4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the development and its component parts (the 'Proposed Development') including the works subject of a proposed application for planning permission to An Bord Pleanála (ABP), Cork County Council (CCC) and Kerry County Council (KCC). The Proposed Development comprises the provision of the following:

i. *110 kV electrical substation with 2 no. control buildings with welfare facilities, all associated electrical plant and apparatus, security fencing, underground cabling, waste water holding tank and all ancillary works;*
ii. *Underground electrical cabling (110kV);*
iii. *Underground electrical cabling (33kV);*
iv. *Access Roads (new and upgrade of existing)*
v. *Temporary access road;*
vi. *Upgrade of access junctions;*
vii. *Amendments to the Permitted Development (Ref. No. 19/4972), including extension to the borrow pit and the omission of the 38kV Electrical Substation, 38KV underground cabling and Battery Storage compound;*
viii. *Borrow pit;*
ix. *Site Drainage;*
x. *Forestry Felling; and*
xi. *All associated site development works and apparatus.*

An Bord Pleanála – Planning Notice Project Description

i. *110 kV electrical substation with 2 no. control buildings with welfare facilities, all associated electrical plant and apparatus, security fencing, underground cabling, waste water holding tank and all ancillary works;*
ii. *Underground electrical cabling (110kV);*
iii. *New access roads;*
iv. *Borrow pit;*
v. *Site Drainage;*
vi. *Forestry Felling; and*
vii. *All associated site development works and apparatus.*

Cork County Council – Planning Notice Project Description

i. *Underground electrical cabling (33kV);*
ii. *Access roads (new and upgrade of existing);*
iii. *Amendments to the Permitted Development (Ref. No. 19/4972), including extension to the borrow pit and the omission of the 38kV Electrical Substation, 38KV underground cabling and Battery Storage compound;*
iv. *Site Drainage; and*
v. *All associated site development ancillary works and apparatus.*

Kerry County Council – Planning Notice Project Description

i. *Underground electrical cabling (33kV);*
ii. *Upgrade of access junctions;*
iii. *Access roads (new and upgrade of existing);*
iv. *Temporary access road;*
v. *Borrow pit;*
vi. *Site Drainage;*
vii. *Forestry Felling; and*
viii. *All associated site development works and apparatus.*

All elements of the Proposed Development have been assessed as part of this EIAR.

4.2 Description of the Proposed Development

A description of the physical characteristics of the study area for this EIAR is provided in Section 2.1 of this EIAR.

The Proposed Development comprises the construction of a 110kV electrical substation and adjacent borrow pit located in the townlands of Cummeennabuddoge and Caherdowney. The proposed underground grid connection cabling consists of two elements, with 110kV underground electrical cabling connecting the proposed 110kV electrical substation to the existing 220kV substation at Ballyvouskill, and 33kV underground electrical cabling connecting the Permitted Development to the proposed 110kV electrical substation. The total length of underground electrical cabling routes will measure approximately 11.9 kilometres (the 110kV and 33kV cable routes are approximately 3.6km and 8.3km respectively), which will be located on existing forest/ agricultural roads (requiring upgrading), forestry land, peatland and agricultural land. Where roads do not exist along the proposed underground cabling routes, new access roads will be provided. No road will be provided across a short section (685m) of peatland habitat along the 110kV cabling route. The proposed 110kV electrical substation is intended to replace the 38kV substation (and associated 38kV underground cabling and battery storage compound) permitted under Pl. Ref. 19/4972. Upgrading of access junctions and existing roads will be required to facilitate the delivery of materials (in particular, turbine components) to the Permitted Development, a short section (209m) of new access road will connect the upgraded access road to the Permitted development, completing the Turbine Delivery Route (TDR). The borrow pit permitted under Pl. Ref. 19/4972 will be extended to facilitate the construction of the TDR. Site drainage measures, forestry felling and all associated site development works and apparatus are also included.

The proposed 33kV underground electrical cabling will consolidate all of the on-site underground cabling, from the individual turbines and solar array, into 3 no. cable circuits connecting the Permitted Development to the proposed 110kV substation.

The Proposed Development also includes for access road works associated with the turbine delivery route, a new on-site borrow pit and extension of the borrow pit permitted under Planning Permission Ref. No. 19/4972.

Of the proposed infrastructure, the 110kV electrical substation,110kV cabling and associated works represents Strategic Infrastructure Development (SID) and therefore a planning application will be submitted directly to ABP, under the provisions of the Planning and Development (Strategic Infrastructure) Act 2006. The proposed on-site borrow pit will be included in the planning application to be submitted to ABP and in the application to KCC given that it will serve the 110kV and 33kV infrastructure.

Approximately 5.6km of the access road works and approximately 5.2km of the underground electrical cabling (33kV) with associated access road connecting the Permitted Development to the proposed

110kV substation are located within the functional area of KCC. The relevant portion of the proposed on-site borrow pit will also be included in the planning application to be submitted to KCC. Approximately 707m of the access road works, approximately 3.2km of the 33kV underground electrical cabling (including approximately 450m of road upgrade) and the proposed extension to the permitted borrow pit are located in the functional area of CCC and will be included in the planning application to be submitted to CCC. A planning application will be submitted to each relevant authority with respect to the works required in areas accordance with the requirements of the Act.

The overall layout of the Proposed Development is shown on Figure 4-1. This figure shows the Proposed Development infrastructure as outlined above. Detailed site layout drawings of the Proposed Development are included in Appendix 4-1 to this EIAR.

4.3 Development Components

This section of the EIAR describes the components of the Proposed Development. Further details regarding 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 Electrical Substation

It is proposed to construct a 110 kV electrical substation to accommodate the connection of the Permitted Development to the national grid. It is intended that the 110kV substation will replace the 38kV substation, 38kV underground cabling and battery storage compound permitted under Pl. Ref. 19/4972. The footprint of the proposed electrical substation compound measures approximately 0.84 hectares. The works will consist of the construction of 2 no. control buildings with welfare facilities, all associated electrical plant and apparatus, security fencing, underground cabling, waste water holding tank and all ancillary works. The substation compound will be surrounded by an approximately 2.4-metre high steel palisade fence in line with standard ESB/ Eirgrid requirements, and internal fences will also segregate different areas within the main substation. The substation compound will serve as a site compound during the construction phase with the site facilities being removed before the final sections of the perimeter fence are erected.

The layouts and elevations of the proposed substation works are shown on Figure 4-2 and Figure 4-3. The construction and electrical components of the substation will be to Eirgrid specifications. The configuration of the substation layout is designed to cater for Eirgrid's future expansion requirements, should it be required by Eirgrid to make provision for future grid connections. Any future development associated with the proposed 110kV substation would be subject to a separate planning application process and would be assessed appropriately. Further details regarding the cabling connection between the Permitted Development and the national electricity grid are provided in Section 4.3.2 of this EIAR chapter.

Map Legend

- EIAR Study Boundary
- Access Road (Upgrade & New)
- Temp Road
- 33kV Underground Cabling and Access Roads
- 33kV Underground Cabling in Permitted Development
- 110kV Underground Cabling
- 110kV Underground Cabling and Access Road
- Ballyvouskill 220kV Substation
- Proposed 110kV Substation Location
- Proposed Borrow Pit
- Permitted Borrow Pit Extension
- Omitted 38kV Electrical Substation and Battery Compound

N

Drawing Title

Proposed Development Layout

Project Title

Proposed Substation, Underground Cabling & Access Roads to Knocknamork Renewable Energy Development

Drawn By	Checked By
NMcH	EOS
Project No.	Drawing No.
210732	Figure 4-1
Scale	Date
1:55000	28.06.2022

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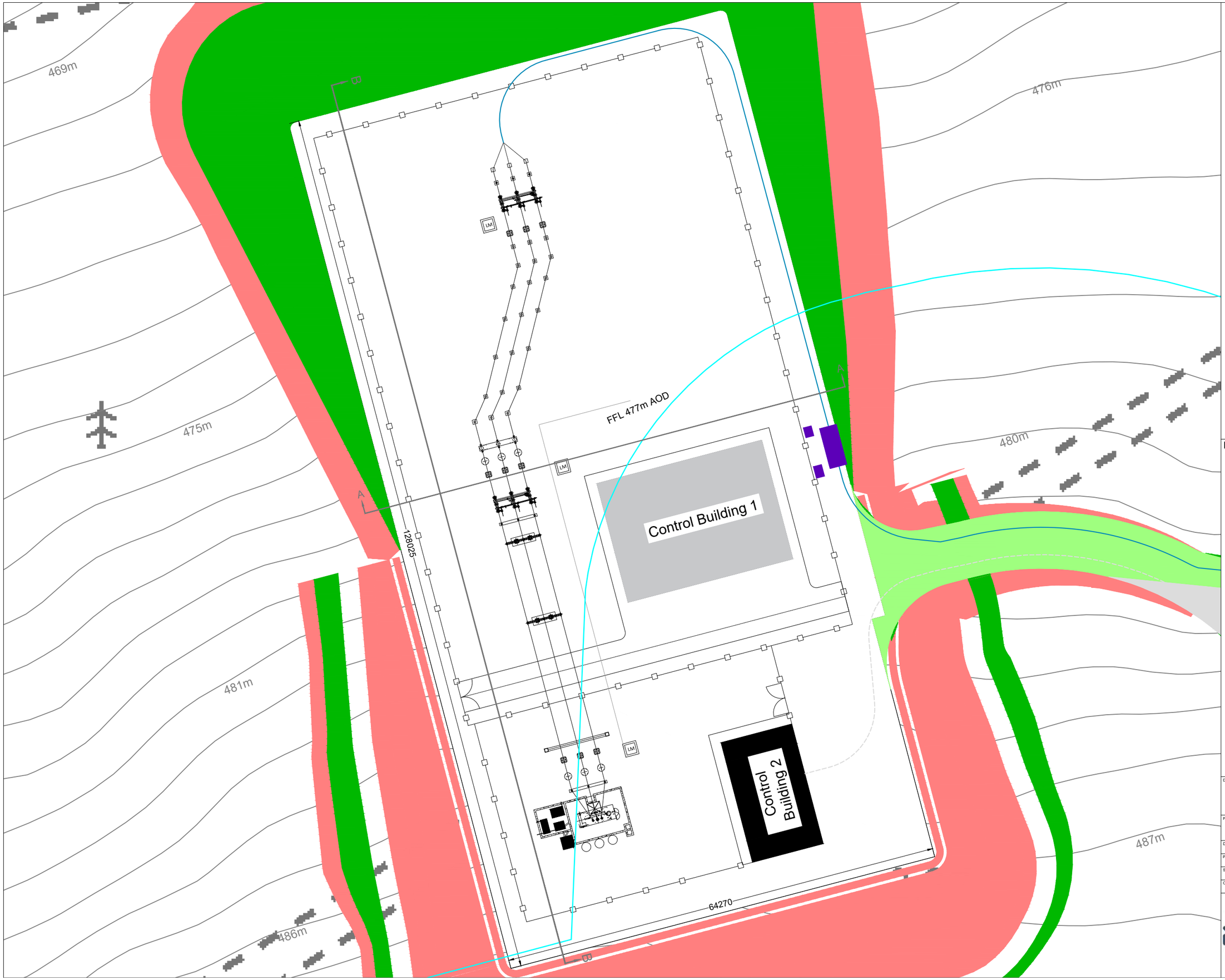

