision of site entrance;*
- vi. *Upgrade of existing tracks/roads and provision of new site access roads, junctions and hardstand areas;*
- vii. *Underground electrical (33kV) and communications cabling;*
- viii. *A temporary construction compound;*
- ix. *Spoil Management;*
- x. *Site Drainage;*
- xi. *Tree Felling;*
- xii. *Operational stage site signage; and*
- xiii. *All ancillary works and apparatus.*

The application is seeking a ten-year planning permission.

The Grid Connection, which will be subject to a separate planning application, includes for a 110kV on-site substation compound (2 no. control buildings with welfare facilities, all associated electrical plant and apparatus, security fencing, underground cabling, waste water holding tank, site drainage and all ancillary works), a temporary construction compound and approximately 31km of underground 110kV electrical cabling connecting the proposed on-site substation to the existing Thornsberry 110kV substation, near Tullamore, Co. Offaly.

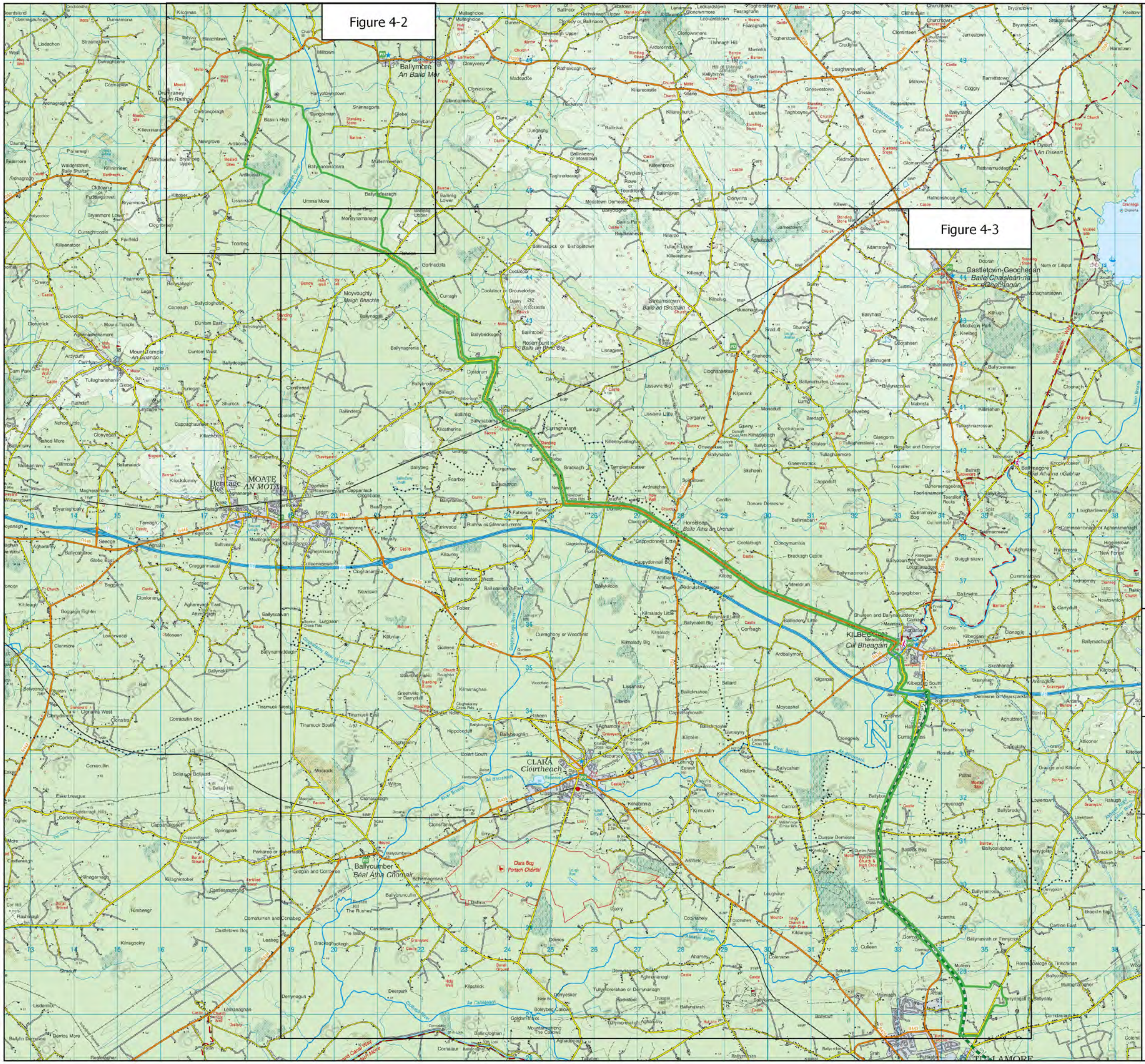
All elements of the Proposed Development, i.e. the Wind Farm Site and Grid Connection, have been assessed as part of this EIAR.

4.2 Development Layout

The overall layout of the Proposed Development is shown on Figure 4-1, this includes the Wind Farm Site and Grid Connection.

The Proposed Development has been designed to minimise potential environmental effects, while at the same time maximising the energy yield from the Wind Farm Site. A constraints study, as described in Section 3.2.6 of this EIAR, has been carried out to ensure that turbines and ancillary infrastructure are located in the most appropriate areas of the Wind Farm Site and makes use of the existing access tracks within the Wind Farm Site where appropriate. Similarly, as described in Section 3.2.8 of this EIAR, a route selection constraints study was undertaken to ensure that the most appropriate route for the Grid Connection undergound electrical cabling was selected. The Wind Farm Site layout is shown in Figure 4-2. The Grid Connection layout is shown in Figure 4-3.

Detailed site layout drawings of the Proposed Development are included in Appendix 4-1 to this EIAR.



Map Legend

EIAR Site Boundary

Drawing Title: Proposed Development Layout Key Plan	
Project Title: Umma More Renewable Energy Development	
Drawn By: NMcH	Checked By: EC
Project No.: 201050	Drawing No.: Figure 4-1
Scale: 1:85,000	Date: 2023-01-31

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Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Hardstands
- Proposed Turbine Foundation
- Proposed Met Mast Location
- Proposed New Roads
- Proposed Upgrades to Existing Roads
- Temporary Construction Compound
- Grid Connection - Subject to a Separate Application

N

Drawing Title: Wind Farm Site Layout	
Project Title: Umma More Renewable Energy Development	
Drawn By: BT	Checked By: EC
Project No.: 201050	Drawing No.: Figure 4-2
Scale: 1:20,000	Date: 2023-01-31

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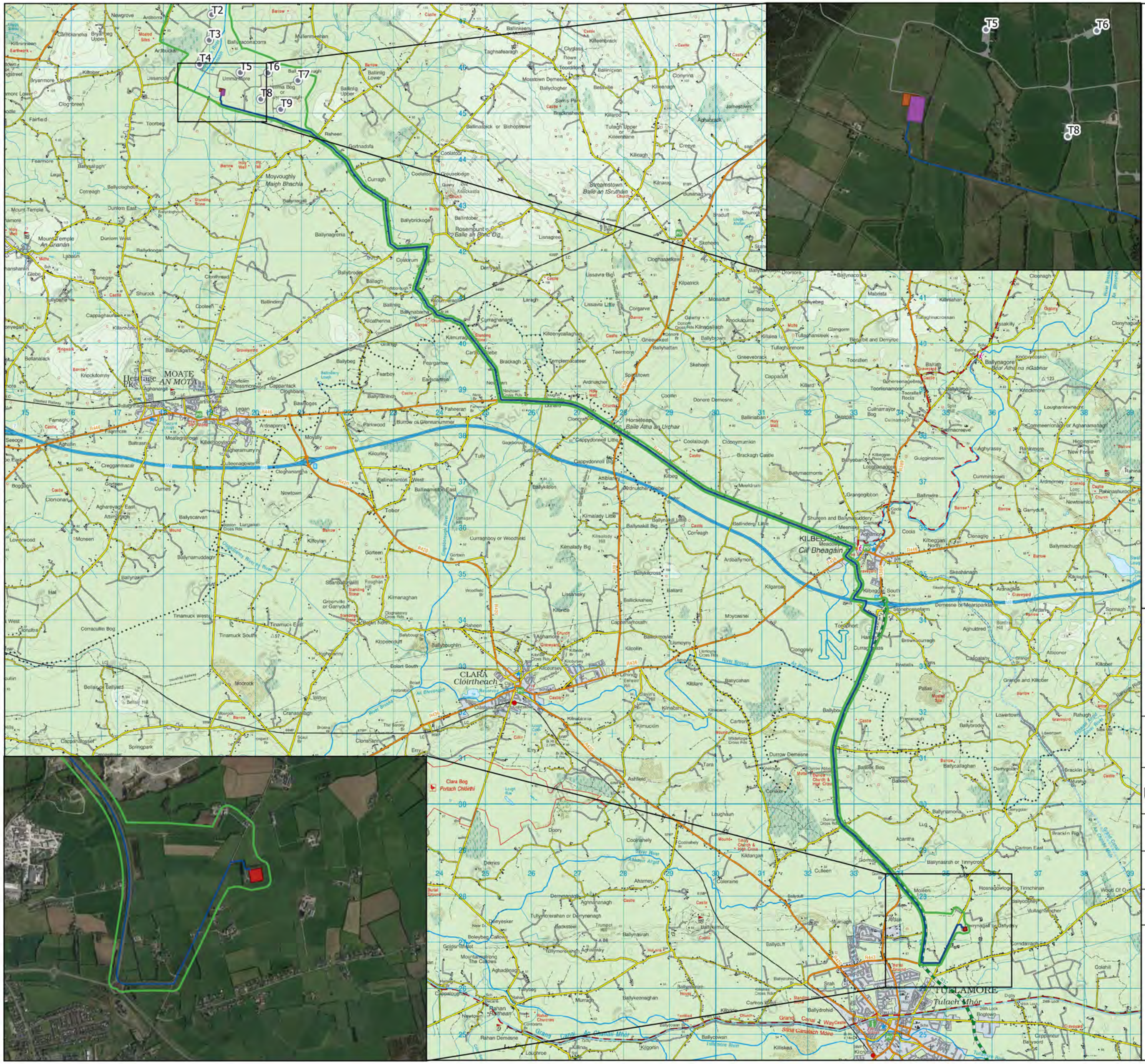

Map Legend

- EIAR Site Boundary
- Proposed 110kV Onsite Substation
- Proposed Temporary Construction Compound
- Proposed Underground Electrical Cabling Route
- Existing Thornsberry 110kV Substation
- Wind Farm Site Infrastructure - Subject to Separate Application

Drawing Title	Grid Connection Layout
Project Title	Umma More Renewable Energy Development
Drawn By: NMcH	Checked By: EC
Project No.: 201050	Drawing No.: Figure 4-3
Scale: 1:80,000	Date: 2023-01-31

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4.3 Development Components

This section of the EIAR describes the components of the Proposed Development. Further details regarding Access and Transportation (Section 4.4), Site Drainage (Section 4.5), Construction Management (Section 4.6) and Construction Methodologies (Section 4.7) are provided subsequently in this chapter.

4.3.1 Wind Farm Site

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 (WindPro) to maximise the energy yield from the Wind Farm Site, while maintaining sufficient distances between the proposed turbines to ensure turbulence and wake effects do not compromise turbine performance. The Grid Reference coordinates of the proposed turbine locations are listed in Table 4-1 below. The final ground level of the turbine foundations will be determined by the actual ground conditions at each proposed turbine location and may differ slightly from those levels listed in Table 4-1. Also, in accordance with the '*Wind Energy Development Guidelines for Planning Authorities'* (Department of the Environment, Heritage and Local Government (DOEHLG), 2006) micro-siting of the turbine positions may be required within the criteria set out in the guidelines.

Table 4-1 Proposed Wind Turbine Locations and Elevations

Turbine	ITM Coordinates		Top of Foundation Elevation (m OD)
	Easting	Northing	
T1	619119	747703	56m
T2	619001	747158	56m
T3	618946	746605	56m
T4	618737	746080	56m
T5	619623	745904	58m
T6	620224	745898	60m
T7	620874	745730	58m
T8	620067	745325	69m
T9	620500	745103	70m

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

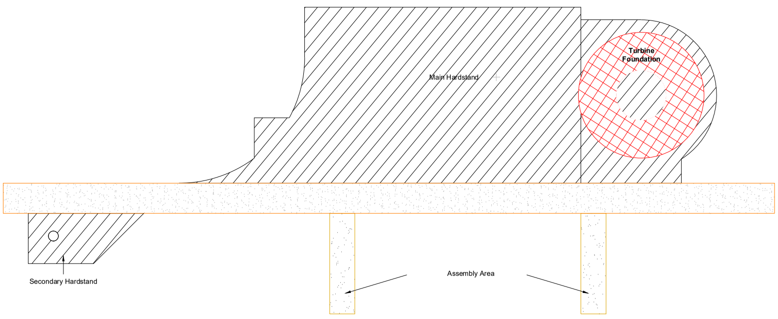
The turbine model to be installed on the Wind Farm Site will have an overall ground-to-blade tip height of 185 metres; blade rotor diameter of 162 metres and hub height of 104 metres. Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics, with only minor cosmetic differences differentiating one from another. The wind turbines that will be installed on the Wind Farm Site will be conventional three-blade turbines, that will be geared to ensure the rotors of all turbines rotate in the same direction at all times.

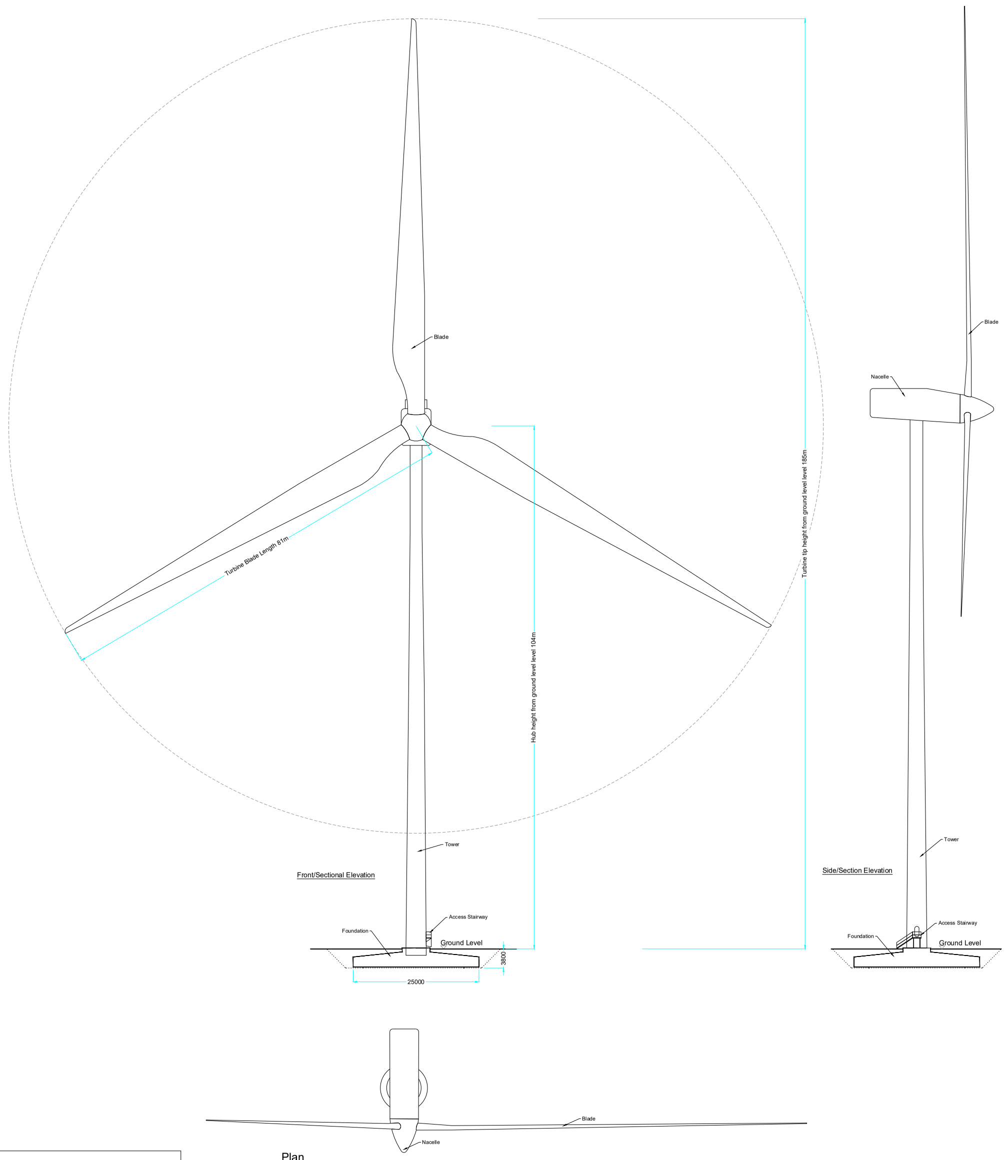
For the purposes of this EIAR, the above turbine dimensions have been selected and considered in the relevant sections of the EIAR. Turbine design parameters have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport and ecology (specifically birds), as addressed elsewhere in this EIAR.

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

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

The individual components of a geared wind turbine nacelle and hub are shown in Figure 4-5 below.





Drawing Notes

1. Proposed wind turbines to have a maximum ground to blade tip height of 185m, blade length of 81m and hub height of 104m
2. Ground level represents the top of turbine foundation.

DRAWING TITLE: **Wind Turbine Hardstanding Elevations & Plan**	
PROJECT TITLE: Umma More Renewable Energy Development, Co. Westmeath	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Ellen Costello**
PROJECT No.: **201050**	DRAWING No.: **Fig 4-4**
SCALE: **1:500 @A1**	DATE: **08.03.2023**

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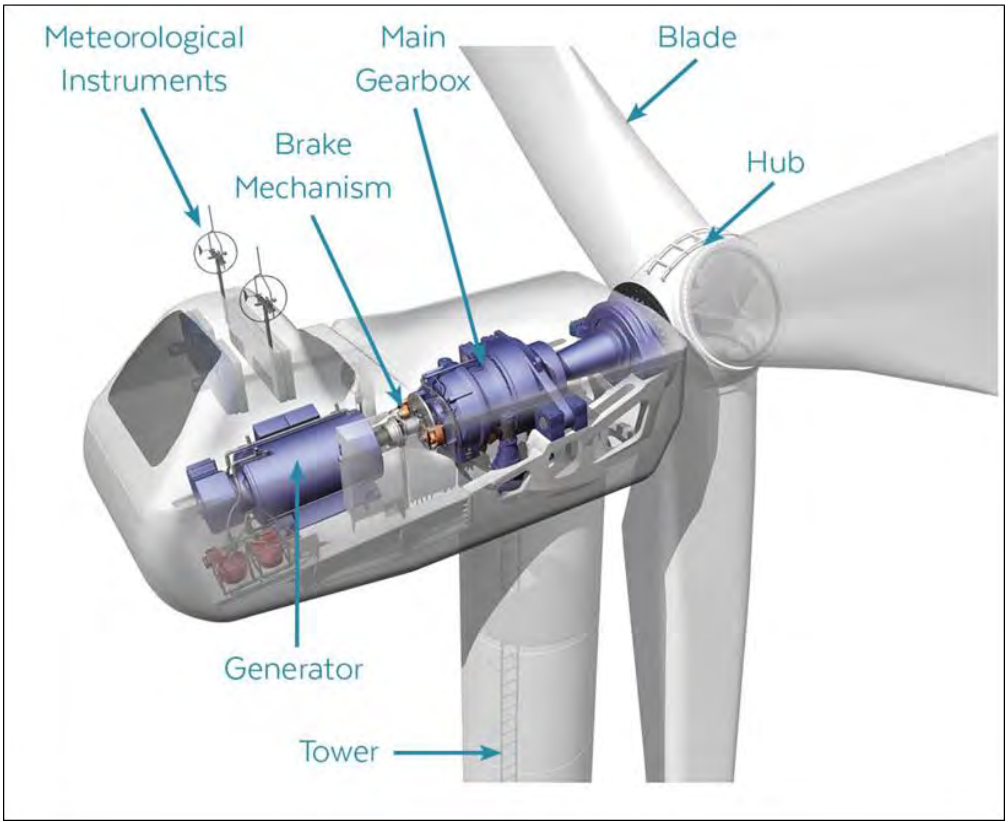


Figure 4-5 Turbine nacelle and-5 hub components

4.3.1.1.3 Turbine Foundations

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

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

Plate 4-2 Turbine 'Anchor Cage' and finished turbine base

4.3.1.1.4 Hard Standing Areas

Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and 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. All crane hardstand areas will be designed taking account of the loadings provided by the turbine manufacturer and will consist of a compacted stone structure. The crane hardstands will be constructed in a similar manner to the excavated site roads and will measure approximately 35m x 75m. The sizes, arrangement and positioning of hard standing areas are dictated by turbine suppliers. The proposed hard standing areas are illustrated in the detailed drawings included in Appendix 4-1 of this report. The extent of the required areas at each turbine location may be optimised on-site depending on topography, position of the Wind Farm Site access road, the proposed turbine position and the turbine supplier's exact requirements

4.3.1.1.5 Assembly Area

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

4.3.1.1.6 Power Output

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

For the purposes of this EIAR, a rated output of 6.2 MW has been chosen to calculate the power output of the proposed 9-turbine renewable energy development, which would result in an estimated installed capacity of 55.8 MW.