Drawing Legend

- Application Boundary KerryCounty Council
- Proposed 110kV Electrical Cabling
- Proposed Substation Access Track
- Joint Bay
- Cut
- Fill

DRAWING TITLE:
Substation Compound Layout

PROJECT TITLE: Knocknamork Grid Connection Infrastructure	
DRAWING BY: Joseph O Brien	CHECKED BY: Eoin O Sullivan
PROJECT No.: 210732	DRAWING No.: Fig 4-2
SCALE: 1:500 @ A3	DATE: 25.07.2022
OS SHEET No.: 6134, 6135, 6136, 6137, 6180, 6181, 6182, 6183, 6228, 6229, 6230, 6276, 6277	

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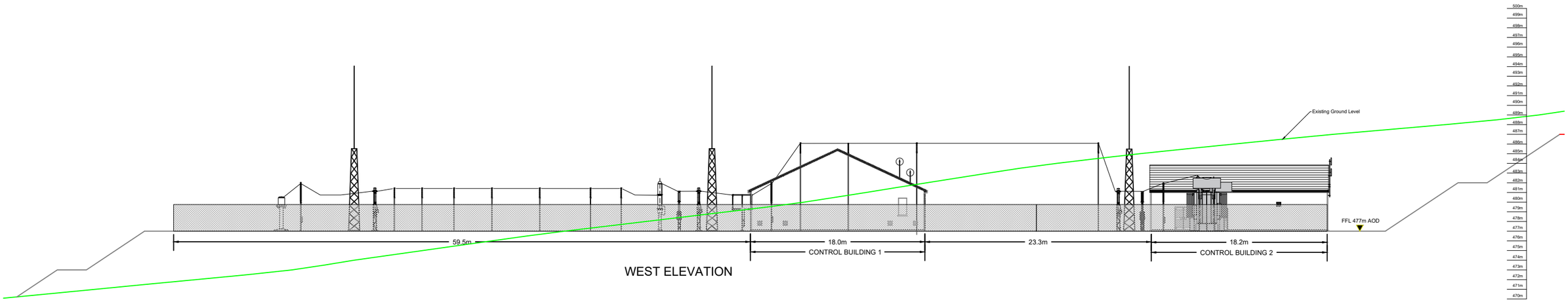
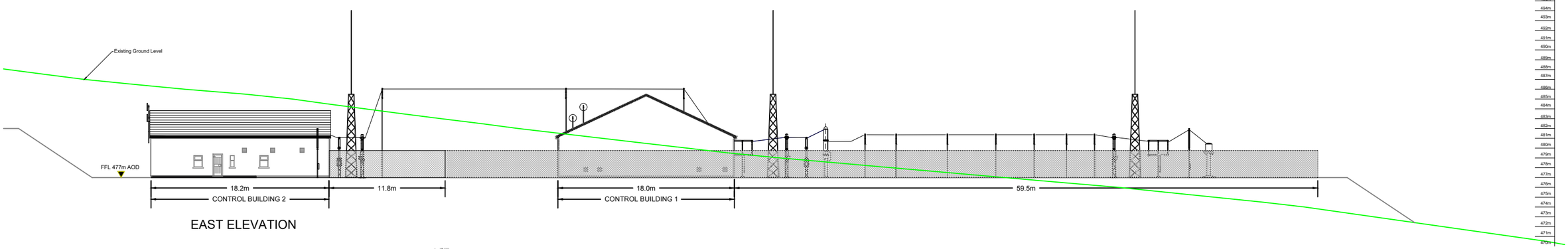
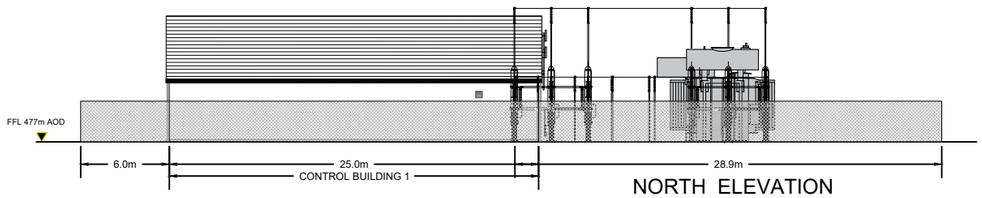


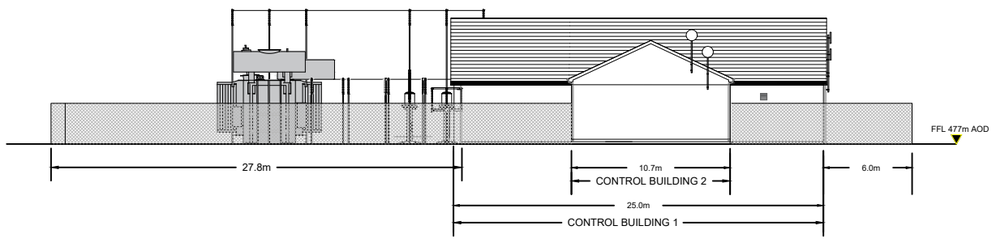
WEST ELEVATION



EAST ELEVATION



NORTH ELEVATION



SOUTH ELEVATION

DRAWING TITLE:
Substation Compound Elevations

PROJECT TITLE:
Knocknamork Grid Connection Infrastructure, An Bord Pleanala

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 210732	DRAWING No.: Fig 4-3
SCALE: 1:200 @ A1	DATE: 25.07.2022

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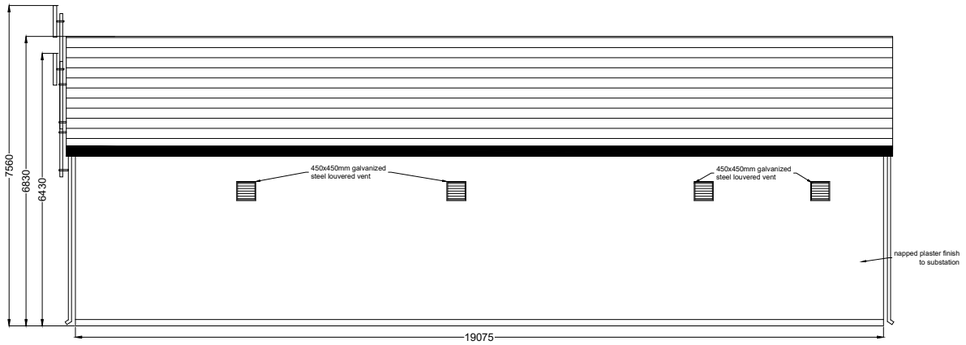
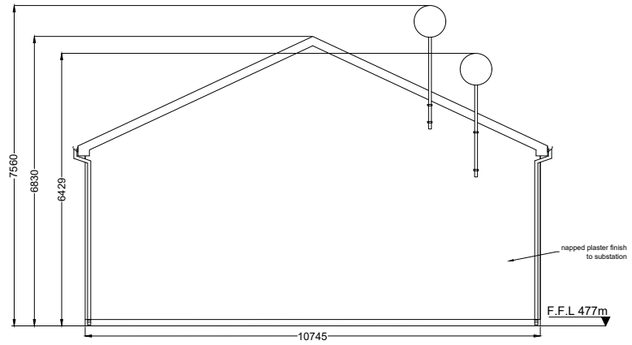


North Elevation



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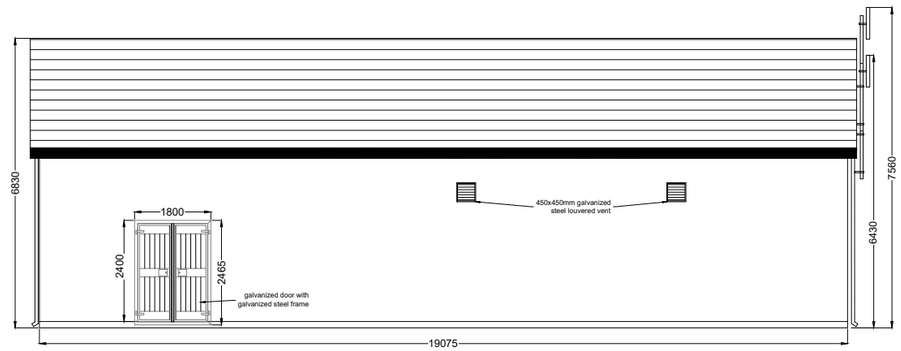
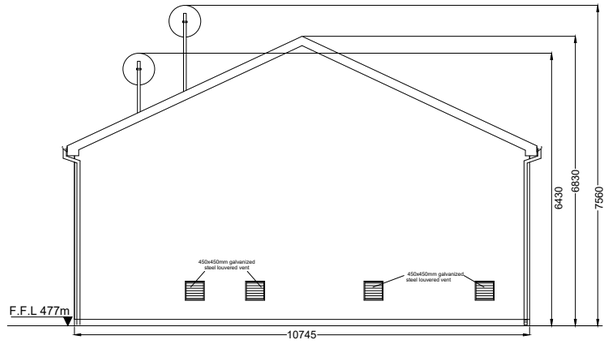


South Elevation



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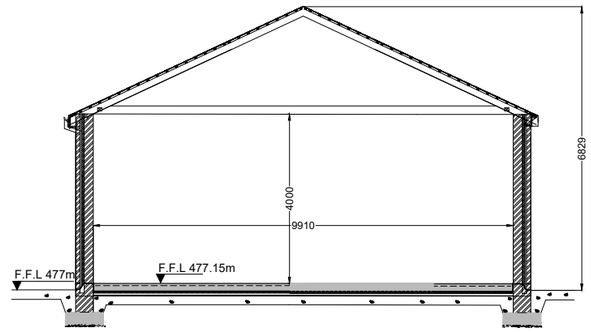
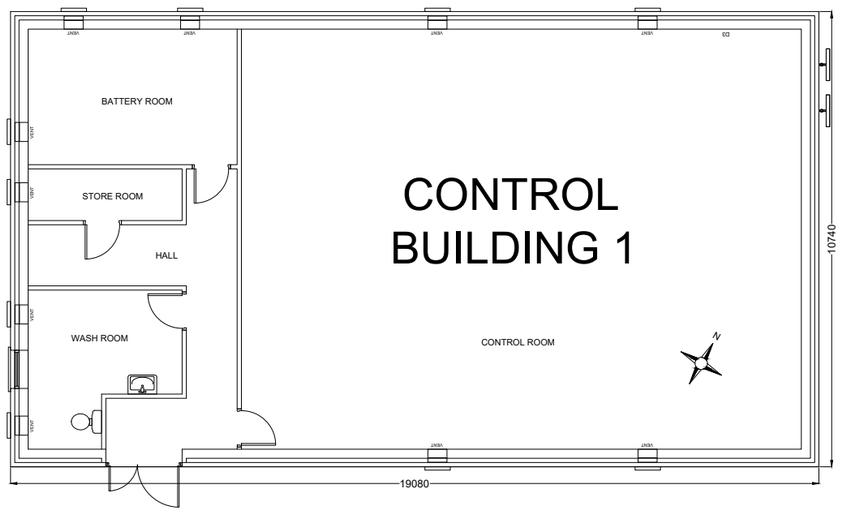


SECTION A-A



DRAWING TITLE:
Control Building 1

PROJECT TITLE:
Knocknamork Grid Connection Infrastructure, An Bord Pleanala

DRAWING BY:	CHECKED BY:
Joseph O Brien	Meabhann Crowe
PROJECT No.: 210732	DRAWING No.: Fig 4-4
SCALE: 1:100 @ A2	DATE: 25.07.2022

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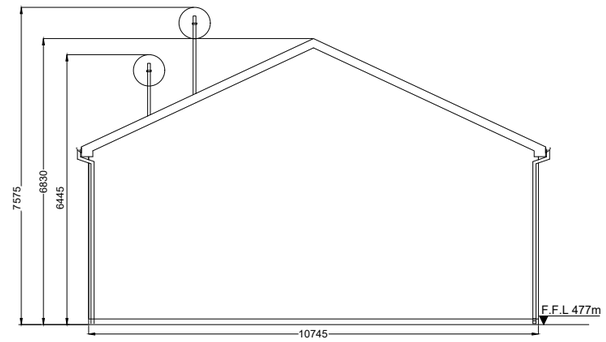
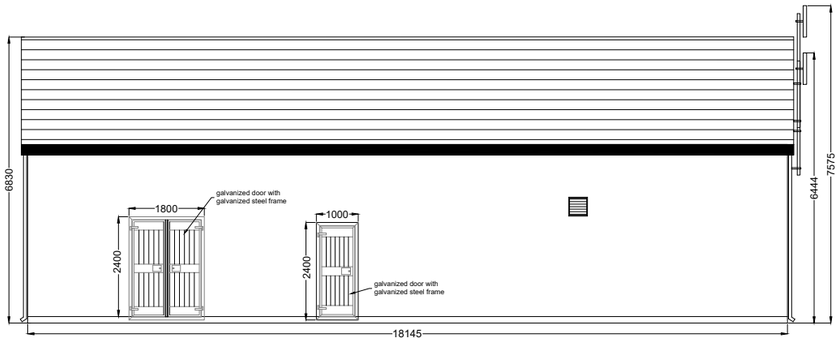
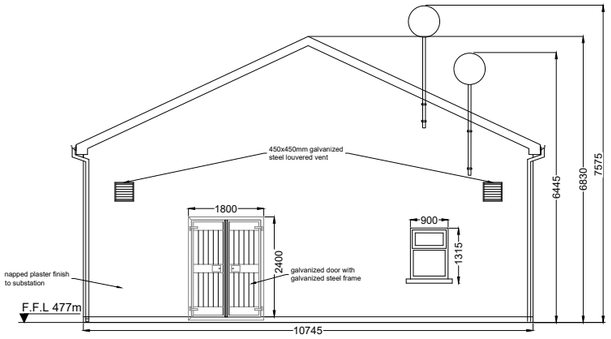


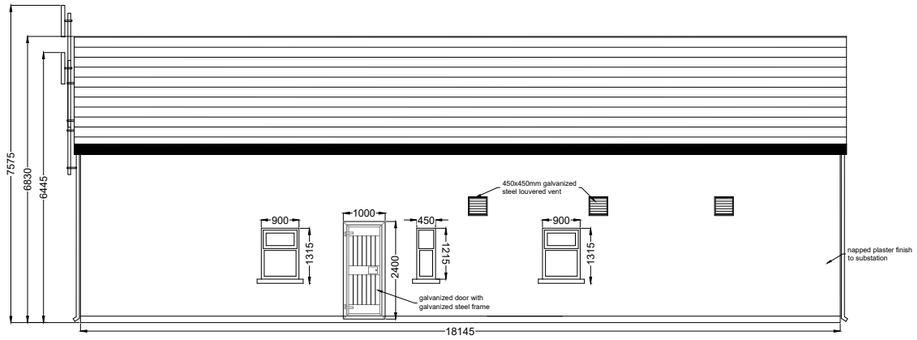
North Elevation



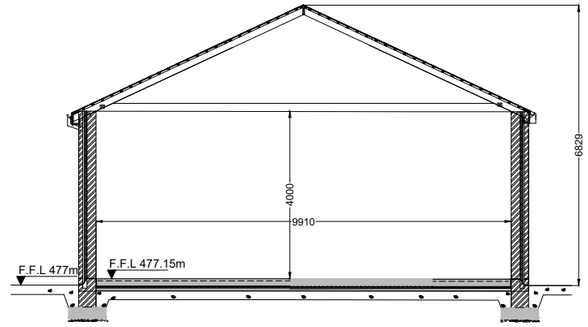
West Elevation



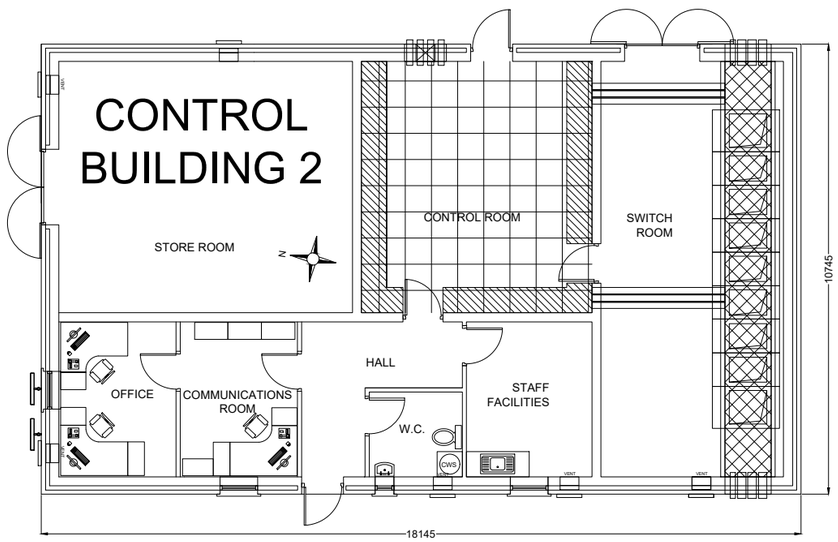
South Elevation



East Elevation



SECTION A-A



DRAWING TITLE:

Control Building 2

PROJECT TITLE:
Knocknamork Grid Connection
Infrastructure, An Bord Pleanala

DRAWING BY:	CHECKED BY:
Joseph O Brien	Meabhann Crowe
PROJECT No.: 210732	DRAWING No.: Fig 4-5
SCALE: 1:100 @ A2	DATE: 25.07.2022

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4.3.1.1 Substation Control Buildings

The wind farm control buildings will be located within the substation compound. Control building 1 will measure approximately 450 square metres in area and 9 metres in height. Control building 2 will measure approximately 195 square metres in area and 7 metres in height. Layout and elevation drawings of the control buildings are included in Figure 4-4 and Figure 4-5.