Assuming an installed capacity of 55.8 MW, the Proposed Development therefore has the potential to produce up to 171,083 MWh (megawatt hours) of electricity per year, based on the following calculation:

A x B x C = Megawatt Hours of electricity produced per year where: A = ... The number of hours in a year: 8,760 hours

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

C = ... Rated output of the wind turbines: 55.8 MW

The 171,083 MWh of electricity produced by the Proposed Development would be sufficient to supply approximately 40,734 Irish households with electricity per year, based on the average Irish household using 4.2 MWh of electricity[1] (this latest figure is available from the March 2017 CER Review of Typical Consumption Figures Decision Paper).

The 2016 Census of Ireland recorded a total of 31,813 occupied households in Co. Westmeath. Per annum, based on a capacity factor of 35%, the Proposed Development would therefore produce sufficient electricity for the equivalent of over 100% of all households in Co. Westmeath.

4.3.1.2 Site Roads

4.3.1.2.1 *Road Construction Types*

To provide access within the Wind Farm 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;*
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 Wind Farm Site makes use of the existing road network insofar as possible. It is proposed to upgrade approximately 1.1 kilometres of existing site roads and tracks, and to construct approximately 7.4 kilometres of new access road on the Wind Farm Site. It is proposed to construct passing bays along the proposed access road network.

Upgrade of Existing Access Roads or Tracks

The existing tracks onsite were constructed using the excavate and replace construction technique. The general construction methodology for upgrading of existing sections of excavated roads or tracks is summarised below.

1. *Access road construction shall be to the alignment illustrated on the planning application drawings.*
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.*

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

4. *The surface of the existing access track will be overlaid with up to 300mm of selected granular fill.*
5. *Access roads to be finished with a layer of capping material across the full width of the road.*
6. *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 onsite engineer).*
7. *For excavations in spoil, side slopes shall be not greater than 1 (v): 2. This slope inclination will be reviewed during construction, as appropriate.*
8. *The finished road width will be approximately 5m, with localised widening at bends and changes in direction.*
9. *The passing bays will be approximately 5m in width and 40m in length where it meets the road network, tapering to 18m in length at the furthest point from the road.*
10. *On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.*
11. *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.*

Sections of existing road for upgrade are shown in Figure 4-6.

Construction of New Excavated Roads

Due to the ground conditions, new access tracks proposed on the Wind Farm Site are proposed to be founded on competent stratum. The typical make-up of the founded access tracks will be a stone thickness of 500mm. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed by the Site Engineer.

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 surface of the excavated access roads will be overlaid with approximately 500mm of selected granular fill. Granular fill to be placed in layers in accordance with the designer's specification.*
4. *Access roads to be finished with a layer of capping material across the full width of the road.*
5. *A layer of geogrid/geotextile may be required at the surface of the competent stratum.*

Section of a new excavated road is shown in Figure 4-7.

Construction of New Excavated Roads in Site-Specific Flood Modelled Zone

There is 110 metres of proposed access road within site-specific flood modelled 100-yr and 1000-yr zone within the Wind Farm Site. The new access tracks proposed on the Wind Farm Site are proposed to be founded on competent stratum and the track surface will be built up by at least 500mm above the flood modelled elevation of both the 100-yr and 1000-yr site-specific modelled flood events. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed by the Site Engineer.

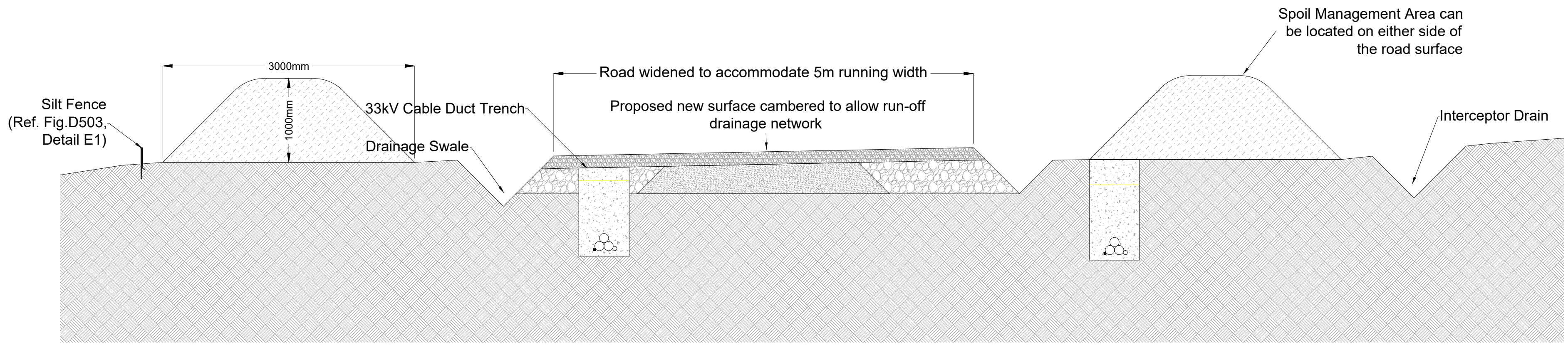
The general construction methodology for construction of excavated roads is summarised below.

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 surface of the excavated access roads will be overlaid with approximately 500mm of selected granular fill which will be at least 500mm above the modelled 100-yr and 100-yr flood elevation (100-yr event - 55.86 mOD, 1000-yr event - 56 mOD).*
4. *There is an existing field drain which will be culverted under the proposed access track. This culvert will provide a drainage outlet for flood water following a significant flood event. This will prevent any damming effect from the proposed access road within this section.*
5. *Granular fill to be placed in layers in accordance with the designer's specification.*
6. *Access roads to be finished with a layer of capping material across the full width of the road.*
7. *A layer of geogrid/geotextile may be required at the surface of the competent stratum.*

Section of a new excavated road in site-specific flood modelled zones is shown in Figure 4-8.

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.

Figure 4-6

DRAWING TITLE: **Existing Road for Upgrade Excavated Road Section**	
PROJECT TITLE: Umma More Renewable Energy Development, Co. Westmeath	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Ellen Costello**
PROJECT No.: **201050**	DRAWING No.: **201050 - 25**
SCALE: **1:50@A3**	DATE: **08.03.2023**

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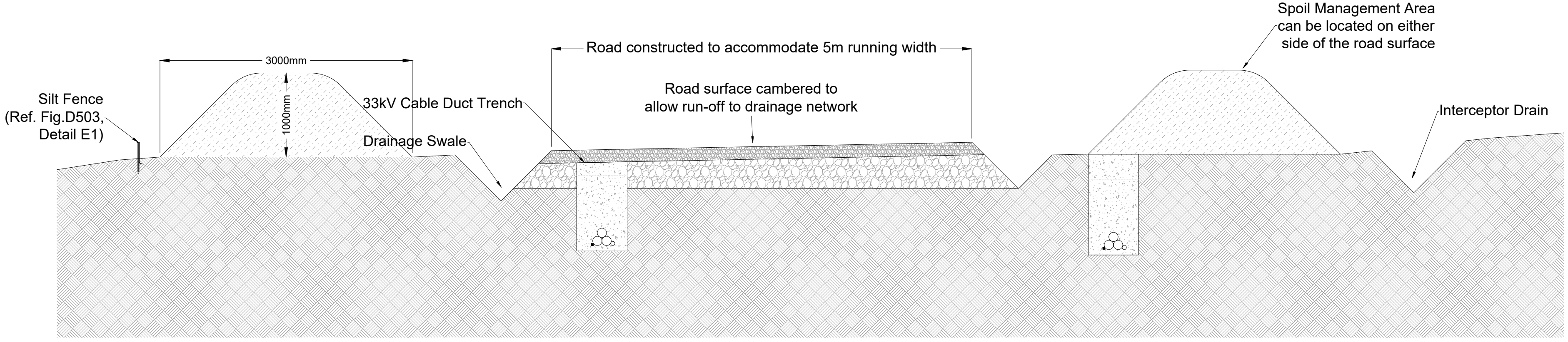
Drawing Notes

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.

Figure 4-7	
DRAWING TITLE: **Proposed New Excavated Road Section**	
PROJECT TITLE: Umma More Renewable Energy Development, Co. Westmeath	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Ellen Costello**
PROJECT No: **201050**	DRAWING No: **201050 - 26**
SCALE: **1:50@A3**	DATE: **08.03.2023**

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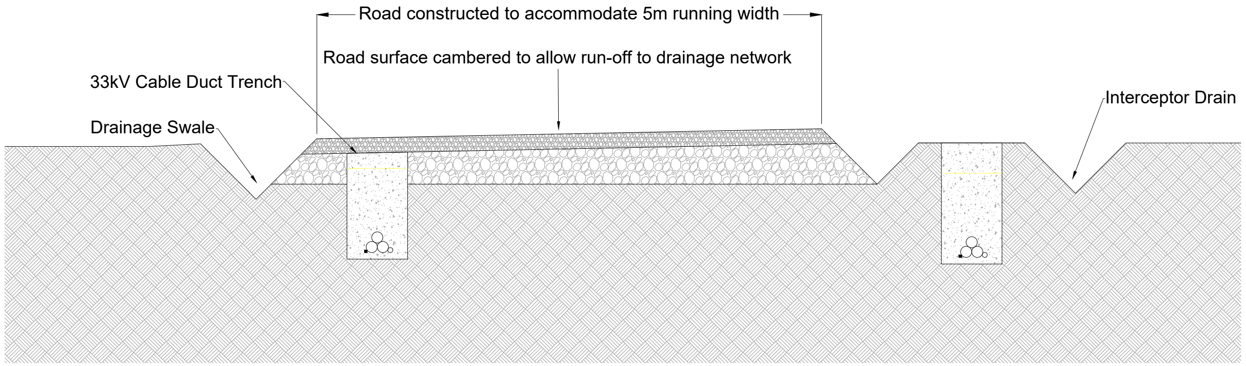
Drawing Notes

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 - Within Modelled Flood Zones

The surface of the excavated access roads will be overlaid with approximately 500mm of selected granular fill which will be at least 500mm above the modelled 100-yr and 100-yr flood elevation (100-yr event - 55.86 mOD, 1000-yr event - 56 mOD).

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

Figure 4-8

DRAWING TITLE:
Excavated road section in Site-Specific Flood Modelled Zones

PROJECT TITLE: Umma More Renewable Energy Development, Co. Westmeath	
DRAWING BY: Joseph O Brien	CHECKED BY: Ellen Costello
PROJECT No: 201050	DRAWING No: 201050 - 27
SCALE: 1:50@A3	DATE: 08.03.2023

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4.3.1.3 Site Underground Electrical (33kV) and Communications Cabling

Each turbine will be connected to the on-site electricity substation via underground 33 kV (kilovolt) electricity cabling. Fibre-optic cables will also connect each wind turbine and the met mast to the onsite substation. The electricity and fibre-optic cabling connecting to the onsite substation compound will be run in cable ducts approximately 1.2 metres beneath ground level, along the sides of roadways or under the roadways. The route of the cable ducts will follow the access track to each turbine location and are illustrated on the site layout drawings included as Appendix 4-1, the exact number and configuration of cable ducting may vary within the cabling trench. Figure 4-9 below shows two variations of a typical cable trench, one for off-road trenches and one for on-road trenches. The cabling may be placed on either side of the roads, on both sides of the road or within the road. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

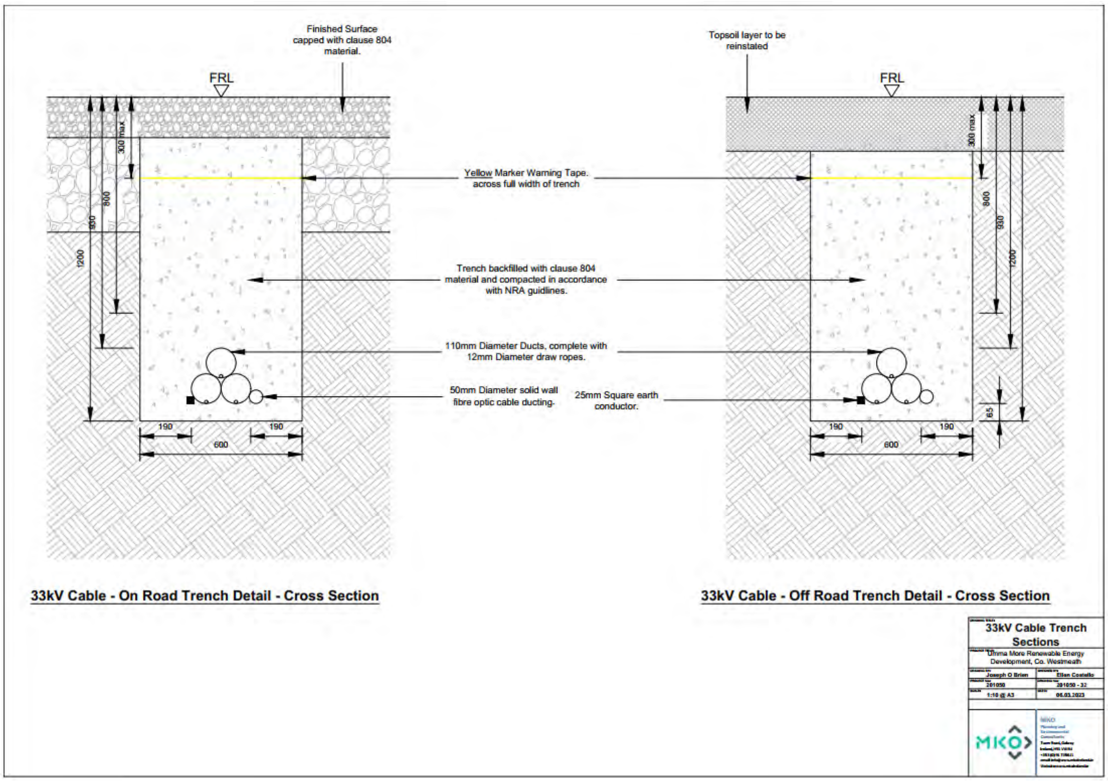
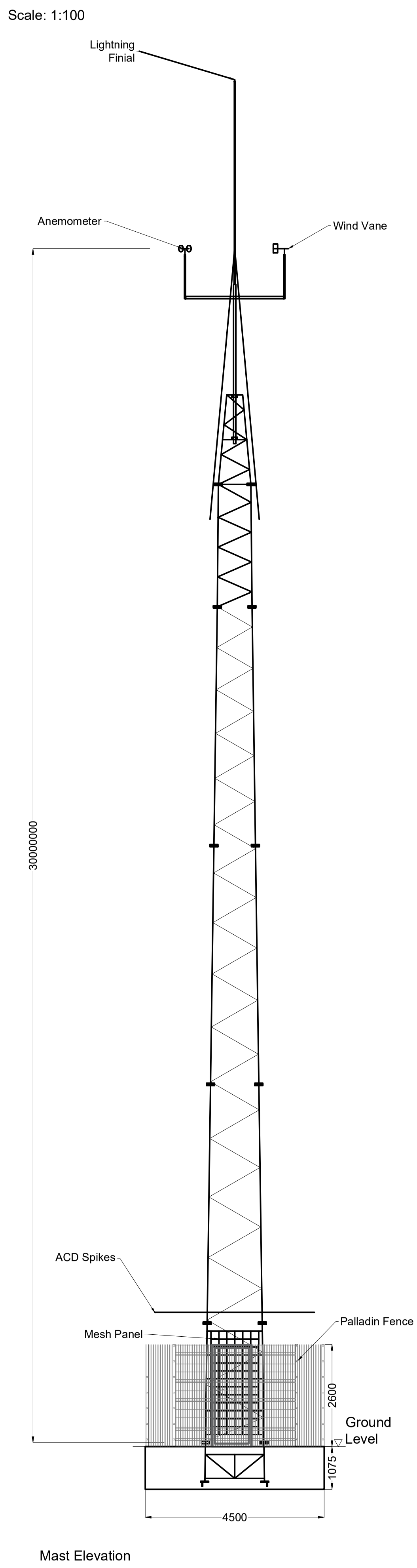


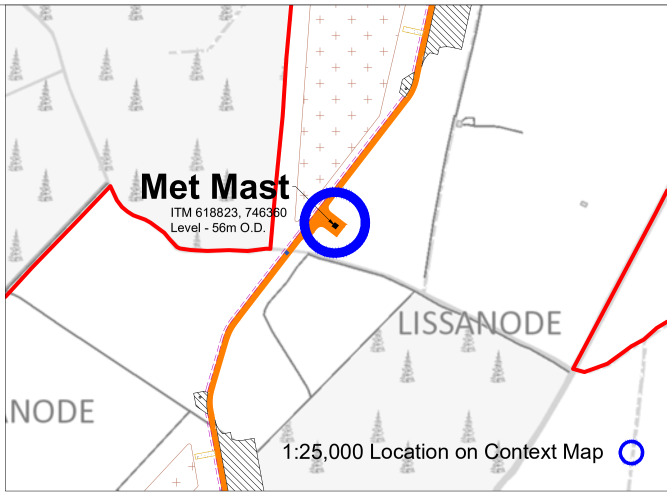
Figure 4-9 Cable trench cross section detail

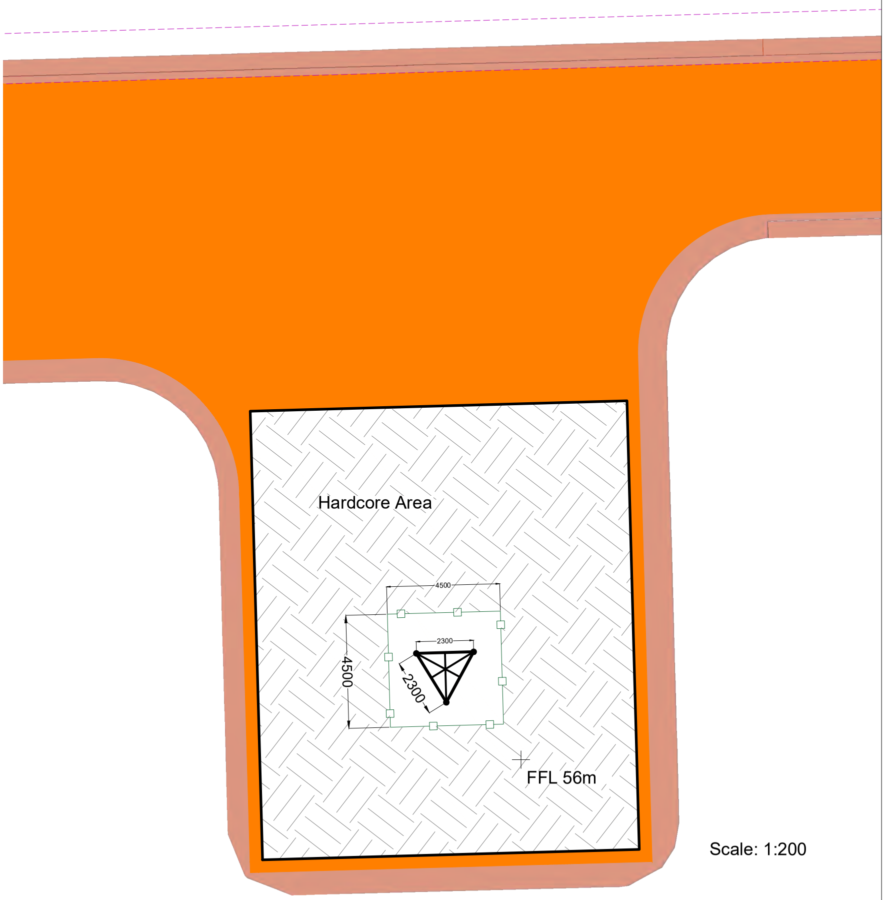
Clay plugs (water flow barrier) will be installed at regular intervals of not greater than 50 metres along the length of the trenches where required to prevent the trenches becoming conduits for runoff water. Backfill material will be compacted in layers with approved engineer's specified material, which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

4.3.1.4 Meteorological Mast

One metrological (met) mast is proposed as part of the Wind Farm Site. The met mast will be equipped with wind monitoring equipment at various heights. The proposed met mast will be located at E618790, N746386 (ITM) as shown on the Wind Farm Site layout drawing in Figure 4-2. 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 4-10.