The substation control buildings will include staff welfare facilities for the staff that will work on the substation during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. There will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement for the substation does not necessitate a potable source. It is proposed to harvest rainwater from the roofs of the buildings, and if necessary, bottled water will be supplied for drinking.

It is proposed to manage wastewater from the staff welfare facilities in the control building by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site, and therefore the EPA's 2009 *'Code of Practice: Wastewater Treatment and Disposal Systems Serving Single Houses (p.e. 10)'* does not apply. Similarly, the EPA's 1999 manual on *'Treatment Systems for Small Communities, Business, Leisure Centres and Hotels'* also does not apply, as it too deals with scenarios where it is proposed to treat wastewater on-site.

Such a proposal for managing the wastewater arising on site has become almost standard practice on substation 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. The wastewater storage tank alarm will be part of a continuous stream of data from the Permitted Development turbines, wind measurement devices and the proposed electrical substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the site to a licensed facility.

4.3.2 Site Underground Cabling

The proposed underground electrical cabling consists of two elements: (1) 110kV underground electrical cabling connecting the proposed 110kV substation to the existing 220kV substation at Ballyvouskill; and (2) 33kV underground electrical cabling connecting the Permitted Development to the proposed 110kV substation.

4.3.2.1 110kV Underground Electrical Cabling

Approximately 3.6km of 110kV underground electrical cabling will connect the proposed 110kV substation to the existing Ballyvouskill 220kV Substation which will be installed predominantly following the alignment of existing forest roads / land and agricultural land.

The 110kV cable circuit will include power ducts, communication fibre ducts and earth wire laid in an excavation depth of approximately 1.3m as illustrated in Figure 4-6. The position of the cable trench relative to the roadways is shown in section in Figure 4-8 and Figure 4-9 below. The exact number and configuration of cable ducting may vary within the cabling trench. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage. A methodology for these works is provided in Section 4.6.3.

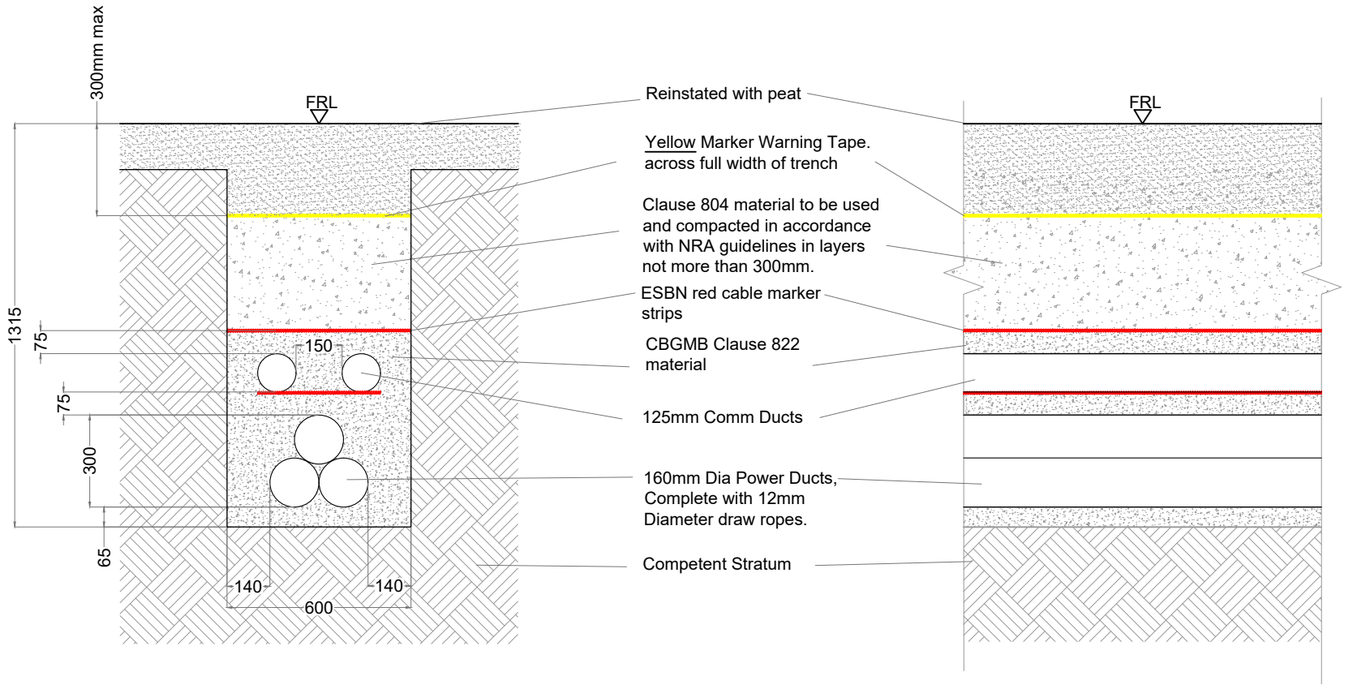
Note:

All dimensions are in millimetres, unless noted otherwise.

All dimensions to be checked on site and any discrepancy to be reported to the engineer.

Figured dimensions only to be used, drawings not to be scaled. If in doubt ask.

For illustration purposes only. Exact size and appearance of unit subject to manufacturer selection.



Cross section - 110kV

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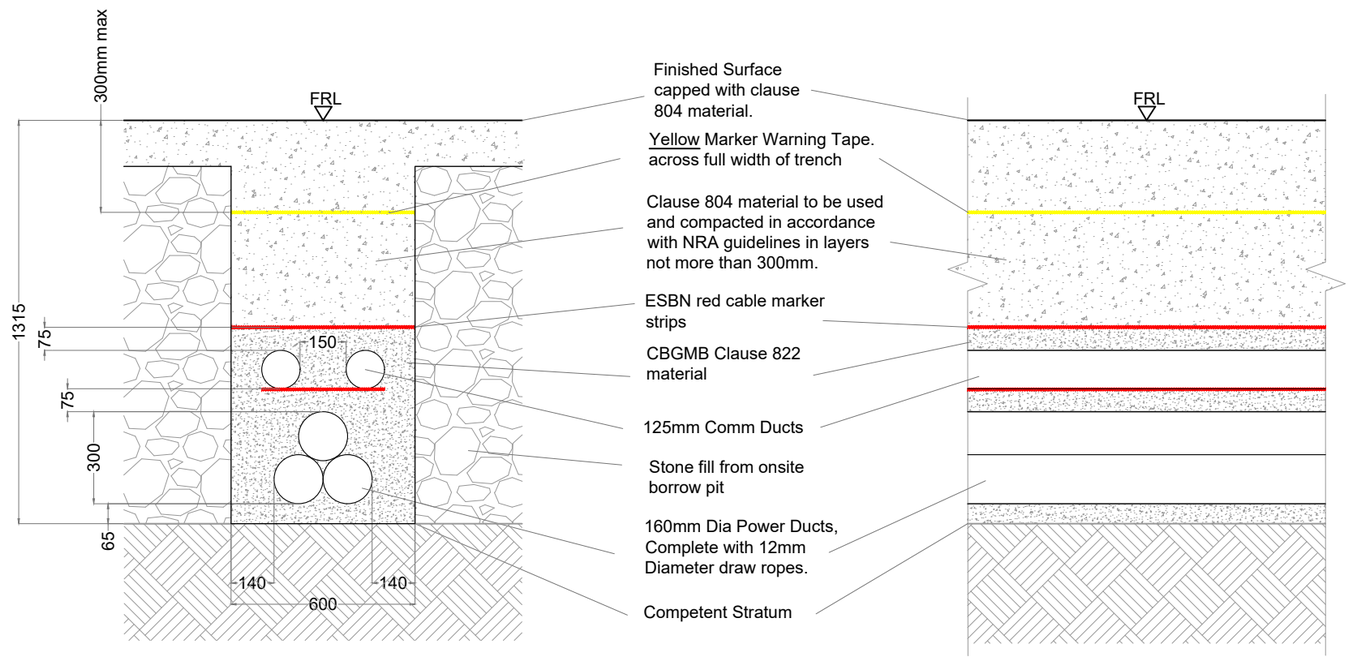

Cross section - 110kV

SCALE 1:20

DRAWING TITLE:
Cross Section - 110kV

PROJECT TITLE:
Knocknamork Grid Connection Infrastructure

DRAWING BY:	CHECKED BY:
Joseph O Brien	Meabhann Crowe
PROJECT No.: 210732	DRAWING No.: Fig 4-6
SCALE: 1:20 @ A3	DATE: 25.07.2022

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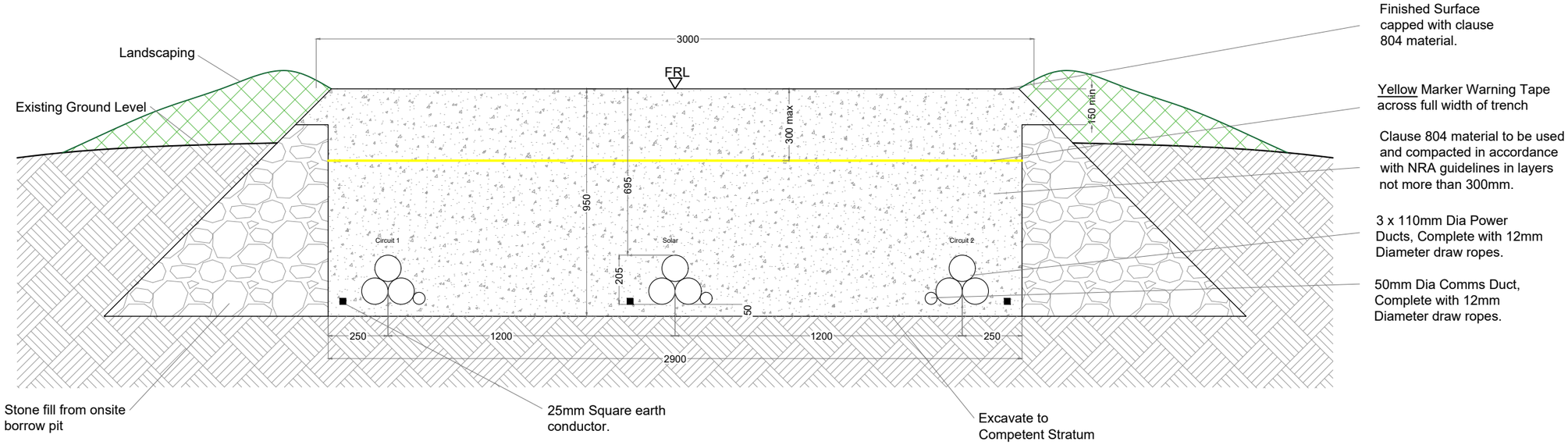

Cabling Cross Section - 33kV

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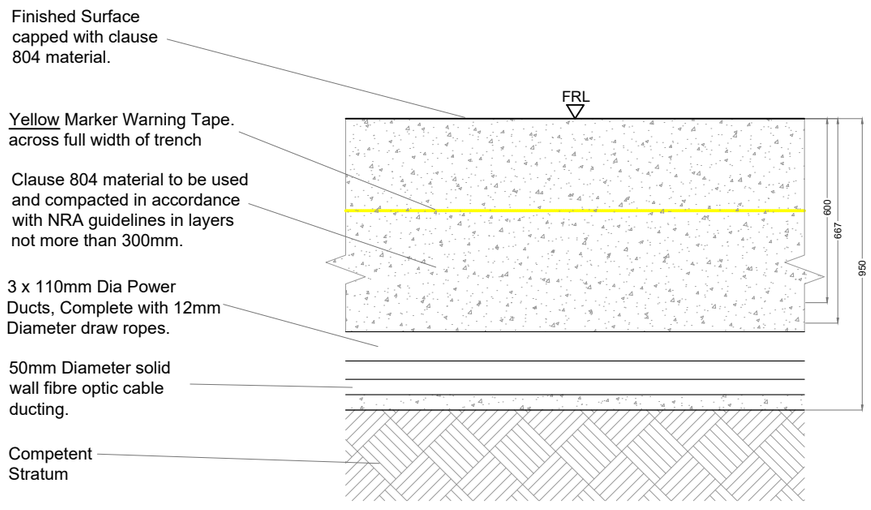

Note:

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For illustration purposes only. Exact size and appearance of unit subject to manufacturer selection.

Cabling Cross Section - 33kV

SCALE 1:20

DRAWING TITLE: **Cabling Cross Section - 33kV**

PROJECT TITLE: Knocknamork Grid Connection Infrastructure

DRAWING BY:	CHECKED BY:
Joseph O Brien	Meabhann Crowe
PROJECT No.: 210732	DRAWING No.: Fig 4-7
SCALE: 1:20 @ A3	DATE: 25.07.2022

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4.3.2.2 33kV Underground Electrical Cabling

The proposed 33kV underground electrical cabling will consolidate all of the on-site underground cabling, from the individual turbines and solar array, into 3 no. cable circuits connecting the Permitted Development to the proposed 110kV substation, The cable circuits will include power ducts, communication fibre duct and earth wire laid in an excavation depth of approximately 0.95m as illustrated in Figure 4-7. The 33kV underground cabling route will be finished with an access track approximately 3m wide and will connect the Permitted Development to the proposed 110kV substation predominately following proposed and existing forestry roads/firebreaks measuring approximately 11.7km. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage. A methodology for these works is provided in Section 4.6.3.

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

4.3.3 Watercourse / Culvert Crossing

The routes of any natural drainage features will not be altered as part of the Proposed Development. The underground electrical cabling route has been selected to avoid natural watercourses where possible. Up to 5 no. new watercourse crossings are required over streams along the proposed cable route (See Section 4.7.3.3 below). The methodologies for new crossings comprises a selection of clear span bridge or corrugated steel arch bridge, bottomless box culverts or piped culvert. These are required mainly where no crossing currently exists and where it is necessary to traverse watercourse with the cabling ducts.

The typical construction methodology for the installation of a clear-span bridge or bottomless box culverts is presented below:

- The cable track on the approach to 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 track will be installed in advance of the works.
- Safe access over the stream for this installation will be via a steel walkway & handrail which will span the stream.
- The foundation will consist of concrete footing which will be installed on a concrete lean mix foundation to provide a suitable base. The base will be excavated to rock or competent stratum 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 in- stream works required.
- The concrete footing will be installed as per a design engineers specification to a height appropriate to achieve the necessary clearance above the watercourse.
- The clear span bridge structure which will essentially be a precast concrete slab will be lifted in place using a crane. Likewise, where a bottomless box culvert is used it will also be precast and lifted into place on to the footings.
- The watercourse edge will be reinforced with rock armour where necessary to avoid any erosion or deterioration of the watercourse bank. This will be carried out in dry conditions and without the use of in-stream (water) works.

All other new crossings will be completed using piped culvert system at minor channels or manmade drains, the crossing will be installed as follows:

- The access road on the approach to the channel will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the culvert and drain crossing.
- The installation of the culvert will take place in low flow conditions.
- Where a flow exists, the water running through the channel will be pumped around the water crossing location and back into the channel downstream of the works area.
- Where over pumping is required, measures will be taken to ensure that the pumped water discharge does not disturb the stream bed with the force of water from the discharge. A steel plate to reduce the force of the flow will be used where appropriate.
- The project engineer will determine the required gradient of the culvert. The pipe must be laid at a gradient that will ensure water is contained within the pipe at all times. Where necessary a rock armour dam will be installed within the stream to reduce flow and ensure an acceptable depth of water remains within the pipe. Where a gradient of 1 – 1.5% is identified, the use of a baffle has been recommended.
- The bed of the channel will be excavated, if necessary, to achieve the correct line and to allow the pipe to be embedded 300mm into the base of the existing drain.
- The embedded section will be allowed to fill naturally with existing material within the base of the drain or with suitable drainage material such as gravel or round shingle where deemed applicable.
- The culvert will be lowered into place using an excavator with a lifting mechanism.
- Large stone boulders (approx. 400mm), sourced from the on-site borrow pits, will be placed over the culvert to create a headwall for the culvert and a suitable sub-base for road construction.
- Smaller 50mm stone, sourced on site will be placed upon the sub-base to construct the road over the water crossing.

Any watercourse crossings required will be installed outside of the salmonid spawning season, October to June in any year, in accordance with Inland Fisheries Ireland best practice (IFI, 2016). This will ensure no potential impacts on salmonid spawning habitat.

The works will be undertaken in line with NRA (TII) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes.

All of the above works will be supervised by the Environmental Clerk of Works and the Project Hydrologist.

4.3.4 Site Access Road

4.3.4.1 Road Construction Types

To provide access within the Proposed Development site and to connect the associated infrastructure existing roads 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. *Maximising use of existing infrastructure;*
3. *Minimising excavation arisings;*
4. *Serviceability requirements for construction and wind turbine delivery and maintenance vehicles;*
5. *Requirement to minimise disruption to peat hydrology.*

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

4.3.4.1.1 Upgrade of Existing Access Roads or Tracks

The general construction methodology for upgrading of existing sections of access roads or tracks, as presented in Fehily Timoney & Company (FT) *Peat & Spoil Management Plan* in Appendix 4-2 of this EIAR, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

1. *Access road construction shall be to the line and level requirements as per design/planning conditions.*

2. *For upgrading of existing access roads the following guidelines apply:*

    a) *Excavation of the widened section of access road should take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.*
    b) *Benching of the excavation may be required between the existing section of access road and the widened section of access road depending on the depth of excavation required.*
    c) *Access roads to be finished with a layer of capping across the full width of the road.*
    d) *A layer of geogrid/geotextile may be required at the surface of the existing access road and at the base of the widened section of access road (to be confirmed by the designer).*
    e) *For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination should be reviewed during construction, as appropriate. Should areas of weaker peat be encountered then slacker slopes (1v:4h) will be required to ensure stability.*

3. *The finished road width will have a running width of 5m (TDR), with wider sections on bends and corners. The finished width on the sections of excavated road alongside existing roads along the 110kV underground cabling will be 2.5m and along the 33kV underground cabling will be 3m.*

4. *On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.*

Sections of existing road for upgrade are shown in Figure 4-8.