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

DRAWING TITLE: **Met Mast**	
PROJECT TITLE: **Umma More Renewable Energy Development, Co. Westmeath**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Ellen Costello**
PROJECT No.: **201050**	DRAWING No.: **Fig 4-10**
SCALE: **As shown @ A3**	DATE: **08.03.2023**

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4.3.1.5 Temporary Construction Compound

A temporary construction compound measuring approximately 4,250 square metres in area will be located in the northern section of the Wind Farm Site, adjacent to the proposed new road junction at Turbine No. 1. The location of the proposed construction compound is shown on the Wind Farm Site layout drawing in Figure 4-2. The layout of this construction compound is shown on Figure 4-11.

The construction compound will consist of 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 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 Wind Farm Site.

4.3.1.6 Tree Felling and Replanting

4.3.1.6.1 *Tree Felling*

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

Further details on tree felling required within and around development footprint on the Wind Farm Site is detailed in Chapter 6 of this EIAR.

A small section of the Wind Farm Site is located on commercial forestry, namely Turbine no. 4 and its associated infrastructure. A total of 6.4 hectares of commercial forestry will be permanently felled within and around Turbine No. 4 and its associated infrastructure, along with existing treeline boundaries as detailed in Chapter 6, Section 6.6.3.1.2. Figure 4-12 shows the extent of the commercial forestry to be permanently felled as part of the Proposed Development.

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

4.3.1.6.2 *Forestry Replanting*

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

The estimated 6.4 hectares that will be permanently felled for the footprint of the Proposed Development infrastructure will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that will be issued in respect of the Proposed Development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The replacement of the 6.4 hectares of forestry can occur anywhere in the State subject to licence. The replacement of forestry, felled as part of the Proposed Development, may occur on any lands, within the state, benefitting from Forest Service Technical Approval[2] for afforestation, should the Proposed Development receive planning permission. Under the Forestry Regulations 2017, all applications for licences for afforestation require the prior written approval (technical approval) of the Minister for Agriculture, Food and the Marine. Before the Minister can grant approval, he/she must first determine if the project is likely to have significant effects on the environment (for EIA purposes) and assess if the development, individually or in combination with other plans or projects is likely to have a significant effect on a European site (for Habitats purposes).

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

Note:
Refer to DWG 201050 -30
for Site Office & Staff
Facilities Details

Project Design Drawing Notes

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2. Drawings not to be used for construction/contract conditions.
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4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
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.
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7. Final levels may vary depending on local ground conditions.

Drawing Legend

- Proposed New Road
- Internal Electrical Cabling Trench
- Drains
- Drain 10m Buffer
- Spoil Management Areas (refer to Section 4.3.3.2 of Chapter 4 of EIAR)
- Cut
- Fill

N

Figure 4-11

DRAWING TITLE: **Temporary Construction Compound**	
PROJECT TITLE: **Umma More Renewable Energy Development, Co. Westmeath**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Ellen Costello**
PROJECT No.: **201050**	DRAWING No.: **201050 - 22**
SCALE: **1:500 @ A3**	DATE: **08.03.2023**
OS SHEET No.: 2900, 2901, 2969, 2970	

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Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Development Footprint
- Proposed Felling (6.4ha)

N

Drawing Title: Proposed Commercial Forestry Felling	
Project Title: Umma More Renewable Energy Development	
Drawn By: BT	Checked By: EC
Project No.: 201050	Drawing No.: Figure 4-12
Scale: 1:25,000	Date: 2023-01-31

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4.3.2 Grid Connection

4.3.2.1 Onsite 110 kV Substation

It is proposed to construct a 110 kV electricity substation within the Wind Farm Site, as shown in Figure 4-1, Figure 4-2 and Figure 4-3. The proposed onsite 110kV substation is located within agricultural land and will be accessed via the internal Wind Farm Site proposed road network.

The footprint of the proposed onsite 110kV substation compound measures approximately 11,100 square metres 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 onsite 110kV substation to the national grid. The layouts and elevations of the proposed onsite 110kV substation are shown on Figure 4-13 and 4-14. The construction and exact layout of electrical equipment in the onsite 110kV substation will be to EirGrid / ESB Networks specifications.

Further details regarding the connection between the onsite110kV substation and the national electricity grid are provided in Section 4.3.2.4 below.

The onsite 110kV substation compound will include steel palisade fencing (approximately 2.4 metre high or as otherwise required by ESB), and internal fences will also segregate different areas within the main substation.

4.3.2.2 Wind Farm Control Buildings

Two wind farm control buildings will be located within the substation compound. The Independent Power Provider (IPP) Control Building will measure 20.1 metres by 10.7 metres and 6.9 metres in height. It will be located at the western edge of the substation compound. The Eirgrid Control Building will be located towards the centre of the substation compound and will measure 25 metres by 18 metre and 8.4 metres in height. Layout and elevation drawings of the control buildings are included in Figure 4-15 and Figure 4-16.

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

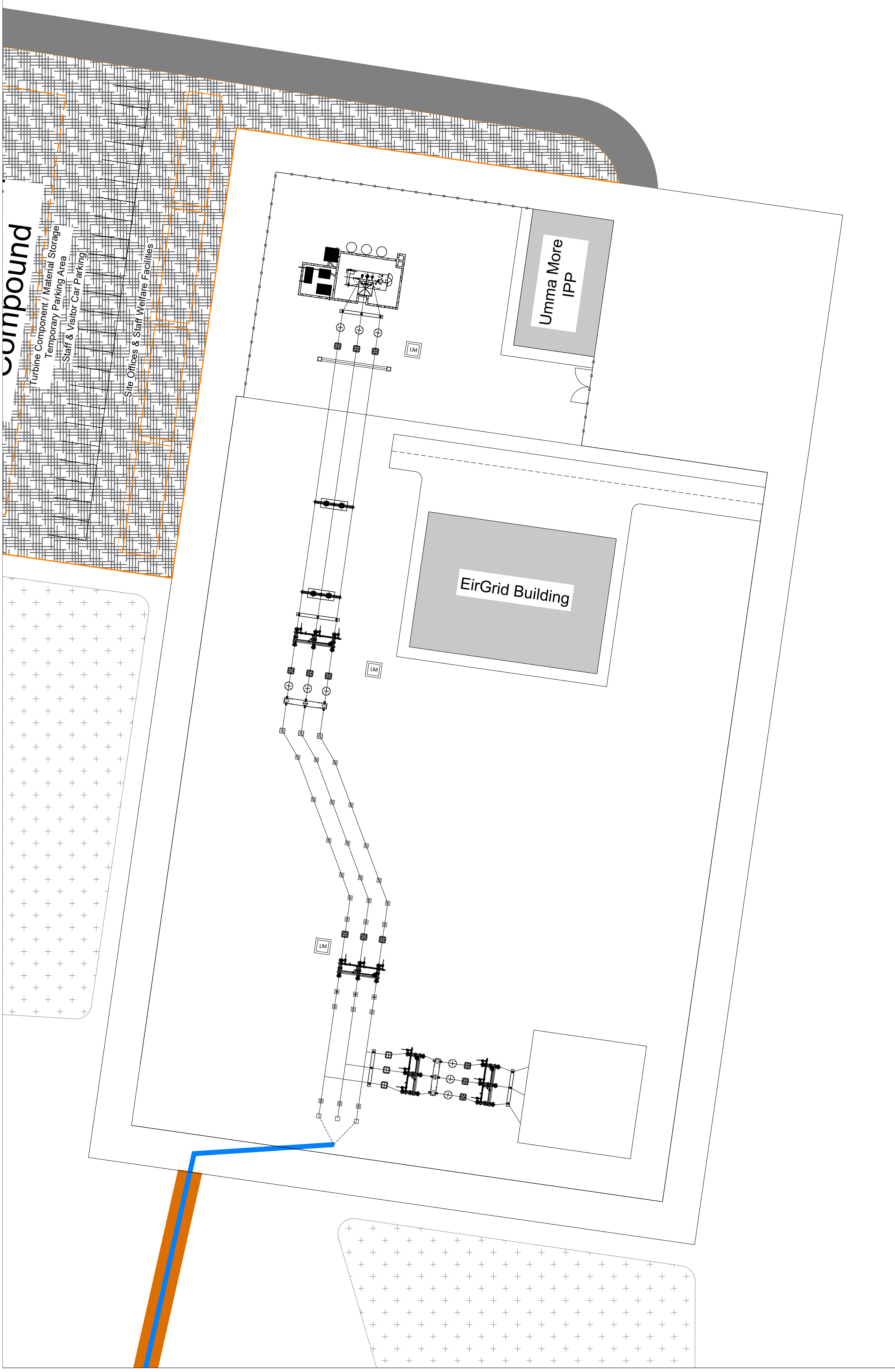
It is not proposed to treat wastewater on site. Wastewater from the staff welfare facilities in the control buildings will be managed by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants.

Such a proposal for managing the wastewater arising on site has become almost standard practice on 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 Wind Farm Site's turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007(as amended), will be employed to transport wastewater away from the Wind Farm Site.

4.3.2.3 Temporary Construction Compound

A temporary construction compound measuring approximately 3,150 square metres in area will be located in the southern section of the Wind Farm Site, located adjacent to the western boundary of proposed onsite substation. This construction compound will consist of 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 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. The location of the proposed construction compound is shown on the Grid Connection layout drawing in Figure 4-3. The layout of this construction compound is shown in Figure 4-17.



DRAWING TITLE: **Onsite 110kV Substation Drawing Layout**	
PROJECT TITLE: Umma More Renewable Energy Development, Co. Westmeath	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **201050**	DRAWING No.: Figure 4-13
SCALE: **1:500 @ A3**	DATE: **06.03.2023**
OS SHEET No.: 2968, 2969, 2970, 2971, 2972, 2973, 3038, 3039, 3040, 3041, 3042, 3043, 3106, 3107, 3108, 3109, 3110, 3111, 3172, 3173, 3174, 3175, 3176, 3177, 3238, 3239, 3240, 3241, 3242, 3243, 3303, 3304, 3305, 3306, 3307, 3308, 3366, 3367, 3368, 3369, 3370, 3371, 3429, 3430, 3431, 3432, 3433, 3434	

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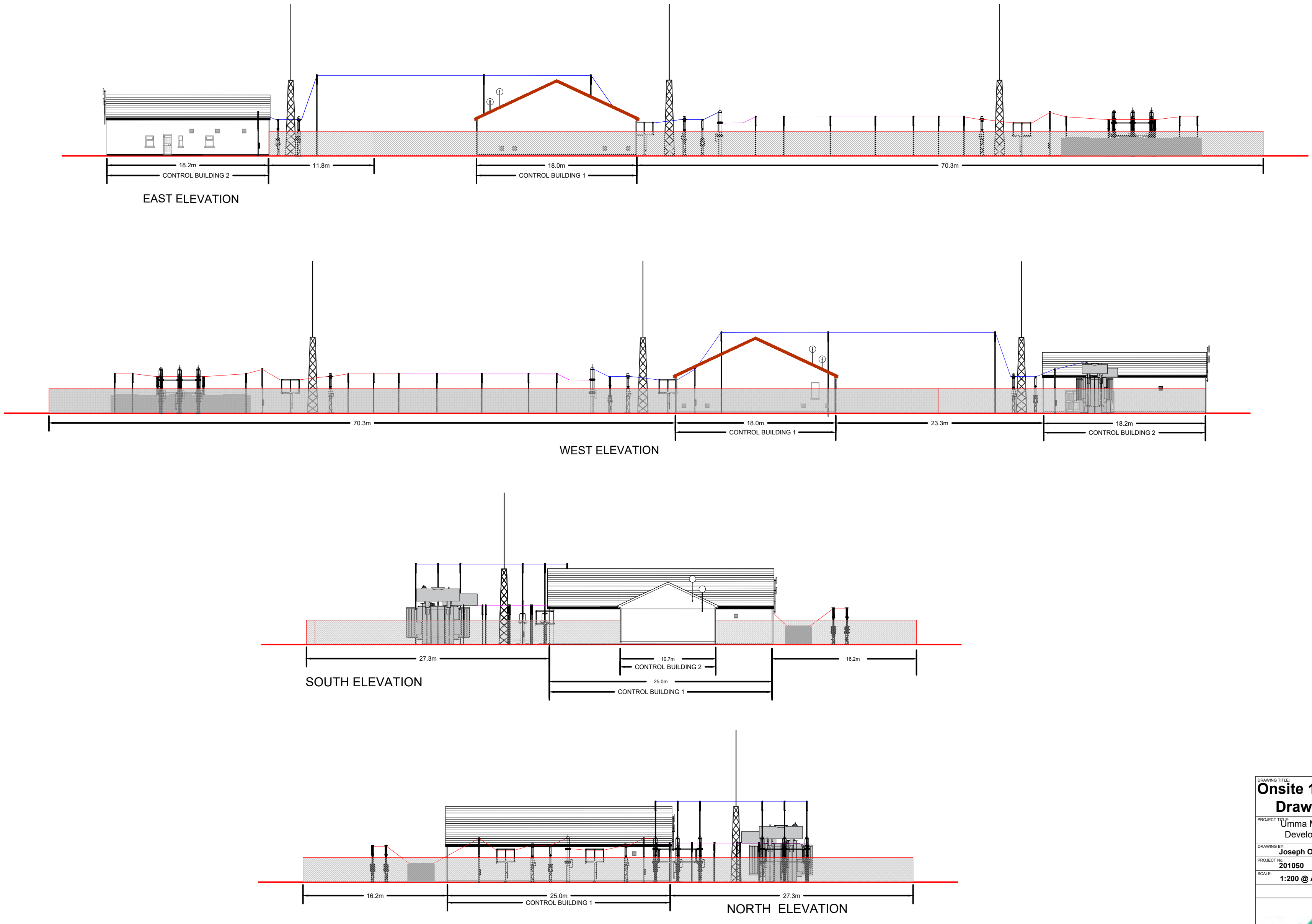

DRAWING TITLE:
Onsite 110kV Substation Drawing Elevations

PROJECT TITLE:
Umma More Renewable Energy Development, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **201050**	DRAWING No.: **Figure 4-14**
SCALE: **1:200 @ A1**	DATE: **02.03.2023**

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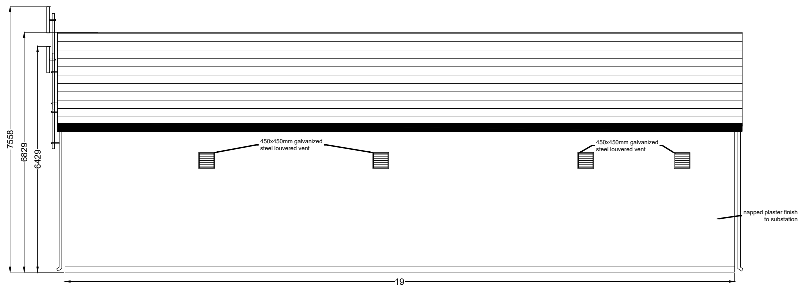
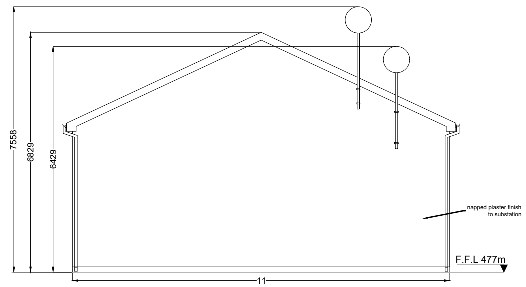
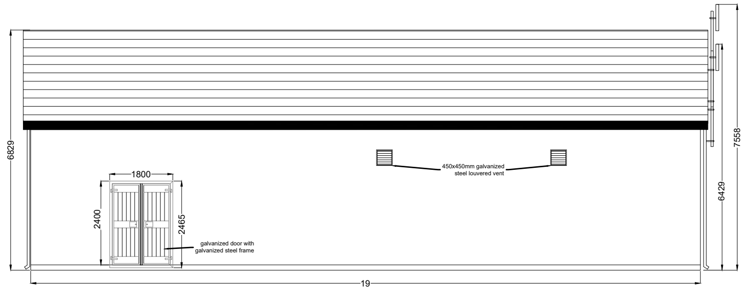


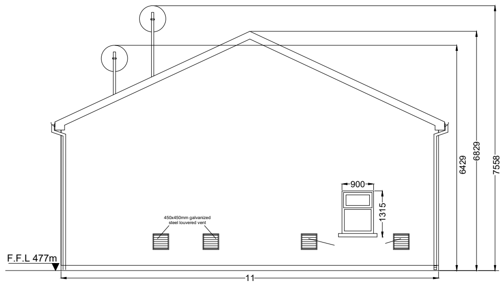
North Elevation



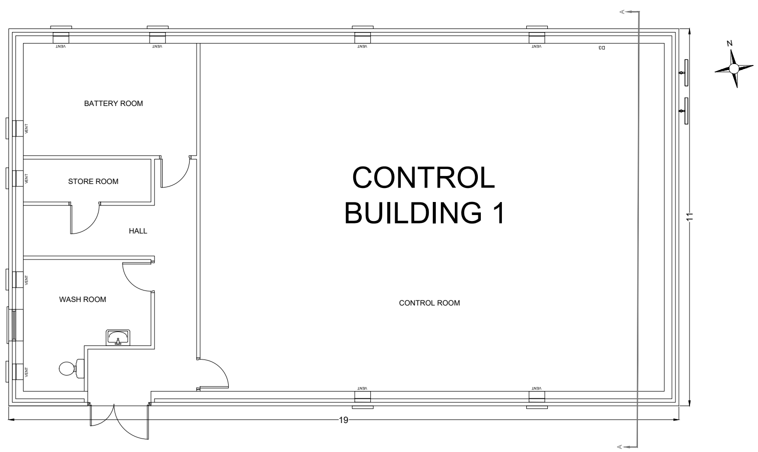
East Elevation

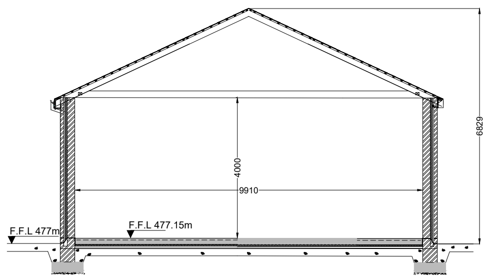


South Elevation



West Elevation





SECTION A-A

DRAWING TITLE: **Control Building 1 Elevations & Section**	
PROJECT TITLE: **Umma More Renewable Energy Development, Co. Westmeath**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **201050**	DRAWING No.: **Fig 4-15**
SCALE: **1:100 @ A2**	DATE: **08.03.2023**

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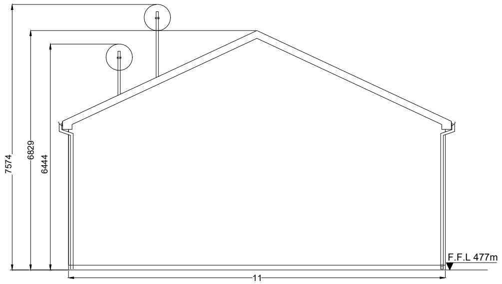
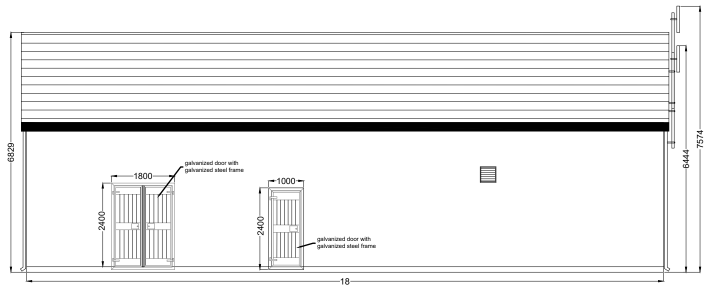
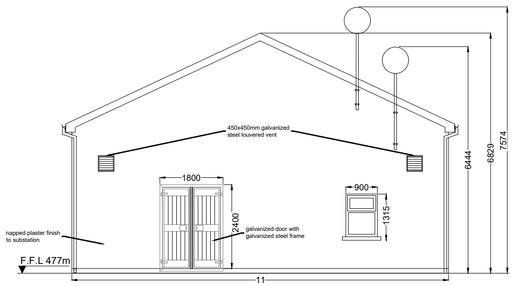