4.3.4.1.2 Construction of New Excavated Roads

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

The construction methodology for the construction of excavated roads, as presented in FT's *Peat & Spoil Management Plan* in Appendix 4-2 of this EIAR, is summarised below. This methodology includes the following procedures.

1. *Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.*

2. *Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.*

3. *Excavation of roads will be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.*

4. *Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill.*

5. *Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads before being placed into the permanent peat storage areas within the borrow pits or reused for landscaping purposes. All temporary storage areas will be upslope of founded roads and will be inspected by a suitably qualified person before material is stored in the area.*

6. *Excavation of materials with respect to control of peat stability:*

    a) *Acrotelm (to about 0.3 to 0.4m of peat) is generally required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.*
    b) *Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.*
    c) *All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated placement areas, unless required for landscaping purposes, such as along the 33kV cable route.*

7. *Side slopes in peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.*

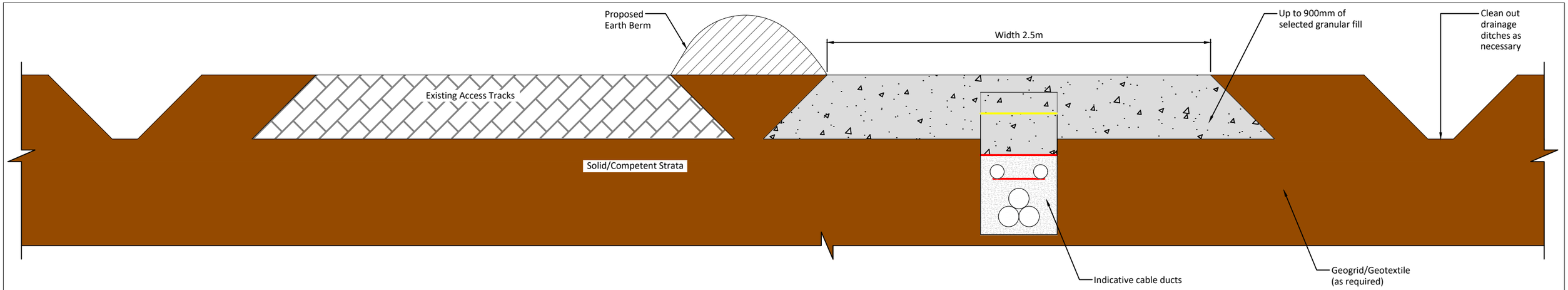
8. *The excavated access road will be constructed with up to 1200mm of selected granular fill, depending on the section of road. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.*

9. *Access roads to be finished with a layer of capping across the full width of the road.*

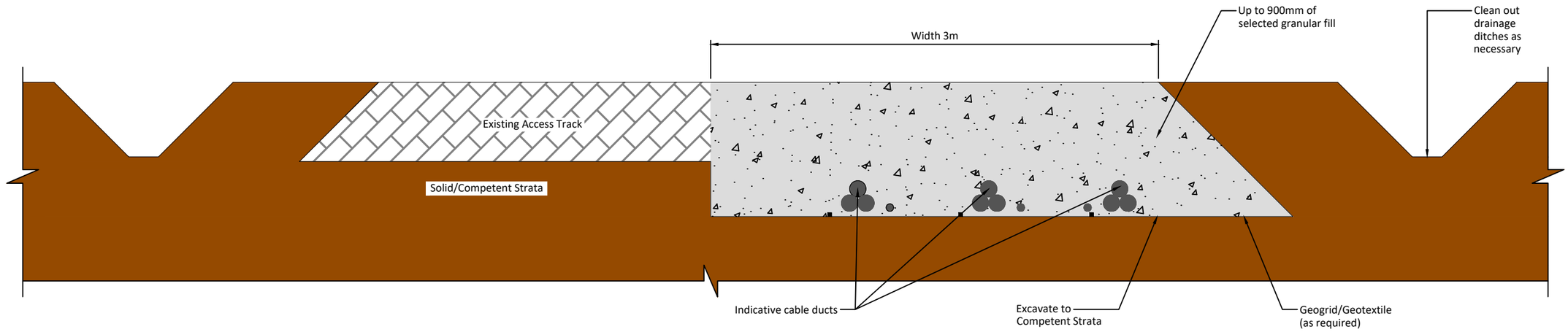
10. *A layer of geogrid/geotextile may be required at the surface of the competent stratum.*

11. *A final surface layer shall be placed over the excavated road and graded to accommodate construction and delivery traffic.*

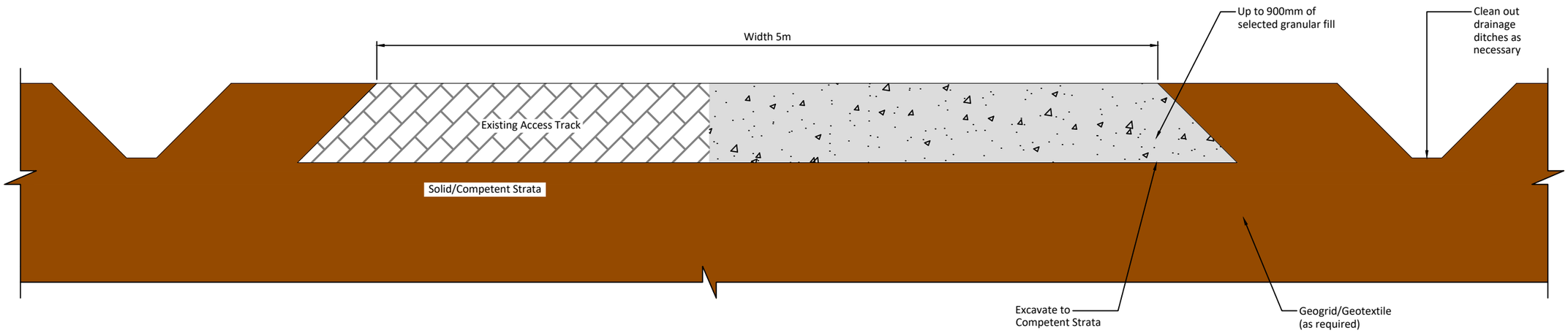
Section of a new excavated road is shown in Figure 4-9.



110 kV underground cabling route



33kV underground cabling route.



Existing access for upgrade

DRAWING TITLE:
Upgrade of Existing Excavated Access Roads

PROJECT TITLE:
Knocknamork Grid Connection Infrastructure

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 210732	DRAWING No.: Fig 4-8
SCALE: 1:30 @ A3	DATE: 25.07.2022
OS SHEET No.:	

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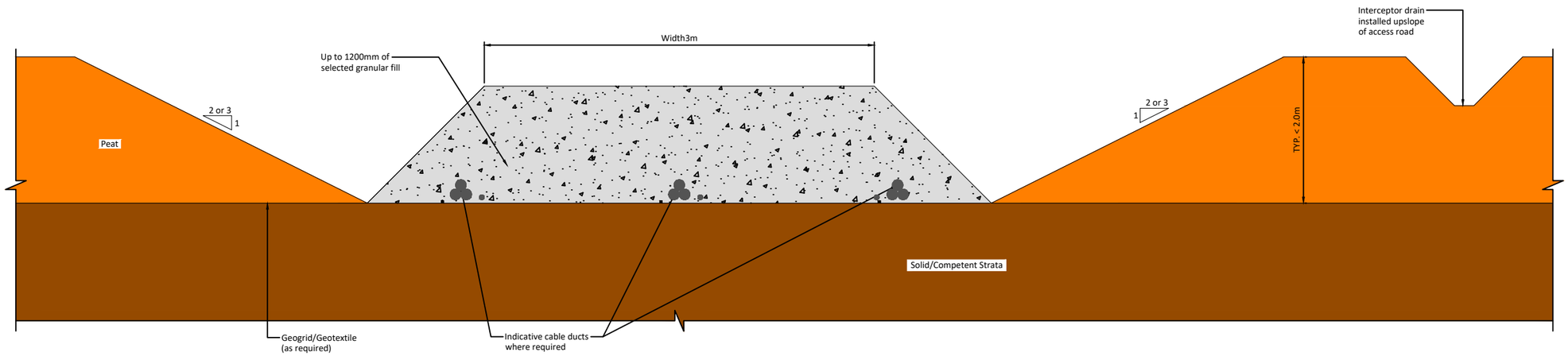
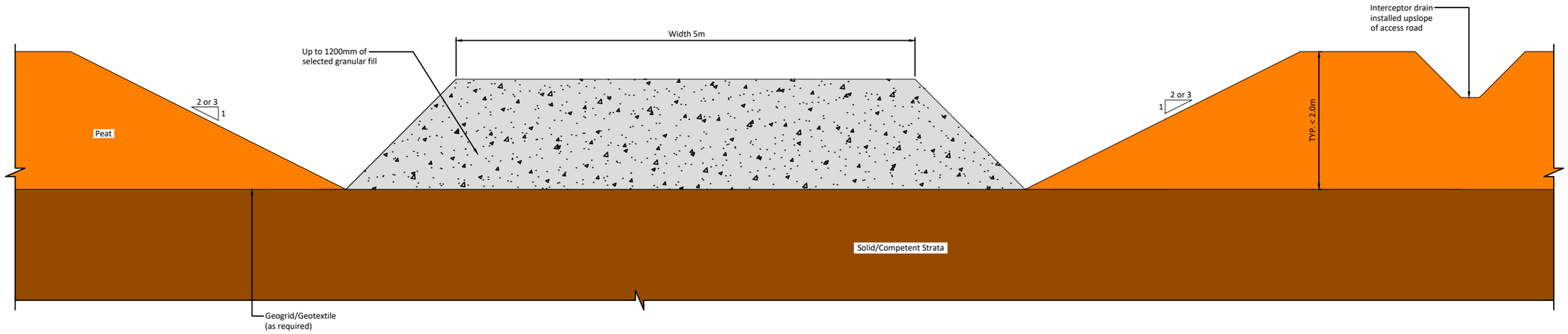
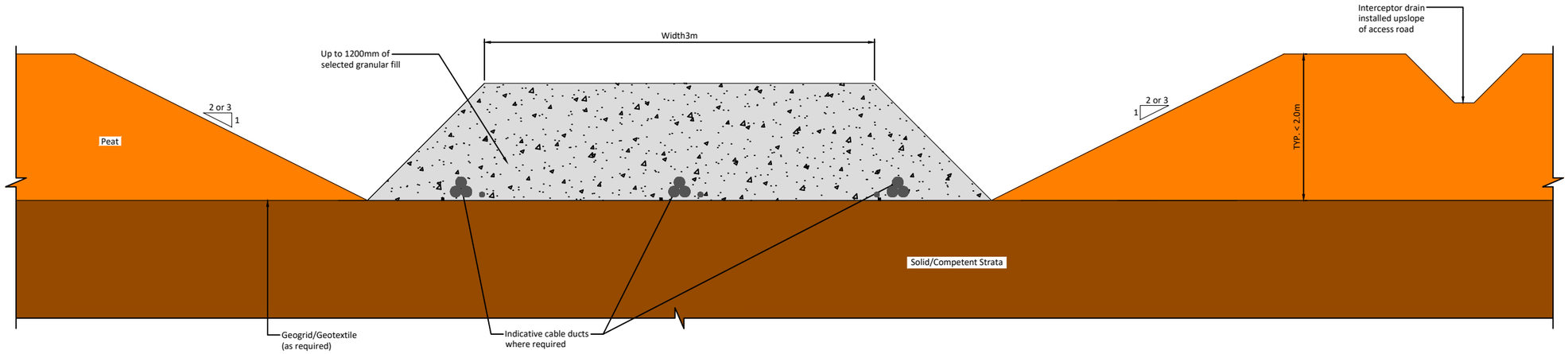


33kV underground cabling route .



Proposed New Access Track



33kV underground cabling route .

DRAWING TITLE:
New Excavate and Replace Access Road

PROJECT TITLE:
Knocknamork Grid Connection Infrastructure

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 210732	DRAWING No.: Fig 4-9
SCALE: 1:50 @ A3	DATE: 25.07.2022
OS SHEET No.:	

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4.3.5 Borrow Pits

4.3.5.1 Description

It is proposed to develop a new borrow pit as part of the Proposed Development and extend the borrow pit as permitted under Planning Permission Ref. No. 19/4972. It is proposed to obtain the majority of all rock and hardcore material that will be required during the construction of the Proposed Development from the borrow pit and the permitted borrow pit extension. Usable rock may also be won from other infrastructure excavations (such as the substation platform excavation).

The location of the borrow pits are shown on Figure 4-1 and on the detailed site layout drawings included as Appendix 4-1 to this EIAR.

The new borrow pit is located approximately 50 metres southeast of the proposed 110kV substation and measures approximately 13,094 m^2 in area. The new borrow pit will be formed in two main cells stepped to align with the natural topography. The northern cell covers an area of 6,249 m^2 and the southern cell covers an area of 6,845 m^2. The borrow pit will cater for the construction of the 110kV substation and 110kV underground electrical cabling route and access roads. The southern cell will cater for the construction of the 33kV underground electrical cabling route and access roads in County Kerry.

The permitted borrow pit will be extended laterally to cover a total area of approximately 9,900 m^2. The extension will cover an area of approximately 3,321 m^2.

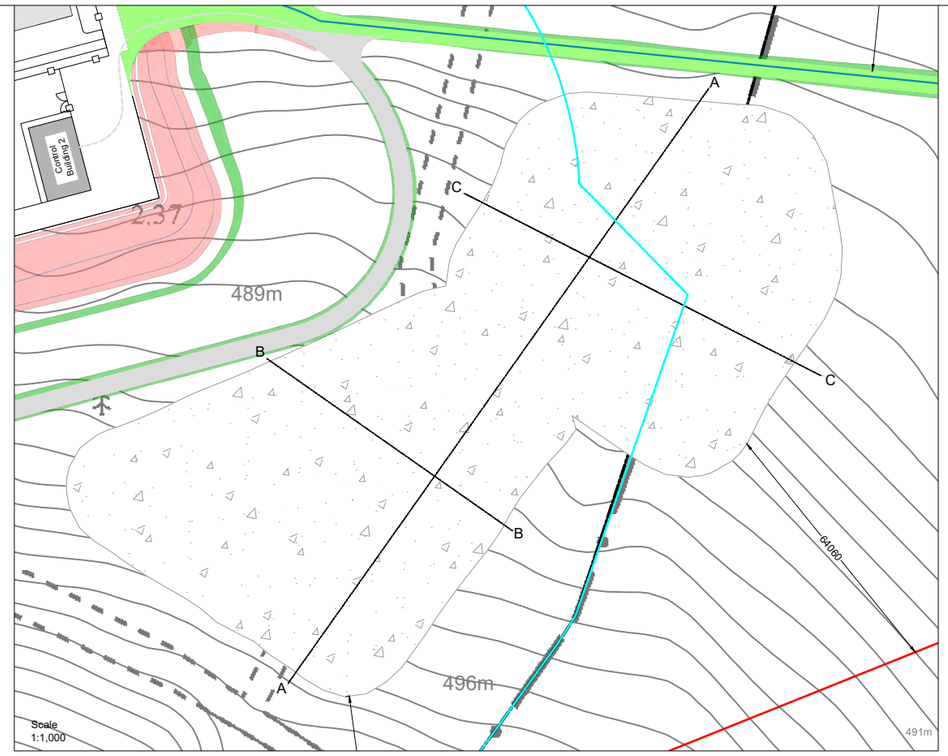
It is intended that all hardcore materials required for the construction of the Proposed Development will be won on-site.

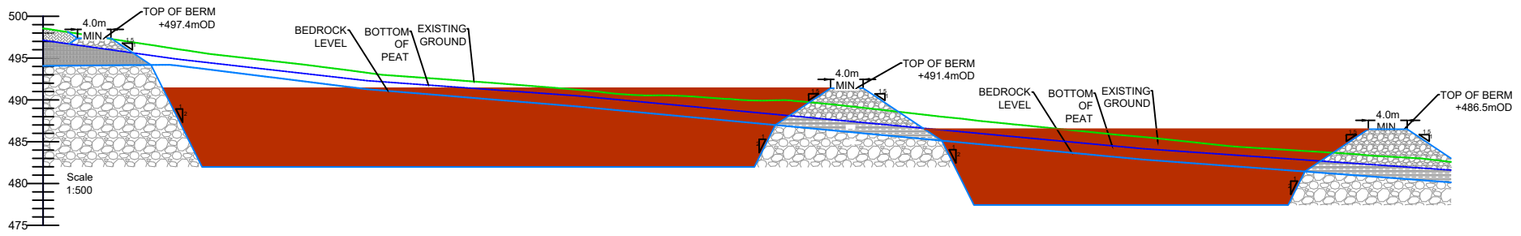
Figure 4-10 and Figure 4-11 below shows detailed sections through the proposed borrow pit and borrow pit extension respectively. The borrow pits will, on removal of all necessary and useful rock, be reinstated with excavated peat and subsoils as described in Section 4.3.6.2 below.

Post-construction, any unsafe areas around the borrow pit areas will be permanently secured and a stock-proof fence will be erected around the borrow pit area to prevent access to these areas. Appropriate health and safety signage will also be erected on this fencing and at locations around the fenced area.

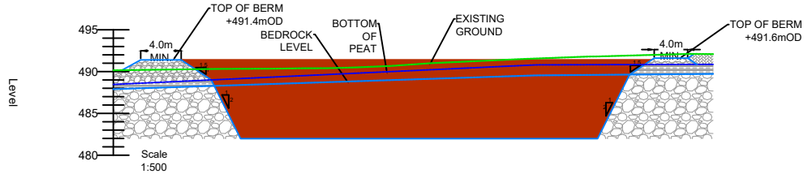
Hardcore materials will be extracted from the borrow pits (and other infrastructure locations, if necessary), principally by means of rock breaking. Depending on the hardcore volume requirements, blasting may also be used as a more effective rock extraction method, capable of producing significant volumes of rock in a matter of milliseconds. Blasting will only be carried out after notifying any potentially sensitive local residents. The developer is committed to notifying all properties within 1km of any proposed blast location which is greater than the distance stated in in the quarry guidance of 500m, *Quarries and Ancillary Activities Guidelines for Planning Authorities April 2004* (DoEHG). The potential noise and vibration impact on sensitive receptors associated with the rock extraction measures, detailed below, are assessed in Chapter 10 of this EIAR.

The two proposed extraction methods are detailed below.