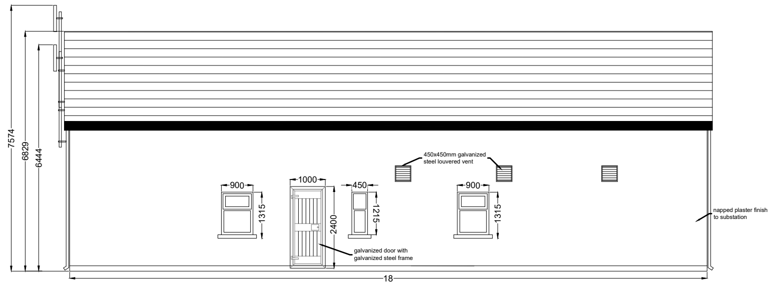
North Elevation



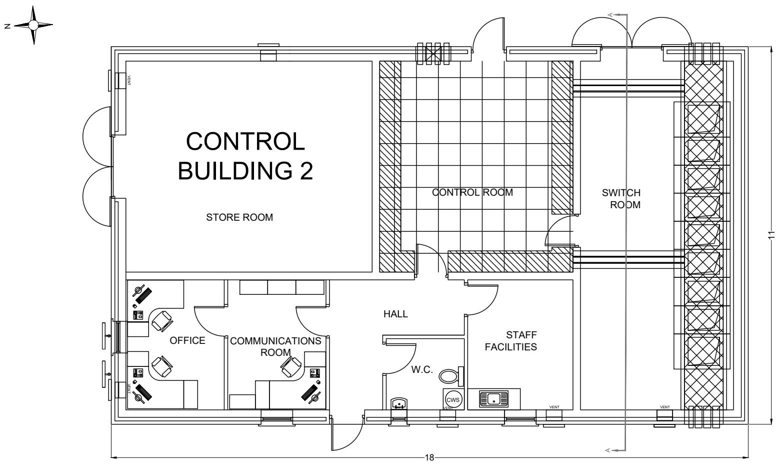
West Elevation

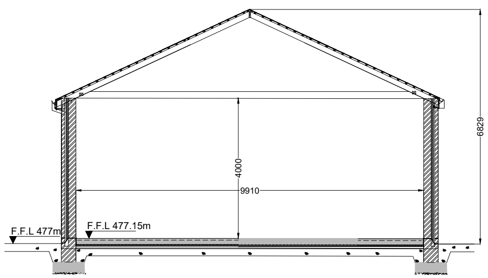


South Elevation



East Elevation





SECTION A-A

DRAWING TITLE: **Control Building 2 Elevations & Section**	
PROJECT TITLE: **Umma More Renewable Energy Development, Co. Westmeath**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **201050**	DRAWING No.: **Fig 4-16**
SCALE: **1:100 @ A2**	DATE: **08.03.2023**

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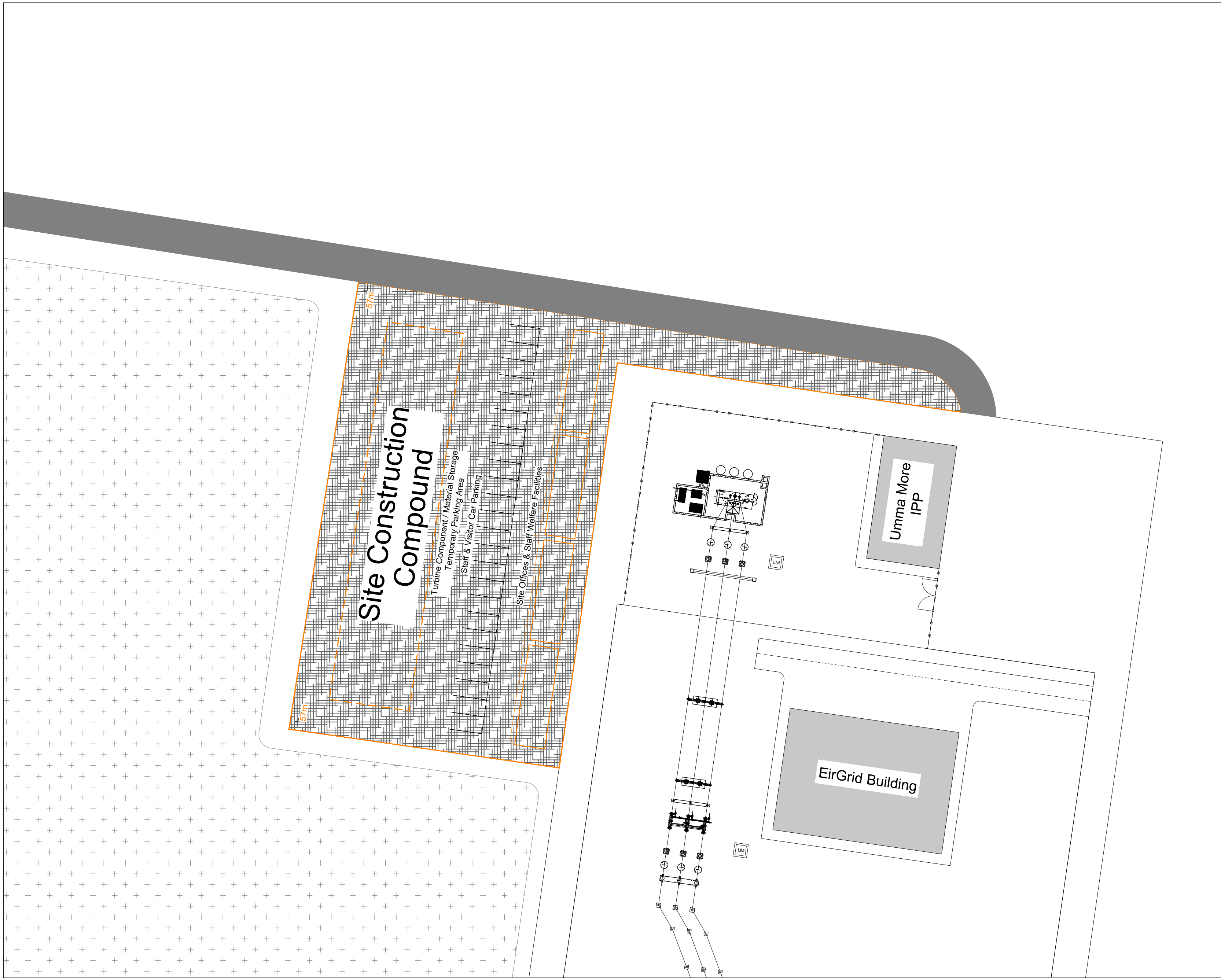

DRAWING TITLE:

Temporary Construction Compound for Grid Connection

PROJECT TITLE: Umma More Renewable Energy Development, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **201050**	DRAWING No.: **Figure 4-17**
SCALE: **1:500 @ A3**	DATE: **02.03.2023**
OS SHEET No.: **2900, 2901, 2969, 2970**	

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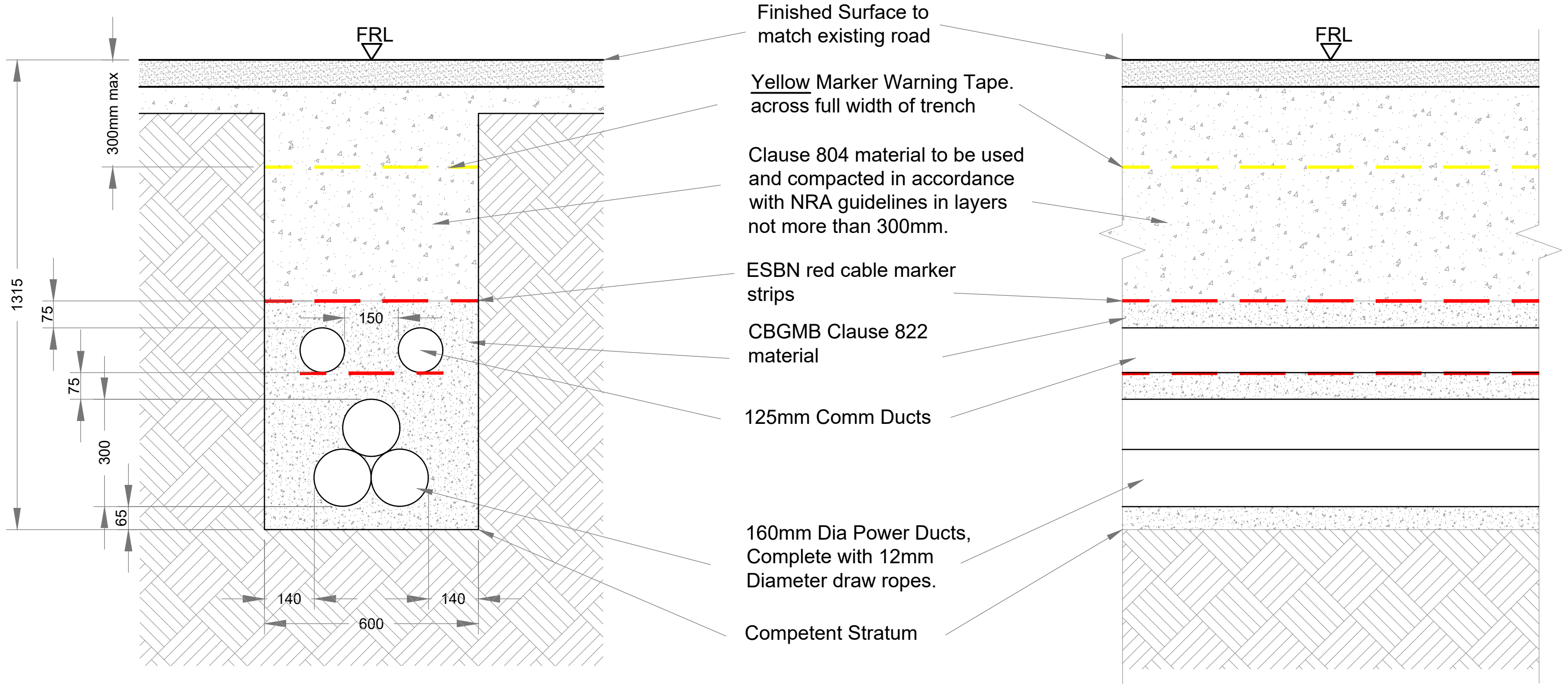
4.3.2.4 Underground Electrical Cabling Route

It is proposed to construct an onsite 110 kV substation within the Wind Farm Site and to connect from here via a 110 kV underground electrical cable connection to the existing 110 kV Thornsberry substation in near Tullamore, Co. Offaly. The underground electrical cabling route originates at the proposed onsite 110kV substation within the Wind Farm Site and before reaching the 110kV Thornsberry substation property and is illustrated in Figure 4-3. The underground electrical cabling route is approximately 31km in length and is located primarily within the public road corridor, with a short section of underground cabling (approximately 0.2km) within an agricultural field within the Wind Farm Site.

The underground electrical cabling route will originate at the proposed onsite substation and run south for 0.2km within an agricultural field within the Wind Farm Site before meeting the local public road L5336 in the townland of Umma More. The underground electrical cabling route will continue south-west along local roads for approx. 10.4km before joining the R446, in the townland of Newtown. The underground electrical cabling route will continue east along the R446 for approx. 8.4km and continues south onto the R436 at the western boundary of the town of Kilbeggan, in the townland of Kilbeggan. The underground electrical cabling route will continue south along the R436 for 0.2km before continuing east on to the L5213 local road in a residential housing estate (Meadow Park, Co. Westmeath) in the townland of Meadowpark for approx. 0.1km before reaching the River Brosna. As detailed in Section 4.7.7.4 below, the cable ducts for the underground electrical cabling route will be installed under this watercourse via directional drilling (DD), the methodology of which is detailed in Section 4.7.7.4.4 below. This crossing methodology for the River Brosna (identified as Grid Connection underground electrical cabling trench watercourse crossing no. 7) will ensure that no contact will be made with the watercourse during the works. Once the River Brosna is crossed, the underground electrical cabling route will continue east into a residential housing estate (Brosna Park, Co. Westmeath) along the L52084 and L52085 in the townland of Kilbeggan for 0.2 km. The underground electrical cabling route will continue south along the L5208 for 0.8km before reaching a footpath that runs adjacent to the M6 motorway in the townland of Kilbeggan and Kilbeggan South. The underground electrical cabling route will continue under the M6 via a footpath that joins local roads north and south of the M6 for approx. 0.4km, the underground electrical cabling route will continue along the local road for 1km before continuing onto the N52 in the townland of Hallsfarm. The underground electrical cabling route will continue south along the N52 for approx. 7.9km until it meets the Ardan roundabout at Tullamore. The underground electrical cabling route meets the local road off the roundabout and will continue along the local roads for approx. 1.4km before entering the 110kV Thornsberry substation property and connecting into the substation compound.

The methodology for construction of the Grid Connection underground electrical component of the Proposed Development is presented in Section 4.7.7 below. The underground electrical cabling route is illustrated in Figure 4-1 and 4-3. 110kV grid connection cabling trench cross sections are shown in Figure 4-18. Further details in relation to the Grid Connection for the Proposed Development are outlined in Sections 4.7.5 – 4.7.7 below.



Standard 110kV Trench Detail

SCALE 1:20

Note:
ALL DIMENSIONS TO BE CHECKED ON SITE AND ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER. FIGURED DIMENSIONS ONLY TO BE USED. DRAWINGS NOT TO BE SCALED.

Enerco Energy

Project:
Umma More

Drawing:
110kV Trench Detail

Drawn By:	Checked By:	Drawing No.
NG	WOC	Figure 4-18
Scale: As Shown @ A3		

4.3.3 Spoil Management Plan

4.3.3.1 Quantities

The quantity of spoil, requiring management on the site of the Proposed Development has been calculated, as presented in Table 4-2 below.

Table 4-2 Spoil Volumes requiring management

Development Component	Area (m2) (approx.)	Spoil Volume(m3) (approx.)
Wind Farm Site		
9 no. Turbines and Hardstanding Areas	32,150	50,400
Access Roads	61,250	24,500
Meteorological Mast	375	150
Temporary Construction Compound	4,250	1,700
Total		**76,750**
Grid Connection		
Onsite Substation	12,000	12,000
Temporary Construction Compound	3,150	1,300
Cabling Trench	18,600	22,320
Total		**35,620**
Total Spoil to be managed		**112,370**

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.

4.3.3.2 Spoil Management Areas and Placement of Spoil Alongside Access Roads

It is proposed to manage any excess overburden generated through construction activities locally within the Wind Farm Site, in identified spoil management areas, as shown in Figure 4-19, and in linear berms along access roads where appropriate, as detailed in Section 4.3.1.2.1. The total capacity of the spoil management areas within the Wind Farm Site is 127,500m^3, providing enough capacity for the total volume of spoil requiring management for the Proposed Development as detailed in Table 4-2 above.

The spoil management areas and placement of spoil alongside access roads 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: Water.

The following recommendations/best practice guidelines for the placement of spoil in identified spoil management areas and alongside access roads will be adhered to during the construction of the Proposed Development:

1. Placement of spoil alongside access roads will consist of a 3m wide berm on either side of the road as appropriate. Spoil placement alongside access roads will take place outside of watercourse buffers and of the site-specific flood modelled zone within the Wind Farm Site (a 110m section of access road) as detailed in Section 9.3.5 in Chapter 9 of this EIAR.
2. 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.
3. 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.
4. In the case of T04 where spoil management areas will be within areas of felled forestry, no topsoil will be excavated. The tree stumps will be left in-situ and the spoil will be placed on top of the existing ground and finished with a layer of topsoil from within the site.
5. The placement of spoil will be restricted to a maximum height of 1.0m, subject to confirmation by the Geotechnical Engineer.
6. Where practical, it will be ensured that 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.
7. 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.
8. 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.
9. An interceptor drain will be installed upslope of the identified spoil management areas to divert any surface water away from these areas.
10. 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.
11. 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.
12. 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 Wind Farm Site are shown in Figure 4-19, along with section drawings of the spoil management areas shown in Figure 4-20.

As detailed above in Table 4-2, the spoil volume requiring management for the Grid Connection underground electrical cabling route has been taken account in the total spoil volume requiring management for the Proposed Development. As detailed above, there is capacity for the total volume of spoil requiring management for the Proposed Development in the spoil management areas within the Wind Farm Site. However, 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 and the distance from the underground electrical cabling route to the Wind Farm Site, the main contractor will determine the appropriate location for management of arisings from the Grid Connection underground electrical cabling route.

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Development Footprint
- Spoil Management Areas

Drawing Title: Spoil Management Areas within the Wind Farm Site	
Project Title: Umma More Renewable Energy Development	
Drawn By: BT	Checked By: EC
Project No.: 201050	Drawing No.: Figure 4-19
Scale: 1:17,500	Date: 2023-02-02

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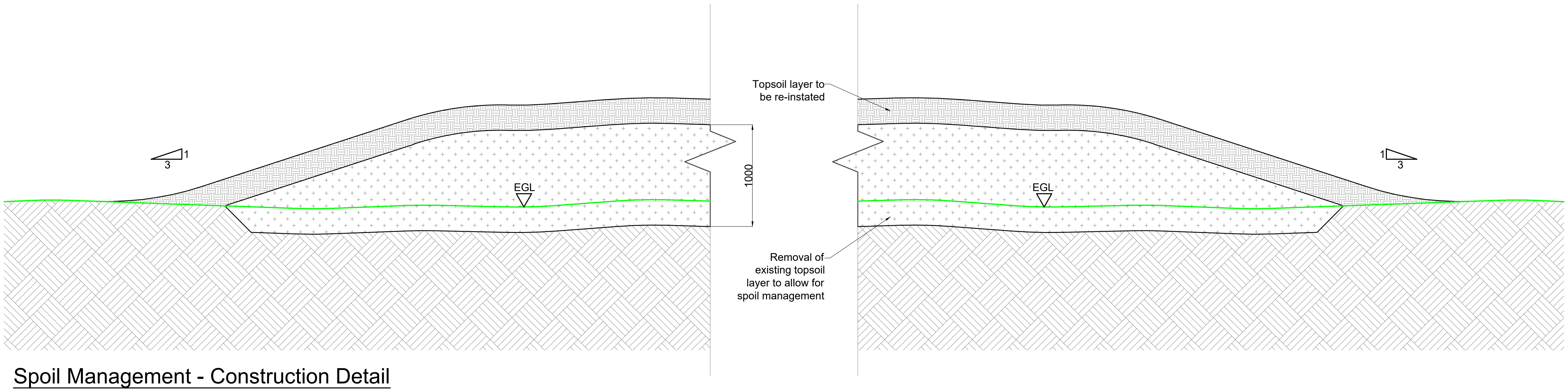
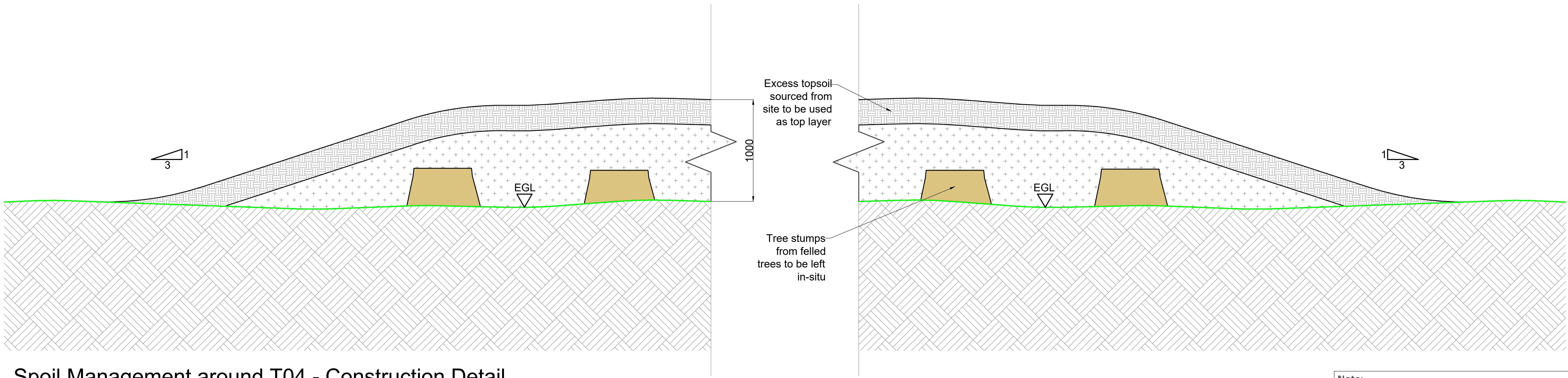


Spoil Management - Construction Detail

Scale 1:40



Spoil Management around T04 - Construction Detail

Scale 1:40

Note:
ALL DIMENSIONS TO BE CHECKED ON SITE AND ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER.
FIGURED DIMENSIONS ONLY TO BE USED.
DRAWINGS NOT TO BE SCALED.

Project:
Umma More

Drawing:
Spoil Management Methodology

Drawn By:	Checked By:	Drawing No.
NG	WOC	Figure 4-20
Scale: As Shown @ A3		

4.3.4 Site Activities

4.3.4.1 Environmental Management

All proposed activities on the site of the Proposed Development will be provided for in an environmental management plan. A Construction and Environmental Management Plan (CEMP) has been prepared for the Proposed Development and is included in Appendix 4-2 of this EIAR.

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

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

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

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

4.3.4.2 Concrete Deliveries

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

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

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

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

Plate 4-3 Concrete washout area

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

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

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

4.3.4.3 Concrete Pouring

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

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

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

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

4.3.4.4 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/settlement ponds in the Wind Farm Site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and temporary construction compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.

4.3.4.5 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 Development because 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 Development.

4.3.4.6 Waste Management

The CEMP, Appendix 4-2 of this EIAR, provides a waste management plan (WMP) which outlines the best practice procedures during the construction phase of the project. The WMP outlines the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of the Proposed Development. Disposal of waste will be a last resort.

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

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

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

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

4.4 Access and Transportation

4.4.1 Site Entrance

It is proposed to access the Wind Farm Site via an existing agricultural site entrance off the L5363 local road to the west of the Wind Farm Site. This entrance will be widened to facilitate the delivery of the construction materials and turbine components. The Wind Farm Site entrance was subject to Autotrack assessment to identify the turning area required, as described in Section 14.1 of the Traffic and Transport Assessment. Appropriate sightlines will be established to the north and south of the proposed Wind Farm Site entrance for the safe egress of traffic. The proposed works will result in a permanent upgrade of this current Wind Farm Site access from the L5363 local road, which will also form the site entrance to the Wind Farm Site during the operational phase.

It is proposed to access the onsite 110 kV substation which forms part of the Grid Connection through the internal Wind Farm Site road network.

The location of Wind Farm Site access is shown in Figure 4-21. A Traffic Management Plan is included in the CEMP in Appendix 4-2 of this EIAR. In the event planning permission is granted for the Proposed Development, the final Traffic Management Plan will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned.

4.4.2 Turbine and Construction Materials Transport Route

It is proposed that large wind turbine components will be delivered to the Wind Farm Site, from Galway Port, via the M6 National Road (other ports such as Shannon Port or Dublin Port could also be used). The proposed turbine transport route from Galway Port via the M6 National Road, N6, N55 and R390 to the Wind Farm Site is shown on Figure 4-22. From Galway Port in Galway City , the turbines will be transported via the M6 and N6 at Athlone, turning northeast along the N55 for approximately 2.7km, before turning east onto the R390 Regional Road. The route continues along the R390 Regional Road for 13.5km before turning south onto the L5363 local road where the route continues south along this road for approximately 1km before turning east into the Wind Farm Site entrance.

Construction materials such as concrete, steel and construction materials will follow the same transport route as the wind turbines from the National Road network to the Wind Farm Site, along with three additional potential routes as detailed in Section 4.4.2.1 below.

All deliveries of turbine components and other construction materials to the Site will only be via the proposed transport routes outlined in Figure 4-23. No other public road route will be used as part of the construction phase of the Wind Farm Site for the transport of materials.

Due to the nature of the Grid Connection underground electrical cabling route, the proposed works will be transient in nature along the public road network in which the underground electrical cabling route is proposed. As such, deliveries of construction materials will utilise the surrounding road network along the underground electrical cabling route as it moves along the public road network in which it's proposed.

The number of construction vehicles that will be generated during the construction phase of the Proposed Development is outlined as part of the traffic and transport assessment in Section 14.1 of this EIAR.

4.4.2.1 Deliveries of Stone and Ready-Mix Concrete from Quarries

In order to facilitate the construction of the Proposed Development, the majority of all rock and hardcore material that will be required during the construction will be sourced from local, appropriately authorised quarries. The quarries that could potentially provide stone and concrete for the Proposed Development are as follows;

1. *Midlands Stone Company Ltd. – Stone,*
2. *Master Stonemasons, Athlone – Stone,*
3. *Roadstone, Tullamore – Stone,*
4. *Spollen Concrete, Glasson – Concrete,*
5. *John Gannon Concrete Ltd. – Concrete*

The locations of these quarries and ready-mixed concrete (RMC) batching plants together with the proposed routes to the Wind Farm Site are shown in Figure 4-23. The potential routes for general construction materials for the purposes of this assessment, is as per the access routes considered for the turbine plant traffic with the additional following routes:

- M6 from the east,
- N55 from the south, and,
- the R390 from the east.

Deliveries of stone and ready-mix concrete for use in construction of the Proposed Development, are discussed in further detail in Chapter 14 of this EIAR.

4.4.2.2 Turbine Delivery Route Accommodation Works

Works such as road widening are sometimes required along proposed turbine transport routes to accommodate the large vehicles used to transport turbine components to wind farm sites. The proposed transport route for the Proposed Development has been the subject of a route assessment to determine if any works are required along its length. Full details of the assessment are included as part of the traffic impact assessment set out in Section 14.1.8 of this EIAR and summarised below. There are sections on the route where the vertical alignment may require specialist transport vehicles. These sections will be further considered by the appointed transport company following turbine procurement process. Accommodation works will be required at various locations on the national and regional road network between the port of arrival in Galway and the Wind Farm Site. These will be limited to temporary measures including temporary local road widening, overruns of roundabout island and temporary relocation of some signs and street furniture.

The proposed turbine delivery route is shown in Figure 4-22 and further detailed below.

Locations in Galway City

A swept path analysis was undertaken for the section of the turbine delivery route in Galway City between the Galway Harbour and the N6 national route which becomes the M6 Motorway. These locations are as follows;

- Galway City Location 1 – R339 signalised junction at Thermo King,
- Galway City Location 2 – R336 Tuam Road junction at Trappers Inn, and,
- N17 / N6 Bothar na dTreabh junction.

A swept path analysis was undertaken using Autotrack for the blade and tower transporter vehicles, and while traffic lights and street furniture will require to be removed during the delivery of the large plant, the assessment indicates that the large turbine delivery vehicles will be accommodated at these locations.

Location 1 – M6 Junction 10 left slip / N55 junction in Athlone

The preliminary swept path analysis indicates that the wind farm blade vehicle will require a shortened wheel base with an extended blade overhang to the rear (increased from a standard 10m to 18m) in order to negotiate this bend junction with minor temporary alterations to the existing streetscape.

Location 2 – N55 / R916 Cornamaddy Roundabout

Minor temporary alterations will be required to the existing streetscape and roundabout island during the delivery of the abnormally sized loads.

Location 3 – N55 / R390 Junction in Athlone

The preliminary swept path analysis indicates that the wind farm blade vehicle will require a shortened wheel base with an extended blade overhang to the rear (increased from a standard 10m to 18m) in order to negotiate this bend junction with minor temporary alterations to the existing streetscape.

Location 4 – Bend on R390 at Coolteen

The preliminary swept path analysis indicates that the wind farm blade vehicle will be accommodated at this location.

Location 5 – Bends on R390 at Beechlawn

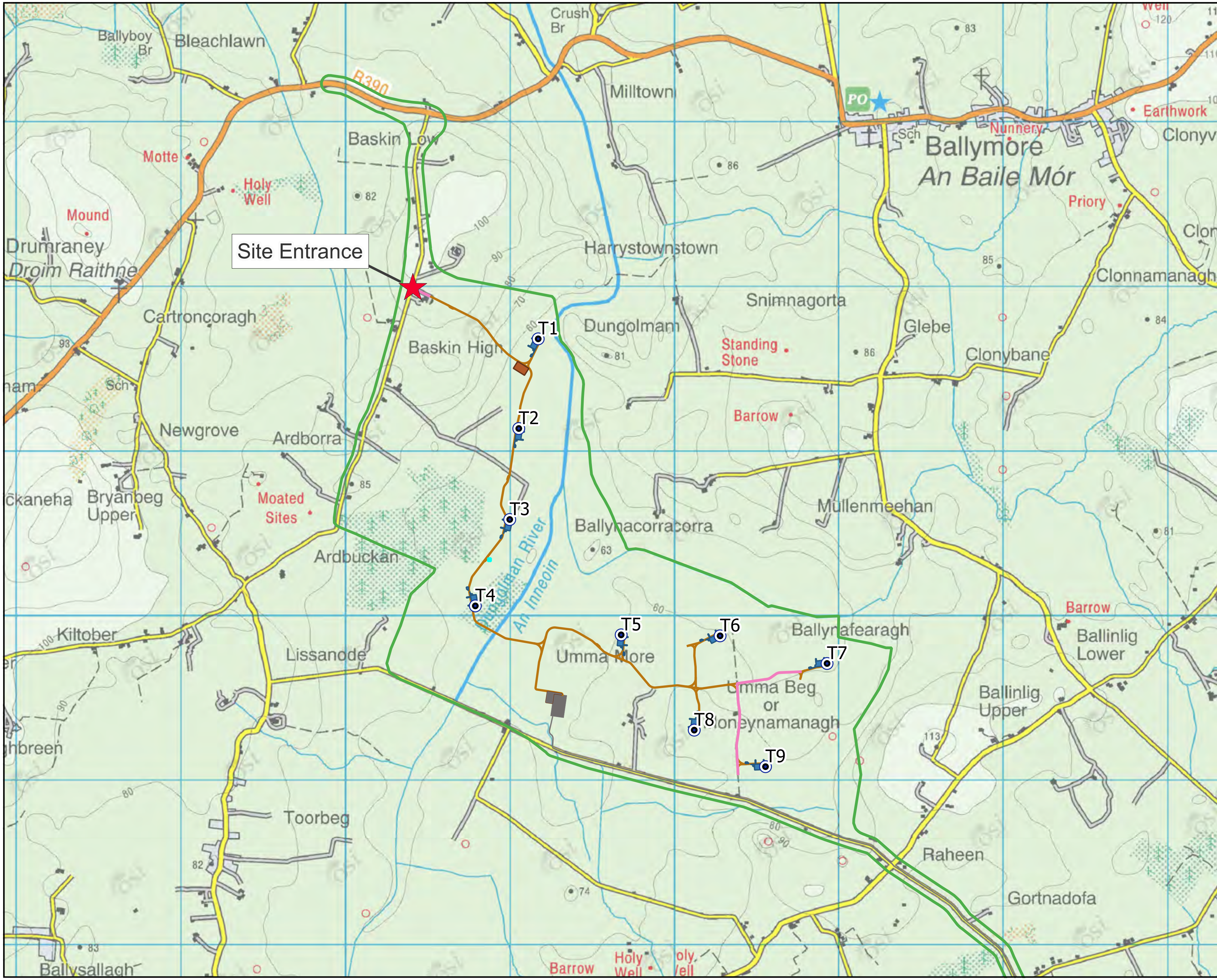
The preliminary swept path analysis indicates that the wind farm blade vehicle will be accommodated at this location. Location 6 – R390 / L5363 Junction

Location 6 – R390 / L5363 Junction

The preliminary swept path analysis indicates that a temporary road will be required at this junction in order to accommodate the wind turbine vehicles.

Location 7 – Access junction on L5363

The preliminary swept path analysis indicates that a temporary road and visibility splays will be required at this junction in order to accommodate the wind turbine vehicles.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstands
- Proposed Met Mast
- Proposed New Roads
- Proposed Upgrades to Existing Roads
- Proposed Temporary Construction Compound
- Grid Connection - Subject to a Separate Application

Drawing Title	Wind Farm Site Access Location
Project Title	Umma More Renewable Energy Development
Drawn By: BT	Checked By: EC
Project No.: 201050	Drawing No.: Figure 4-21
Scale: 1:30,000	Date: 2023-02-07

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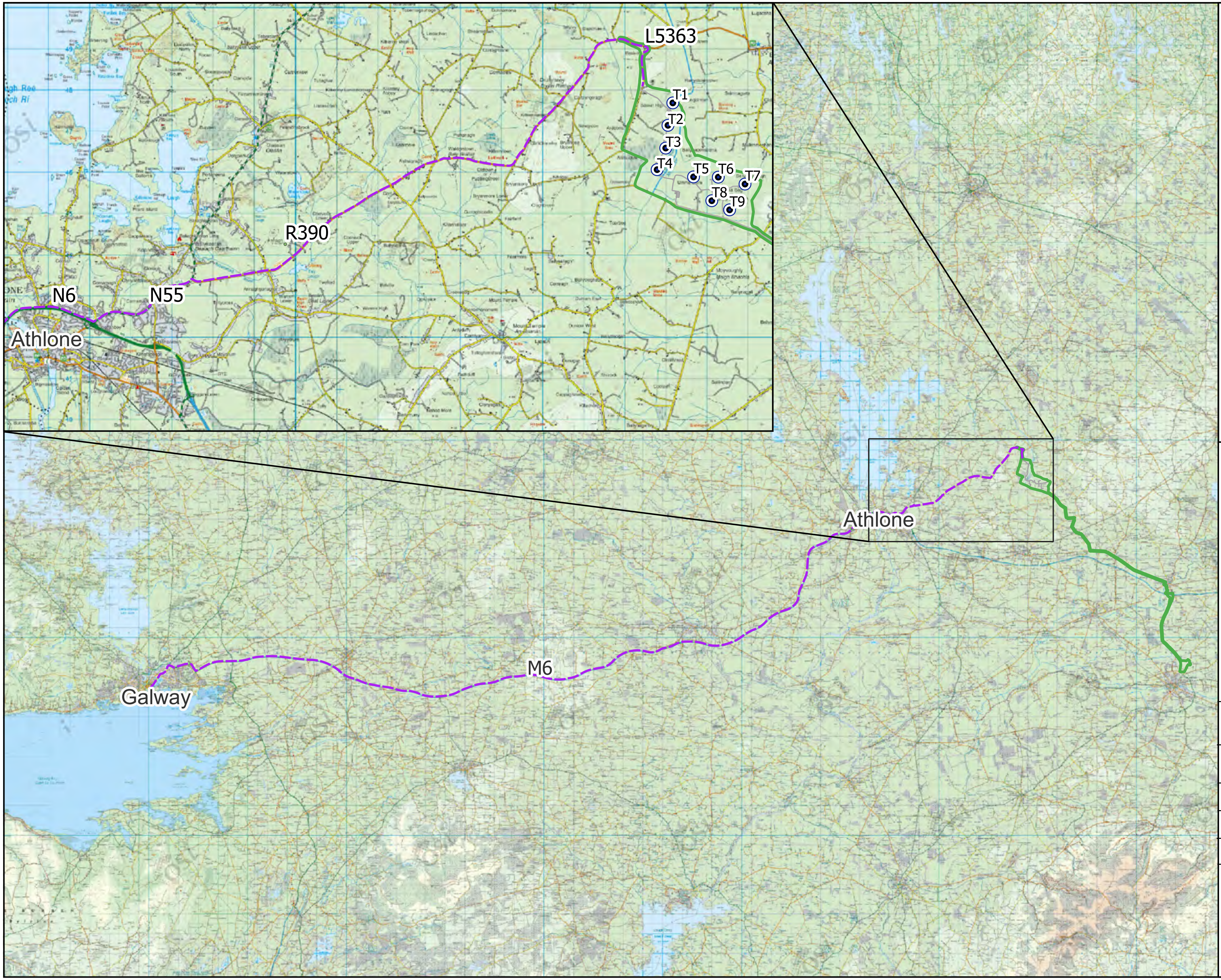

Map Legend

EIAR Site Boundary

Proposed Turbine Delivery Route

Proposed Turbine Layout

Proposed Development Footprint

Drawing Title
Turbine Delivery Route and Construction Haul Route

Project Title
Umma More Renewable Energy Development

Drawn By	Checked By
BT	EC
Project No. 201050	Drawing No. Figure 4-22
Scale 1:500,000	Date 2023-02-01

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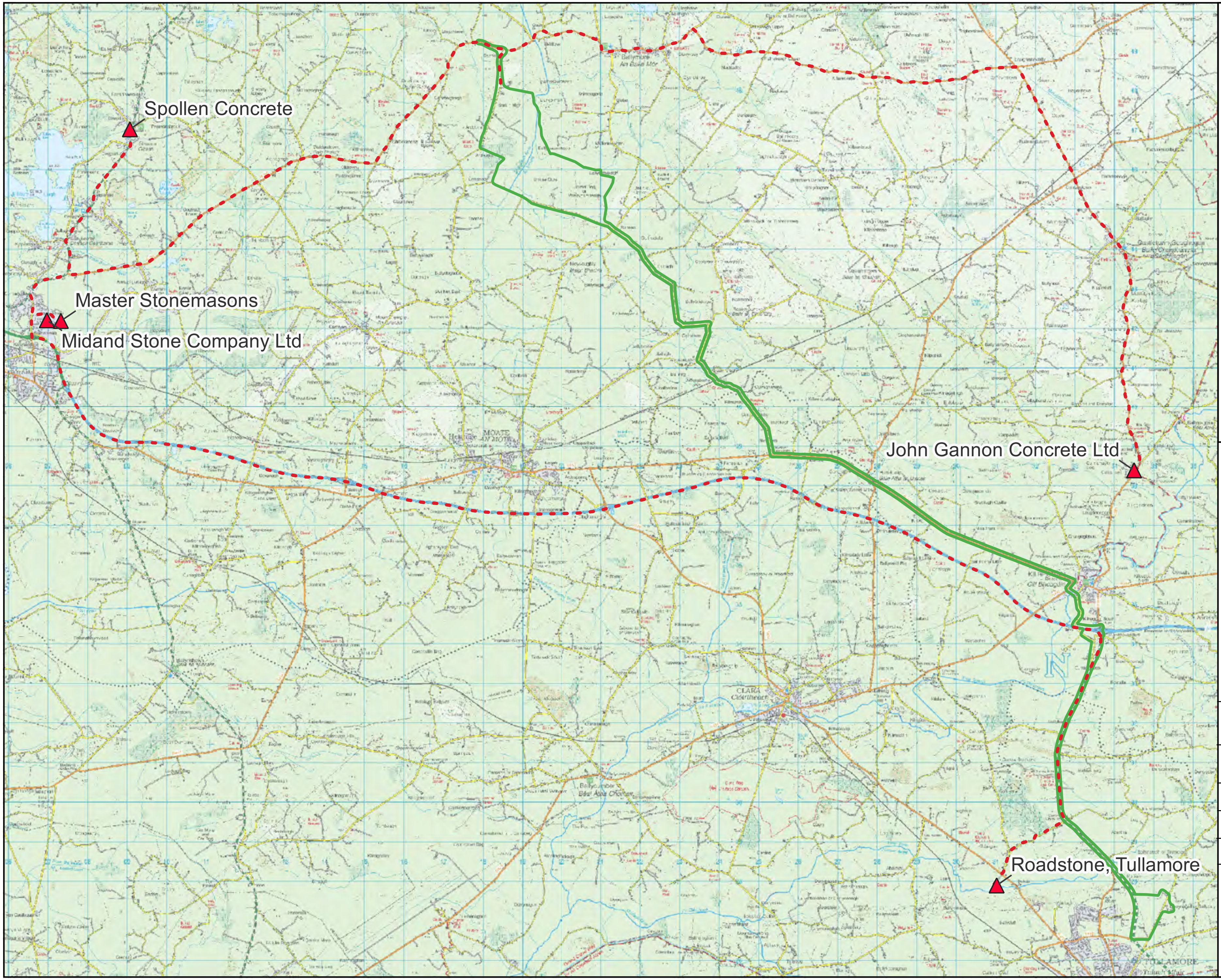

Map Legend

- EIAR Site Boundary
- Location of Local Quarries
- Proposed Delivery Routes from Quarries

Drawing Title	Local Quarry Locations and Associated Delivery Routes
Project Title	Umma More Renewable Energy Development
Drawn By: BT	Checked By: EC
Project No.: 201050	Drawing No.: Figure 4-23
Scale: 1:125,000	Date: 2023-02-02

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4.4.3 Traffic Management

A turbine with the maximum blade length of 81 metres has been used in assessing the traffic impact of the Proposed Development. The blade transporter for such a turbine blade would have a total vehicle length of 87.5 metres, including the blade which overhangs the back of the vehicle. The total length of the tower transporter is 46.7 metres with the axles located at the front and rear of the load with no overhang.

The vehicles used to transport the nacelles will be similar to the tower transporter. All other vehicles requiring access to the site of the Proposed Development will be smaller than the design test vehicles. The turbine delivery vehicles have been modelled accurately in the Autotrack assessments for the Wind Farm Site access junctions, as detailed in Section 14.1 of this EIAR.

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

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

Plate 4-4 Blade adaptor transport system

The plan will include:

- A delivery schedule.
- Details of works or any other minor alteration identified.
- A dry run of the route using vehicles with similar dimensions.

The deliveries of turbine components to the Wind Farm Site may be made in convoys of three to four vehicles at a time, and at night when roads are quietest. Convoys will be accompanied by escorts at the front and rear operating a "stop and go" system. Although the turbine delivery vehicles are large, they will not prevent other road users or emergency vehicles passing, should the need arise. The delivery escort vehicles will ensure the turbine transport is carried out in a safe and efficient manner with minimal delay or inconvenience for other road users.

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

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

4.5 Community Gain Proposal

4.5.1 Background

The Proposed Development 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 Umma More 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, Umma More 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 Development.

The applicant company has given careful consideration to the issue of community gain arising from the Proposed Development, 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 Wind Farm Site 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 Development 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.

4.5.2 Renewable Energy Support Scheme

The Renewable Energy Support Scheme (RESS) Terms and Conditions, published by the Department of Communications, Climate Action and Environment on in February 2020, make some high-level provisions for how this type of benefit fund will work. Any project which wants to avail of RESS 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. *A minimum of 40% of the funds shall be paid to not-for-profit community enterprises whose primary focus or aim is the promotion of initiatives towards the delivery of the UN Sustainable Development Goals, in particular Goals 4, 7, 11 and 13, including education, energy efficiency, sustainable energy and climate action initiatives;*
3. *A maximum of 10% of the funds may be spent on administration. This is to ensure successful outcomes and good governance of the Community Benefit Fund.*
4. *The balance of the funds shall be spent on initiatives successful in the annual application process, as proposed by clubs and societies and similar not-for-profit entities, and in respect of Onshore Wind RESS 1 Projects, on "near neighbour payments" for households located outside a distance of 1 kilometre from the Project but within a distance of 2 kilometres from such Project.*

4.5.3 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 Development will contribute €2 into a community fund for the first 15 years of operation of the Proposed Development. If this commitment is changed in upcoming Government Policy, the fund would be adjusted accordingly.

Should the Proposed Development be developed under RESS, it would attract a community contribution in the region of approx. €340,000/year for the local community. The value of this fund would be directly proportional to the electricity generated by the wind farm. Under current T&C's of RESS, the following would be required for Umma More Wind Farm:

- **Direct payments** – to those living closest to the Wind Farm Site. A minimum €1,000 payment per annum for houses within 1km of the Proposed Development;
- **Energy Efficiency** – Up to €136,000/year 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.
- **Support for local groups** –Up to €136,000/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% of this fund to be made available for the administration and governance costs of the fund.

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 Gain proposal could include youth, sport and community facilities, schools, educational and training initiatives, and wider amenity, heritage, and environmental projects. Initial local suggestions for use of the fund included grants for Eon Naofa National School, the construction of footpaths and footpath improvement works, water-mains connections for residents who relied on river water, local enterprise schemes, riparian planting of native species, energy retro-fitting of houses and contributions to electrical bills.

Should the Proposed Development not be developed under RESS, a community benefit scheme is proposed to provide a fund of €100,000 per annum over the lifespan of the Proposed Development based on the current estimated generating capacity. This will equate to potential funding of €3 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 project benefiting to varying degrees depending on their funding requirement.

4.6 Site Drainage

4.6.1 Introduction

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

The protection of the watercourses within and surrounding the Site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. The Proposed Development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the Site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the Proposed Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones around the existing natural drainage features have been used to inform the layout of the Proposed Development.

4.6.2 Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the Proposed Development. Turbine locations have been selected to avoid natural watercourses. It is proposed that 1 no. new watercourse crossing will be required to facilitate the renewable energy development infrastructure.

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

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

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

4.6.3 Drainage Design Principles

The key principles of drainage design that will be implemented and adhered to as part of the Proposed Development 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 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 if required.

Drainage water from any works areas of the site of the Proposed Development 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 4-24 below.

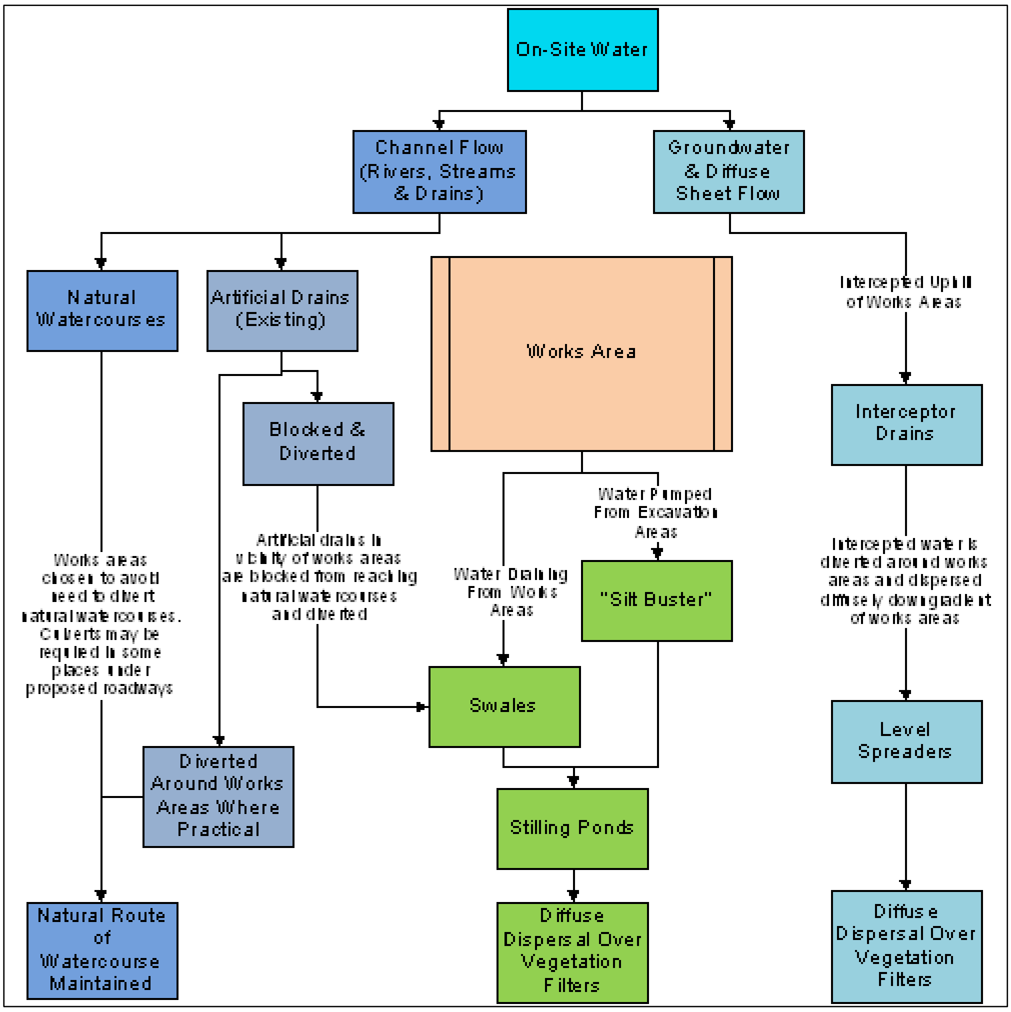


Figure 4-24 Proposed Development Drainage Process Flow

4.6.4 Drainage Design

A drainage design for the Proposed Development, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 4-3 to this EIAR. The drainage design employs the various measures further described below and is cognisant of the following guidance documents:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest 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;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);

- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- 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, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed Site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting of conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction. Figure 4-25 below shows an illustrative drawing of an interceptor drain.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.6.4.3 below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel.

Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader (see Section 4.6.4.4 below). Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

4.6.4.2 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 Development during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above. Figure 4-25 below, shows an illustrative example of a drainage swale.

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

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

4.6.4.3 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 4-25, below, shows illustrative examples of check dams.

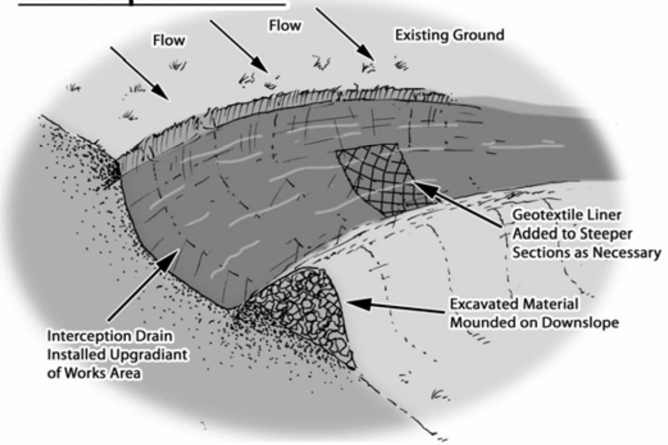
The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges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

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

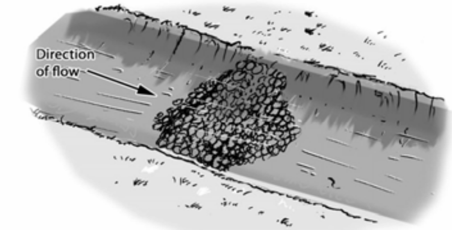
Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained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

Drainage Design Measures

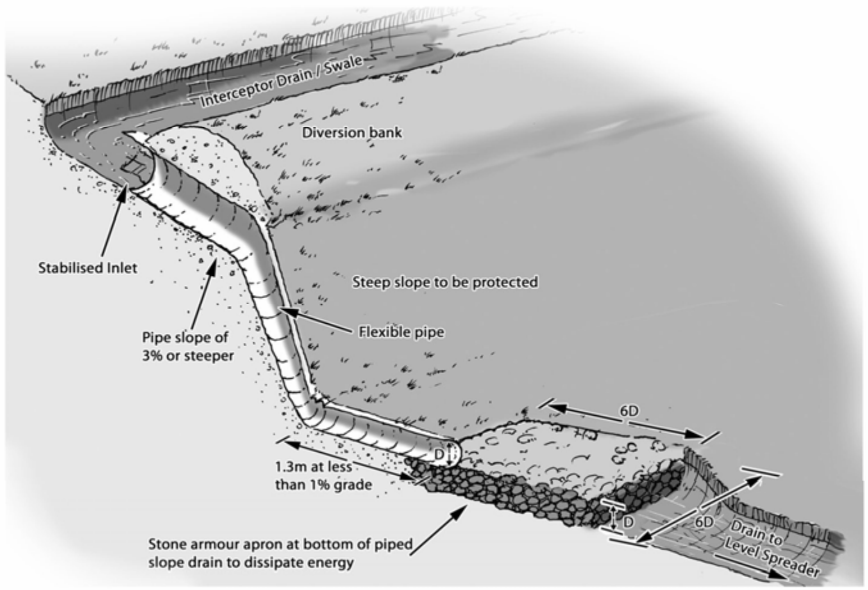
Interceptor Drain



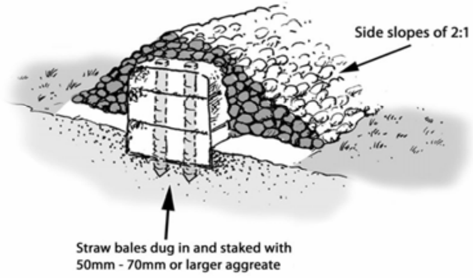
Check Dam (Stone Dam in Drain)



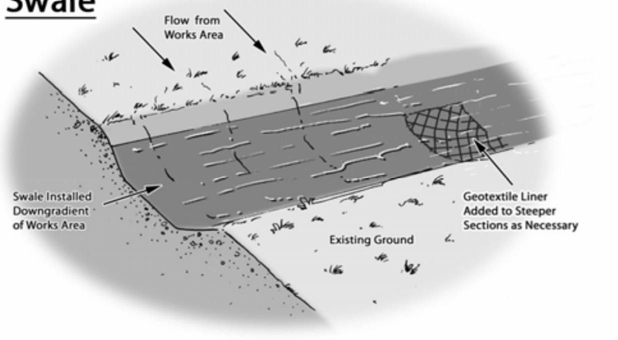
Slope Pipe Drain



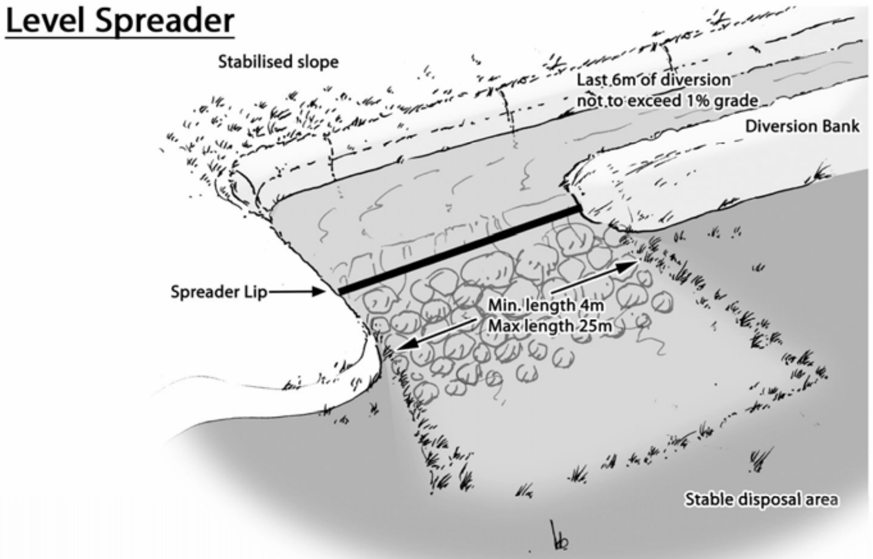
Check Dam
(Straw Bale & Stone Dam - Cross Section)



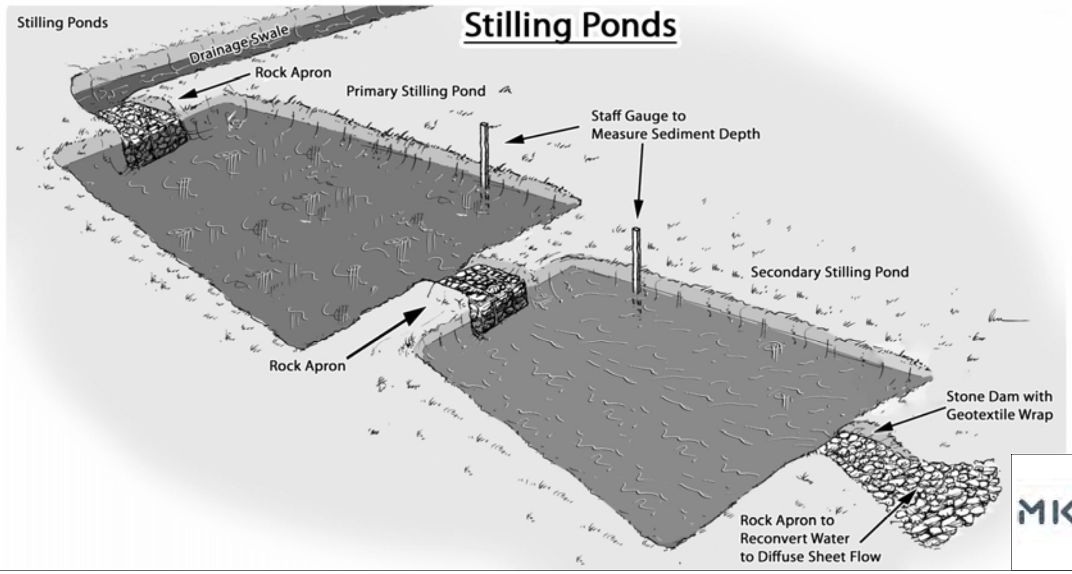
Swale



Level Spreader



Stilling Ponds



MAP TITLE: **Drainage Design Measure Illustrations**		MAP NO.: **Figure 4-25**	SCALE: **NTS**
PROJECT TITLE: **Umma More Renewable Energy Development**			DATE: **10-03-2023**
DRAWING BY: **Ellen Costello**	CHECKED BY: **Michael Watson**	ISSUE NO.: **201050- 2023.10.03 F**	

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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 4-25, 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 (see Section 4.6.4.5 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 4-25, above, shows a diagrammatic example of a piped slope drain and rock apron.

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

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

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

Stilling ponds will be excavated/constructed 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 4-25, 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 4-26 below shows an illustrative diagram of the Siltbuster.

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

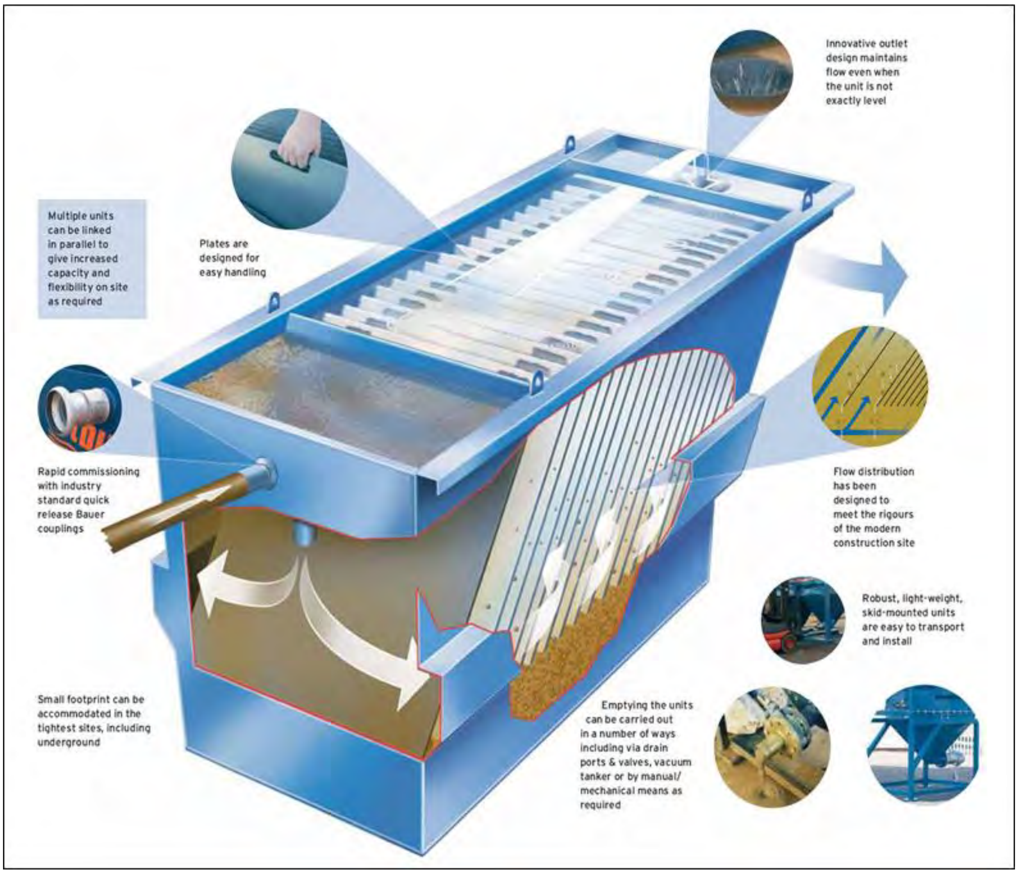


Figure 4-26 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

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

Plate 4-5 Silt Bag with water being pumped through

Plate 4-6 Silt bag under inspection

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

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

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

4.6.4.12 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 or 100m buffer zone of a lake, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the Proposed Development. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the drainage design drawings included in Appendix 4-3.

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 Forestry Felling Drainage

As part of the Proposed Development, tree felling will be required within and around Proposed Development footprint to allow for the construction of the turbine bases, access roads underground cabling, and the other ancillary infrastructure. Tree felling to facilitate the Proposed Development will be undertaken prior to construction groundworks to facilitate construction works within the forestry. A small section of the Wind Farm Site is located on commercial forestry, namely Turbine no. 4 and its associated infrastructure. A total of 6.4 hectares of commercial forestry will be permanently felled within and around Turbine No. 4 and its associated infrastructure, along with existing treeline boundaries as detailed in Chapter 6.

Tree felling to facilitate the Proposed Development will not be undertaken simultaneously with construction groundworks. Keyhole felling to facilitate construction works will take place prior to groundworks commencing. Some further turbulence felling may take place after all groundworks have been completed but while turbines are being commissioned (depending on the requirements of the selected turbine manufacturer). A Harvest Management Plan is included in Appendix 4-4.

Permanent felling will be undertaken in and around the footprint of the Proposed Development, namely Turbine no. 4 and its associated infrastructure. Temporary felling will be carried out around the turbines to reduce turbulence effects or bat mitigation. Tree stumps will only be removed in areas around the Proposed Development footprint. 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 Section 9.5.2.1 of Chapter 9 Water 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.

Before the commencement of any felling works, an Environmental Clerk of Works (ECoW) shall be appointed to oversee the keyhole and extraction works. The ECoW shall be experienced and competent, and shall have the following functions and operate their record using a Schedule of Works Operation Record (SOWOR), as proposed in the planning application:

- Attend the Site for the setup period when drainage protection works are being installed and be present on Site during the remainder of the forestry keyhole felling works.
- Prior to the commencement of works, review and agreement of the positioning by the Operator of the required Aquatic Buffer Zones (ABZs), silt traps, silt fencing (see below), water crossings and onsite storage facilities for fuel, oil and chemicals (see further below).
- Be responsible for preparing and delivering the Environmental Tool Box Talk (TBT) to all relevant parties involved in Site operations, prior to the commencement of the works.
- Conduct daily and weekly inspections of all water protection measures and visually assess their integrity and effectiveness in accordance with Section 3.4 (Monitoring and Recording) and Appendix 3 (Site Monitoring Form (Visual Inspections)) of the *Forestry & Freshwater Pearl Mussel Requirements*.
- Take representative photographs showing the progress of operation onsite, and the integrity and effectiveness of the water protection measures.
- Collect water samples for analysis by a 3rd party accredited laboratory, adhering to the following requirements:
    - Surface water samples shall be collected upstream and downstream of the keyhole felling site at suitable sampling locations.
    - Sampling shall be taken from the stream / river bank, with no in-stream access permitted.
    - The following minimum analytical suite shall be used: pH, EC, TSS, BOD, Total P, Ortho-P, Total N, and Ammonia.
- Review of operator's records for plant inspections, evidence of contamination and leaks, and drainage checks made after extreme weather conditions.
- Prepare and maintain a contingency plan.
- Suspend work where potential risk to water from siltation and pollution is identified, or where operational methods and mitigation measures are not specified or agreed.
- Prepare and maintain a Water Protection Measure Register. This document is to be updated weekly by the ECoW.

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 Section 9.5.2.2 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 developed in short 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.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should any rainfall cause runoff from the excavated material, the material is contained in the downgradient cable trench. Excess subsoil is removed from the cable trench works area immediately upon excavation, and in the case of the Proposed Development, would be used for landscaping and reinstatements of other areas elsewhere on site or disposed off-site at an appropriate licensed soil recovery facility.

On steeper slopes, silt fences, as detailed in Section 4.6.4.12, above, will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

4.6.6 Site and Drainage Management

4.6.6.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures outlined above, will be brought on-site in advance of any works commencing. An adequate amount of straw bales, clean stone, terram, stakes, etc will be kept on Site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

4.6.6.2 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the Proposed Development will also take account of weather forecasts, and predicted rainfall in particular, working under a schedule of works operation system (SOWOR) system as proposed in the planning application. 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 Development 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 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 onsite will be prepared in advance of commencement of any works on the Proposed Development. 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.

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 Development 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 Development 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 be 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 Development 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 Development. 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.

4.6.8 Construction Phasing and Timing

It is estimated that the construction phase of the Proposed Development will take approximately 18-24 months from starting on Site to the commissioning of the electrical system. In the interest of breeding birds, construction will not commence during the bird breeding season which runs from the 1st of March to the 31st of August inclusive. Construction may commence at any stage from September onwards to the end of February, so that construction activities are ongoing by the time the next breeding bird season comes around, and can continue throughout the next breeding season.

4.6.9 Construction Sequencing

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

Electrical Works

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

Turbine and Meteorological Mast Erection

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

The phasing and scheduling of the main construction task items are outlined in Figure 4-27 below, where the 1st January has been selected as an arbitrary start date for construction activities.

			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									

Figure 4-27 Indicative Construction Schedule

4.6.10 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 and objective manner. The basis for auditing is presented in Section 6 of the CEMP which effectively lists all mitigation measures prescribed in any of the planning documentation. The first assessment is a simply Yes/No question, has the mitigation measure been employed on-site or not? Following confirmation that the mitigation measure has been implemented, the effectiveness of the mitigation measures has to be the subject of regular review and audit during the full construction stage of the project. If some remedial actions are needed to improve the effectiveness of the mitigation measure, then these are notified to the site staff immediately during the audit site visit, and in writing by way of the circulation of the findings of the audit. Depending on the importance and urgency of rectifying the issue, the construction site manager is given a timeframe by when the remedial works need to be completed.

A CEMP has been prepared for the Proposed Development, and is included in Appendix 4-2 of this EIAR. The CEMP includes details of drainage, spoil management, waste management etc, and describes how the above-mentioned audit will function and how the findings are presented.

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

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

4.7 Construction Methodologies

4.7.1 Turbine Foundations

Each of the turbines to be erected on the Wind Farm 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 base, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be sealed using the back of the excavator bucket and surrounded by silt fences to ensure sediment-laden run-off does not occur.

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

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

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

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

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

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

4.7.2 Site Roads and Hardstand Areas

4.7.2.1 New Site Access Road

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

- Establish alignment of the new site road from the construction drawings and mark out the centrelines with ranging rods or timber posts;
- All drainage measures prescribed in the detailed drainage design for the Proposed Development 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 Wind Farm Site);
- All excavated material will be managed on-site. Some topsoil will be temporarily stockpiled locally for reuse for landscaping purposes.
- The subsoil will be excavated down to a suitable formation layer of either firm clay or bedrock and managed on-site in the spoil management areas;
- The subsoil will be excavated down to a suitable formation layer of competent stratum;
- The road will be constructed using well-graded imported granular fill, 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 site road.

4.7.2.2 New Site Access Roads in Site-Specific Flood Modelled Zone

There is 110 metres of proposed access road within site-specific flood modelled 100-yr and 1000-yr zones within the Wind Farm Site. The construction methodology for the proposed new access roads in Site-Specific Flood Modelled Zone is outlined as follows:

- Establish alignment of the new site road from the construction drawings and mark out the centrelines with ranging rods or timber posts;
- All drainage measures prescribed in the detailed drainage design for the Proposed Development 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 Wind Farm Site);
- All spoil excavated will be placed within the identified spoil management areas within the Wind Farm Site, which are located outside the site-specific flood modelled zone (100-yr and 1000-yr events).
- The subsoil will be excavated down to a suitable formation layer of competent stratum;
- The road will be constructed using well-graded imported granular fill, 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 surface of the excavated access roads will be overlaid with approximately 500mm of selected granular fill which will be at least 500mm above the modelled 100-yr and 100-yr flood elevation (100-yr event - 55.86 mOD, 1000-yr event - 56 mOD).
- There is an existing field drain which will be culverted under the proposed access track. This culvert will provide a drainage outlet for flood water following a significant flood event. This will prevent any damming effect from the proposed access road within this section. 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 site road.

4.7.2.3 Upgrading of Existing Site Access Road

Approximately 1.1km of the existing roads will require upgrading which will comprise widening of the roadway to a total running width of approximately five metres, with wider sections at corners and the laying of a new surface dressing on the existing section of roadway where necessary. 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 placed alongside access roads with cross slopes of less than 10 degrees. As detailed in Section 4.3.3.2, placement of spoil alongside access roads will take place outside of the site-specific flood modelled zones within the Wind Farm Site. Spoil placed alongside access roads will be restricted to a maximum height of 1.0m over a 3m wide corridor on both sides of the access roads.
- All drainage measures prescribed in the detailed drainage design for the Proposed Development 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;
- A layer of geogrid will be installed directly onto the top of the granular fill layer and the existing road surface where required;
- A layer of finer well graded stone for the running surface will be laid on the geogrid and compacted; and
- 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 Section 4 of the CEMP.

4.7.3 Proposed Clear-Span Watercourse Crossing

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

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

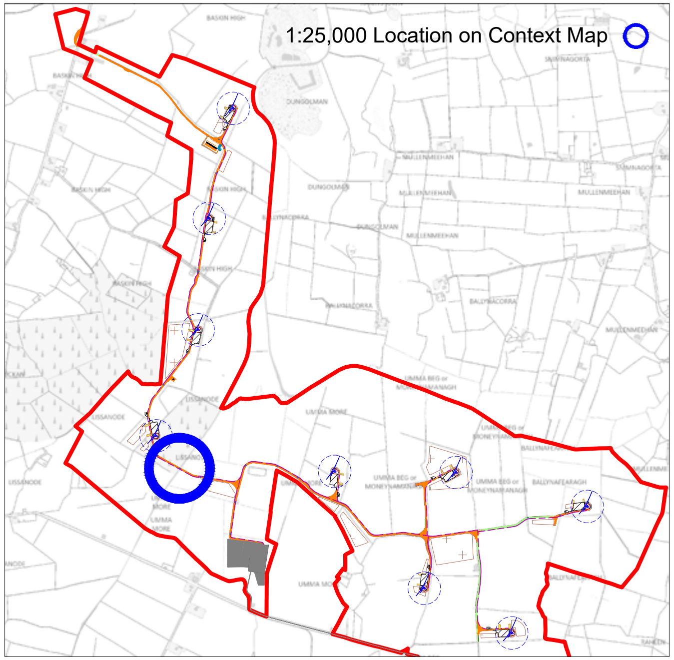
- The access road on the approach either side of the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the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

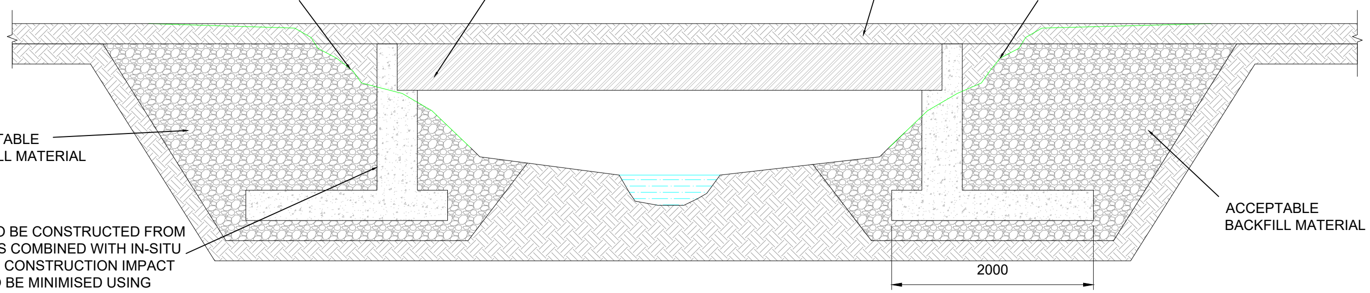
A standard design drawing of a pre-cast concrete, clear span crossing is shown in Figure 4-28.

The watercourse crossing will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland.

Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

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





Scale 1:50

DRAWING TITLE:

Clear Span Bridge Crossing

Umma More Renewable Energy Development, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Ellen Costello
PROJECT No.: 201050	DRAWING No.: Fig 4-28
SCALE: As Shown @A3	DATE: 08.03.2023
OS SHEET No.: 2900, 2901, 2969, 2970	

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4.7.4 Wind Farm Site Underground Electrical (33kV) and Communication Cabling

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

Plate 4-7 Typical Cable Trench View

4.7.5 Onsite Electricity Substation and Control Buildings

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

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

- The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- The roof slabs will be lifted into position using an adequately sized mobile crane;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.
- The electrical equipment will be installed and commissioned.
- Perimeter fencing will be erected.
- The construction and components of the substation are to Eirgrid specifications.

4.7.6 Temporary Construction Compounds

The temporary construction compounds will be constructed as follows:

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

4.7.7 Grid Connection Cabling Trench

4.7.7.1 Underground Cabling Trench

The underground cabling works will consist of the installation of ducts in an excavated trench to accommodate power cables, and a fibre communications cables to allow communications between the proposed 110kV onsite substation and the existing110kV Thornsberry substation. Further details are included in Appendix 4-5: Grid Connection Infrastructure.

The underground electrical cabling will be laid beneath the surface of the Wind Farm Site and the public road using the following methodology:

- Before works commence, updated surveying will take place along the proposed cable route, with all existing culverts identified. All relevant bodies i.e. ESB, Westmeath County Council, Offaly County Council etc. will be contacted and all up to date drawings for all existing services sought.
- When the cable is located on public roads, a traffic management plan will be prepared prior to any works commencing. A road opening licence will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.

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

4.7.7.2 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.

4.7.7.3 Joint Bays

Joint bays are typically pre-cast concrete chambers where lengths of cable will be joined to form one continuous cable. They will be located at various points along the ducting route generally between 600 to 1000 metres intervals or as otherwise required by ESB/Eirgrid and electrical requirements. Joint Bays are typically 2.5m x 6m x 1.75m pre-cast concrete structures installed below finished ground level.

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

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between the onsite 110kV substation and the existing 110kV Thornsberry substation. Earth Sheath Link Chambers are also required approximately every second joint bay along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground power cables, installed in a flat formation, so that the circulating currents and induced voltages are eliminated or reduced. Earth Sheath Link Chambers and Communication Chambers are located in close proximity to Joint Bays. Earth Sheath Link Chambers and Communication Chambers will be pre-cast concrete structures with an access cover at finished surface level. The locations of the joint bays and chambers are shown on the Grid Connection Infrastructure in Appendix 4-5.

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

4.7.7.4 Underground Cable Watercourse/Culvert/Service Crossings

There are a total of 34 identified watercourse and existing culvert/drain crossings along the proposed Grid Connection underground electrical cabling route, of which 11 no. are EPA/OSI mapped crossings. The remaining crossings are classified as culverts over minor channels or manmade drains. Further detail on the watercourse, drain and culvert crossings of the underground electrical cabling route are included in Appendix 4-5 of this EIAR: Grid Connection Infrastructure.

The construction methodology for the 11 no. EPA/OSI mapped crossings has been designed to eliminate the requirement for in-stream works on these locations requiring a crossing to be constructed to traverse the watercourse with the cabling ducts. A general description of the various construction methods employed at watercourse/ culvert/ drain crossings are described in the following paragraphs below. A list of the EPA/OSI mapped crossings along the underground electrical cabling route and the proposed crossing method is provided in Table 4-3 below. The EPA/OSI mapped crossing locations are shown in Figure 4-29. An illustration of the proposed crossing methodology at each of the 11 locations is included in Appendix 4-5 and the associated drawing number is referenced in Table 4-3 below.

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

The crossing locations for the culvert and drain crossing locations along the underground electrical cabling route are shown in Appendix 4-5 of this EIAR, along with the details of all identified culvert and drain crossings.

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

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

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

4.7.7.4.1 Standard Formation Crossing over Culvert – Option A

Where adequate cover exists above a culvert, the standard aforementioned trench arrangement will be used where the cable ducts pass over a culvert without any contact with the existing culvert or water course. The cable trench will pass over the culvert in a standard trench as outlined in Figure 4-30.

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

4.7.7.4.2 Standard Formation Crossing under Culvert – Option B

Where the culvert consists of a socketed concrete or sealed plastic pipe and sufficient depth is not available over the crossing, a trench will be excavated beneath the culvert and cable ducts will be installed in the standard formation 300mm below the existing pipe, as outlined in Figure 4-31.

4.7.7.4.3 Shallow Formation Crossing over Culvert – Option C

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

Where sufficient deck cover is not available to fully accommodate the required ducts, it may be necessary to locally raise the footpath level if present, or to locally raise the pavement level. Should the footpath or pavement level be increased, the parapet wall levels will also increase to facilitate the raise in pavement level if required, Any addition of a new pavement will be tied back into the existing road pavement at grade. This method of duct installation is further detailed in Figure 4-32.

4.7.7.4.4 Directional Drilling – Option D

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

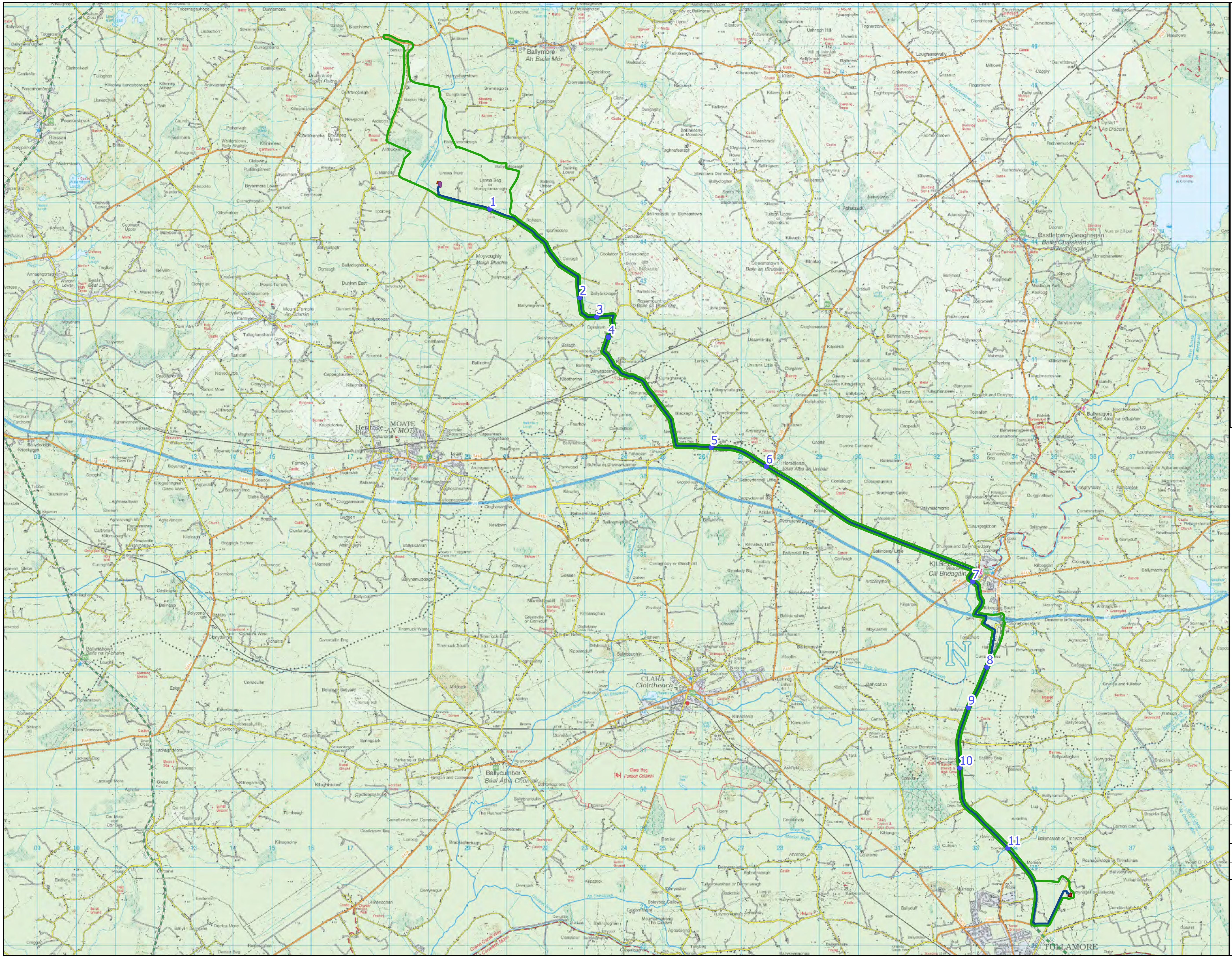
DD is a method of drilling under obstacles such as bridges, culverts, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible.

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

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

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

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. Sufficient controls and monitoring will be put in place during drilling to prevent frack-out, such as the installation of casing at entry points where reduced cover and bearing pressure exits. The directional drilling methodology is further detailed in Figure 4-33.



Map Legend

- EIAR Site Boundary
- Watercourse Crossings
- Underground Electrical Cabling Route
- Proposed Onsite Substation
- Proposed Temporary Construction Compound
- Thornsberry 110kV Substation

Drawing Title	Grid Connection Watercourse Crossing Locations
Project Title	Umma More Renewable Energy Development
Drawn By: EC	Checked By: MW
Project No.: 201050	Drawing No.: Figure 4-29
Scale: 1:85000	Date: 2023-03-08

MKO
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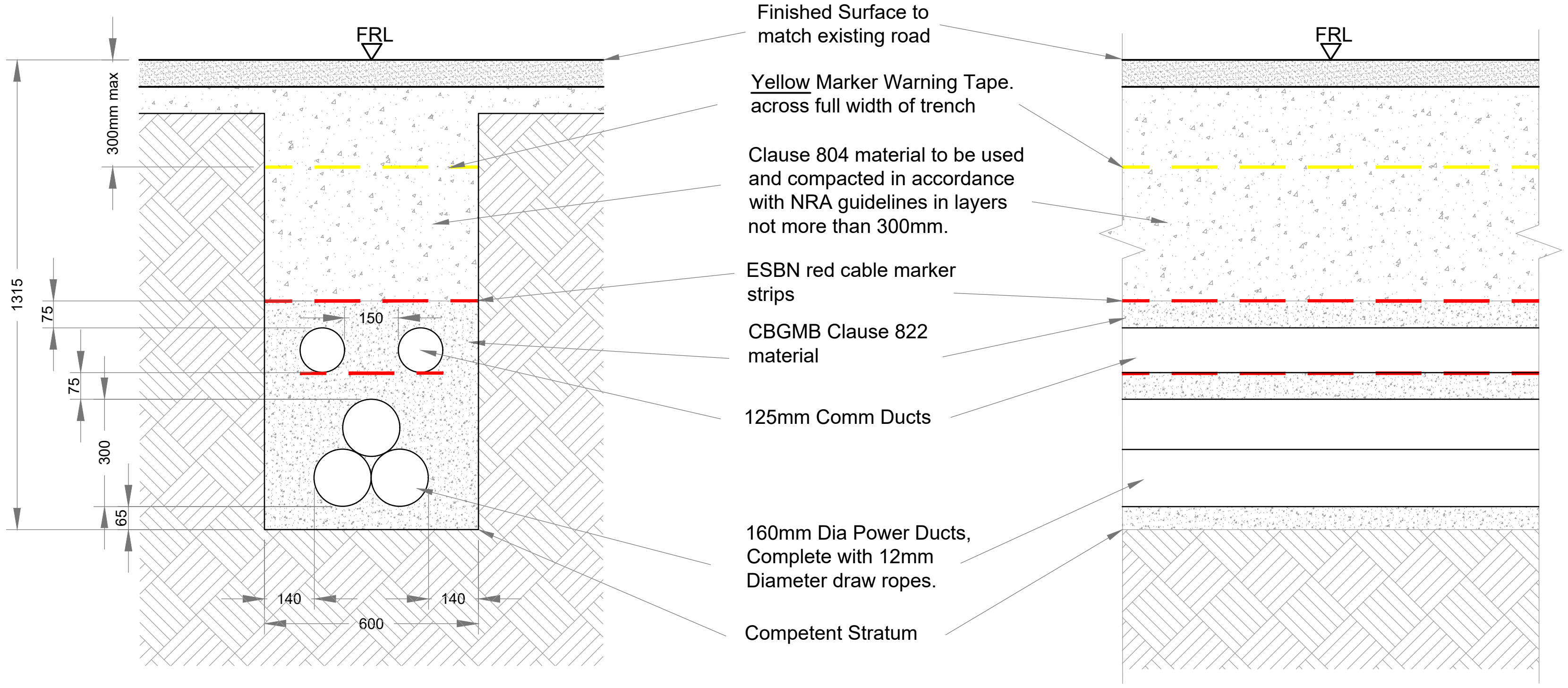


Option A

SCALE 1:20

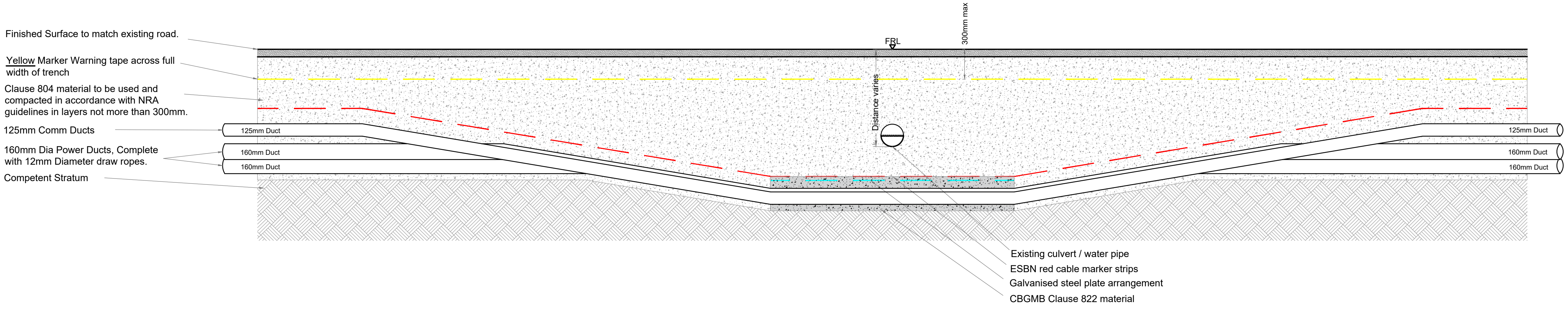
Note:
ALL DIMENSIONS TO BE CHECKED ON SITE AND ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER.
FIGURED DIMENSIONS ONLY TO BE USED.
DRAWINGS NOT TO BE SCALED.

Enerco Energy

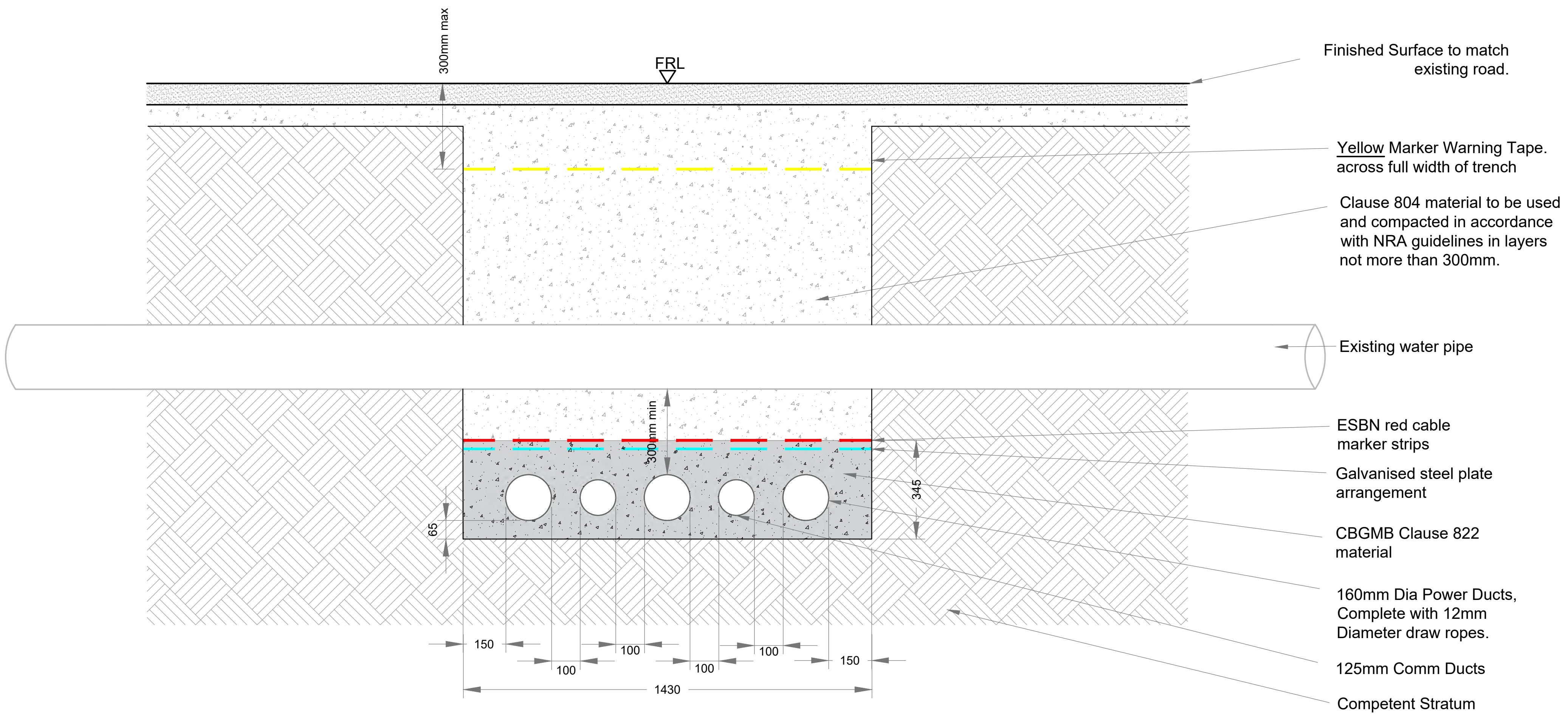
Project:
Umma More

Drawing:
Standard Formation Crossing Over Culvert - Option A

Drawn By:	Checked By:	Drawing No.
NG	WOC	Figure 4-30
Scale: As Shown @ A3		



Option B
SCALE 1:50



Option B
SCALE 1:20

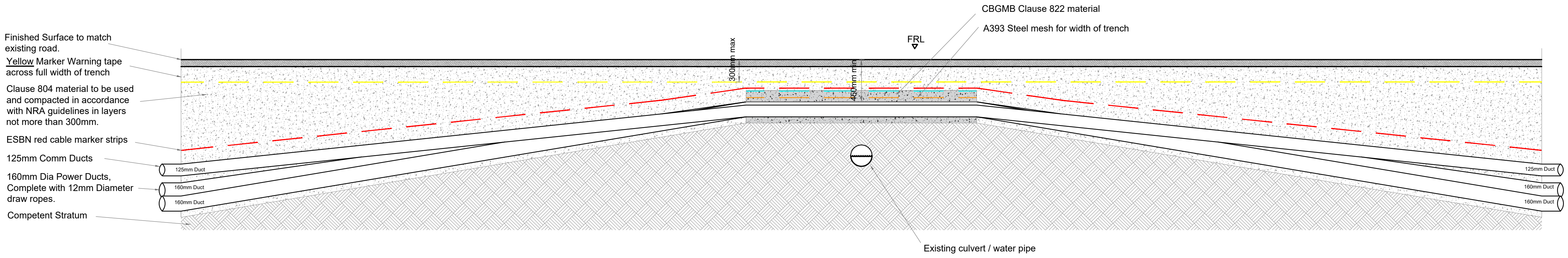
Note:
ALL DIMENSIONS TO BE CHECKED ON SITE AND ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER.
FIGURED DIMENSIONS ONLY TO BE USED.
DRAWINGS NOT TO BE SCALED.

Enerco Energy

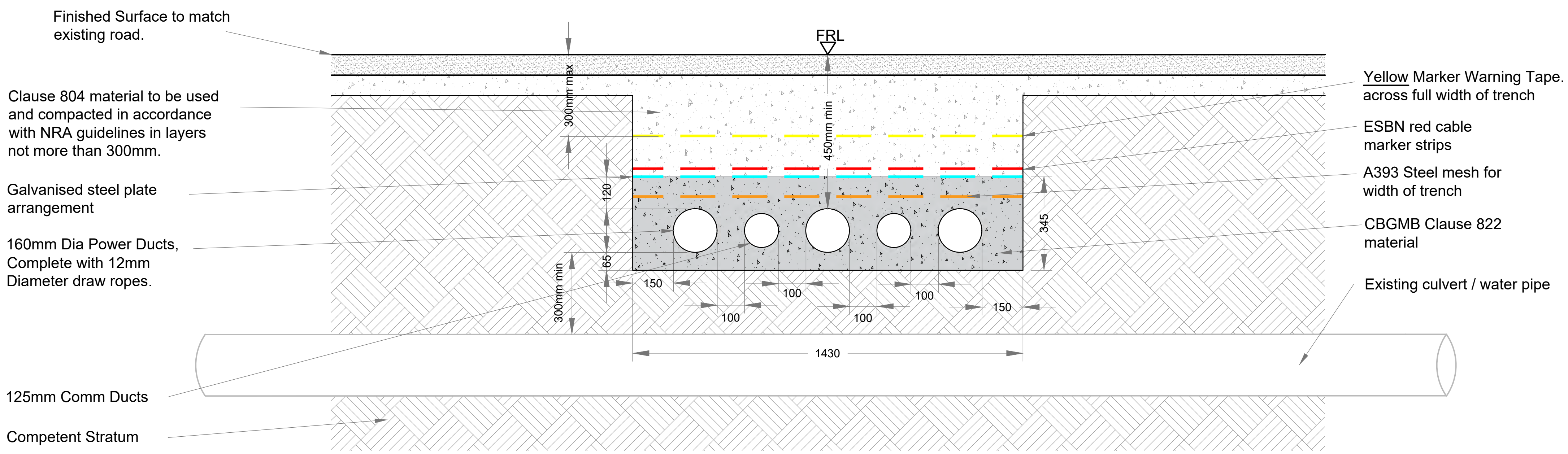
Project:
Umma More

Drawing:
Standard Formation Crossing Under Culvert - Option B

Drawn By:	Checked By:	Drawing No.
NG	WOC	Figure 4-31
Scale: As Shown @ A3		



Option C
SCALE 1:50



Option C
SCALE 1:20

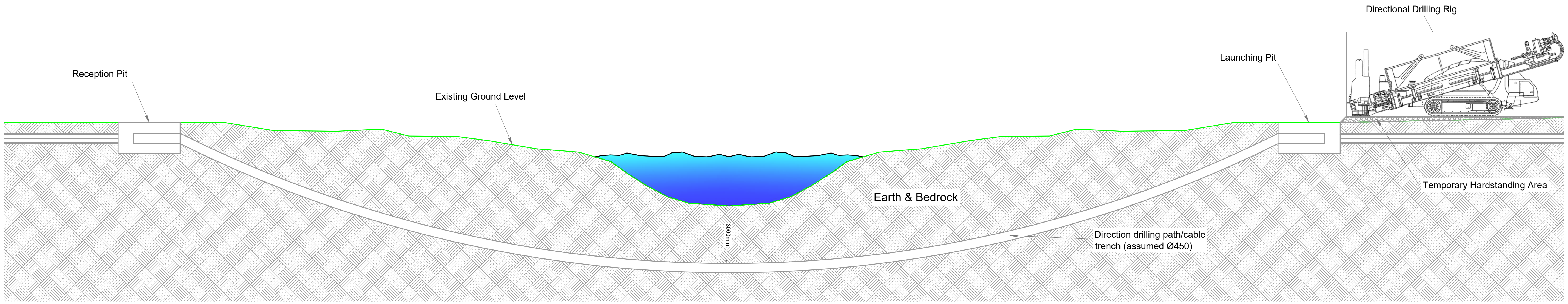
Note:
ALL DIMENSIONS TO BE CHECKED ON SITE AND ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER. FIGURED DIMENSIONS ONLY TO BE USED. DRAWINGS NOT TO BE SCALED.

Enerco Energy

Project: Umma More

Drawing: Standard Formation Crossing Over Culverts - Option C

Drawn By:	Checked By:	Drawing No.
NG	WOC	Figure 4-32
Scale: As Shown @ A3		



Option D

SCALE: 1:200

Note:
ALL DIMENSIONS TO BE CHECKED ON SITE AND ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER.
FIGURED DIMENSIONS ONLY TO BE USED.
DRAWINGS NOT TO BE SCALED.

Enerco Energy

Project: Umma More		
Drawing: Horizontal Directional Drill - Option D		
Drawn By: NG	Checked By: WOC	Drawing No. Figure 4-33
Scale: As Shown @ A3		

Table 4-3 Underground Electrical Cabling Route – Watercourse Crossings Methodology

Watercourse Crossing Reference No.	Watercourse Type	Width of Channel (m)	Cover from Road Level to Top of Culvert (m)	Crossing Option Description	Watercourse Crossing Option	Extent of In-Channel Works	Grid Connection Infrastructure Reference (included as Appendix 4-5)
1	Stone Culvert	-	0.6	Where cable ducts are to be installed over an existing culvert and sufficient cover cannot be achieved, the ducts will be laid in a much shallower trench, the depth of which will be determined by the cover available at the culvert crossing location. The ducts within the shallow formation trench will be encased in 6mm thick steel galvanized plates and backfilled with 35N concrete.	Option C	None. No in-stream works required.	Appendix 4-5: Figure 1
2	Concrete Bridge	-	0.4	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling. This crossing methodology will ensure that no contact will be made with the watercourse during the works.	Option D	None. No in-stream works required.	Appendix 4-5: Figure 2
3	Stone Arch Bridge	-	0.4	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling. This crossing methodology will ensure that no contact will be made with the watercourse during the works.	Option D	None. No in-stream works required.	Appendix 4-5: Figure 3
4	Stone Arch Bridge	-	0.4	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling.	Option D	None. No in-stream works required.	Appendix 4-5: Figure 4

				This crossing methodology will ensure that no contact will be made with the watercourse during the works.			
5	Concrete Bridge	-	0.4	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling. This crossing methodology will ensure that no contact will be made with the watercourse during the works.	Option D	None. No in-stream works required.	Appendix 4-5: Figure 5
6	Stone Arch Bridge	-	1.2	Where cable ducts are to be installed over an existing culvert and sufficient cover cannot be achieved, the ducts will be laid in a much shallower trench, the depth of which will be determined by the cover available at the culvert crossing location. The ducts within the shallow formation trench will be encased in 6mm thick steel galvanized plates and backfilled with 35N concrete.	Option C	None. No in-stream works required.	Appendix 4-5: Figure 6
7	Open channel	3.9	-	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling. This crossing methodology will ensure that no contact will be made with the watercourse during the works.	Option D	None. No in-stream works required.	Appendix 4-5: Figure 7
8	1500 mm Concrete Pipe	-	0.9	Where cable ducts are to be installed over an existing culvert and sufficient cover cannot be achieved, the ducts will be laid in a much shallower trench, the depth of which will be determined by the cover available at the culvert crossing location.	Option C	None. No in-stream works required.	Appendix 4-5: Figure 8

				The ducts within the shallow formation trench will be encased in 6mm thick steel galvanized plates and backfilled with 35N concrete.			
9	600mm Concrete Pipe	-	0.9	Where cable ducts are to be installed over an existing culvert and sufficient cover cannot be achieved, the ducts will be laid in a much shallower trench, the depth of which will be determined by the cover available at the culvert crossing location. The ducts within the shallow formation trench will be encased in 6mm thick steel galvanized plates and backfilled with 35N concrete.	Option C	None. No in-stream works required.	Appendix 4-5: Figure 9
10	1200mm Concrete Pipe	-	1.6	Where adequate cover exists above a culvert, the standard aforementioned trench arrangement will be used where the cable ducts pass over a culvert without any contact with the existing culvert or watercourse.	Option A	None. No in-stream works required.	Appendix 4-5: Figure 10
11	Box Culvert Bridge	-	1	Where sufficient depth is not available over or under the crossing for a trench arrangement, the laying of cable ducts to be completed using directional drilling. This crossing methodology will ensure that no contact will be made with the watercourse during the works.	Option D	None. No in-stream works required.	Appendix 4-5: Figure 11

4.8 Operation

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

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

4.8.1 Maintenance

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

The electricity substation components as part of the Grid Connection will also require periodic maintenance.

Although the level of activity required for the maintenance of the both the Wind Farm Site and Grid Connection is not significant, the impacts associated with traffic volumes for this period are assessed in Chapter 14.

4.8.2 Monitoring

Section 7 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 brief summary of the key information is provided below:

- Monthly sampling and laboratory analysis will be undertaken for 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 which includes breeding bird surveys, winter roost surveys and corpse searching on the Site determine the level of fatalities for the Site as a result of collisions with the installed turbines. These surveys will be completed in accordance with guidelines issued by the Scottish Natural Heritage (SNH, 2009)
- Post-construction bat monitoring will be undertaken for at least three years' post construction of the renewable energy development. The monitoring will also include corpse searching in the areas surrounding the turbines to gather data on any actual collisions.

- 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.

4.9 Decommissioning

The wind turbines proposed as part of the Wind Farm Site 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 Site may be decommissioned fully.

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

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

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

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

The Grid Connection underground electrical cabling route and onsite substation will remain in place as it will be under the ownership and control of the ESB and Eirgrid.

A Decommissioning Plan has been prepared (Appendix 4-6) the detail of which will be agreed with the local authority prior to any decommissioning. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agreed with the competent authority at that time. The potential for effects during the decommissioning phase of the Proposed Development 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 Development, 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".