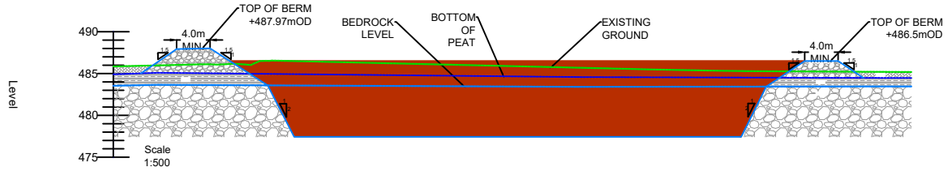




SECTION A-A



SECTION B-B



SECTION C-C

DRAWING TITLE:
Borrow Pit Plan & Section

PROJECT TITLE:
Knocknamork Grid Connection Infrastructure

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 210732	DRAWING No.: Fig 4-10
SCALE: As Shown @ A2	DATE: 25.07.2022

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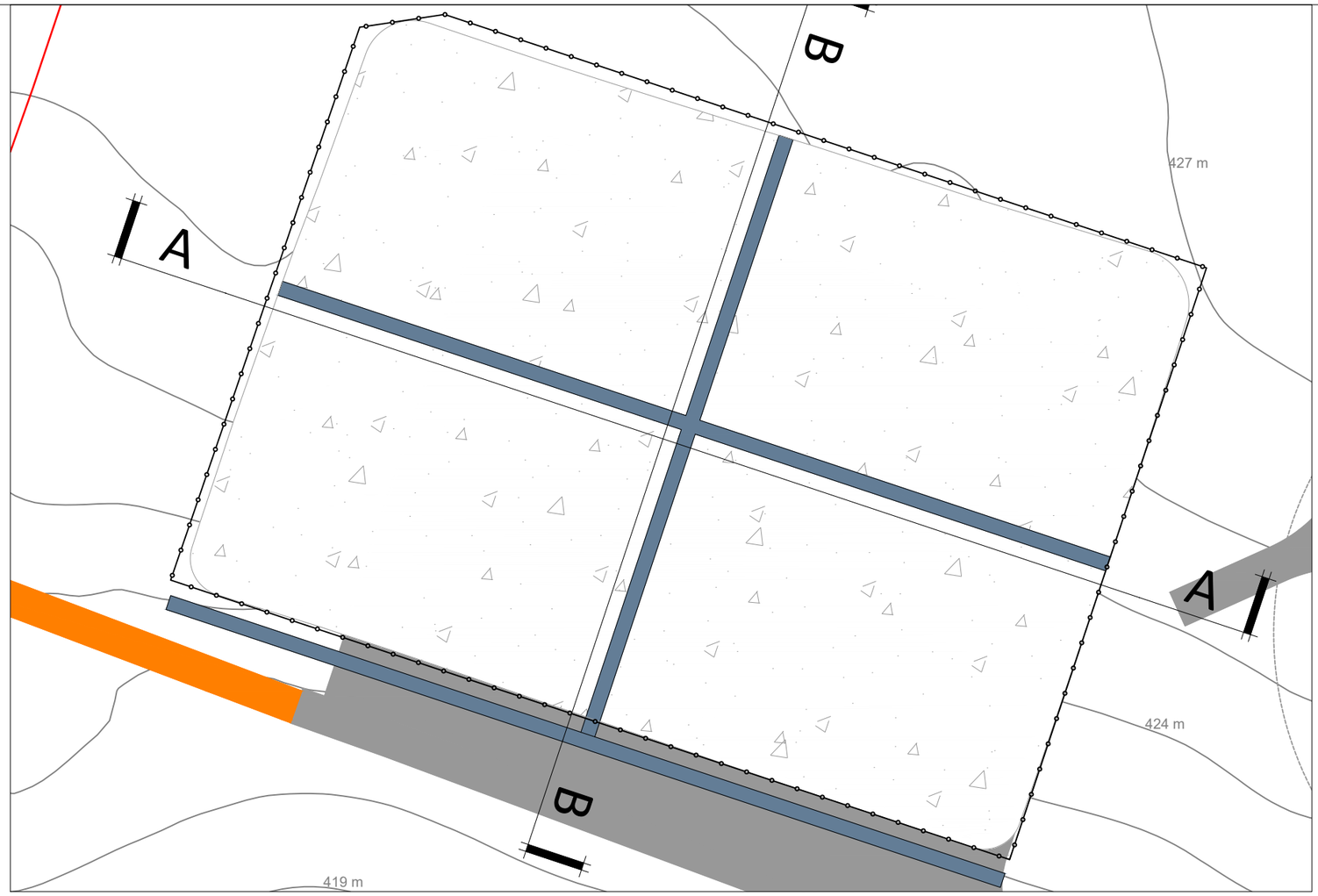
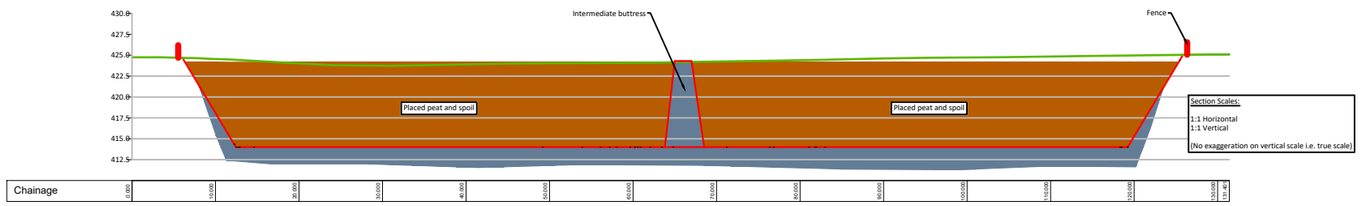
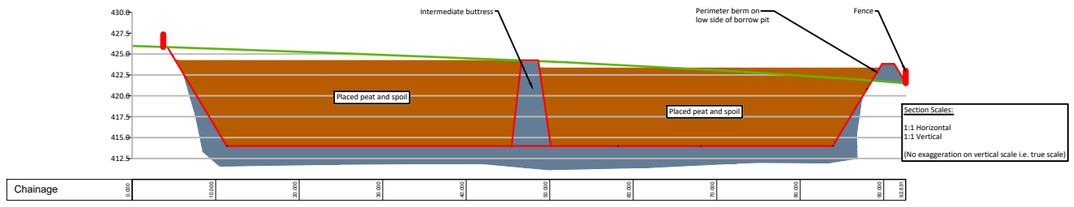




SECTION A-A



SECTION B-B

DRAWING TITLE:
Borrow Pit Extension Plan & Section

PROJECT TITLE:
Knocknamork Grid Connection Infrastructure

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 210732	DRAWING No.: Fig 4-11
SCALE: 1:500 @ A2	DATE: 25.07.2022

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4.3.5.2 Rock Extraction Methods

The extraction of rock is a work stage of the Proposed Development which will be a temporary operation run over a short period of time relative to the duration of the entire project. Where there is a layer of overburden present within the area to be excavated, it will be stripped back and stockpiled using standard track mounted excavators. Two extraction methods have been assessed for breaking out the useful rock below; rock breaking and blasting.

4.3.5.2.1 *Rock Breaking*

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

A large rock breaking excavator progressively breaks out the solid rock from the ground in the borrow pit area. The large rock breaker is typically supported by a smaller rock breaker which can often be in the 30-40 tonne size range and works to break the rocks down to a size that they can be fed into a crusher.

The extracted broken rock is typically loaded into a mobile crusher using a wheeled loading shovel and crushed down to the necessary size of graded stone required for the on-site civil works. The same wheeled loader takes the stone from the crusher conveyor stockpile and stockpiles it elsewhere away from the immediate area of the crusher until it is required elsewhere on the site of the Proposed Development. The potential impacts associated with noise are assessed in Chapter 10 Noise.

4.3.5.2.2 *Rock Blasting*

Where blasting is used as an extraction method, a mobile drilling rig is used to drill vertical boreholes into the area of rock that is to be blasted. The drilling rigs used are normally purpose built, self-propelled machines, designed specifically for drilling blast boreholes. A drilling rig working for 3-4 days would typically drill the necessary number of boreholes required for a single blast. The locations, depth and number of boreholes are determined by the blast engineer, a specialist role fulfilled by the blasting contractor that would be employed to undertake the duties. Where blasting is employed as the extraction method, it is more efficient to increase the depth of the excavation and thus minimise the excavation footprint.

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

A properly designed blast should generate rock of a size that can be loaded directly into a mobile crusher, using the same wheeled loader description outlined above. From that point on, the same method is used for processing the rock generated from a blast, as would be used to process rock generated by rock breaking. It would be likely that a drilling rig would recommence drilling blast holes for the next blast as soon one blast finished. Rock blasting will be undertaken in line with the Safety and Health Commission for the Mining and other Extractive Industries report on *Guidance on the Safe*

Use of Explosives in Quarries to ensure the safe use of explosives on-site. Only authorised people will handle explosives for rock blasting at the site. Given the small quantities of explosives to be used on site, it is considered that there is negligible risk of a major accident occurring from the use of explosives on site. The potential impacts associated with noise are assessed in Chapter 10 Noise.

4.3.6 Peat and Spoil Management Plan

4.3.6.1 Quantities

The quantity of peat and non-peat material (spoil), requiring management on the site of the Proposed Development has been calculated, as presented in Table 4-1 below. These quantities were calculated by FT) as part of the *Peat and Spoil Management Plan* in Appendix 4-2 of this EIAR.

Table 4-1 Peat and Spoil Volumes requiring management

Development Component	Area (m2) (approx.)	Peat Volume (m^3) (approx.)	Spoil Volume(m3) (approx.)
Turbine Delivery Route (TDR) plus Site Entrance works	Widening of existing access road to 5m running surface. Construction of new 5m access road. Widening of existing entrance and construction of temporary track from N22..	17,000	2,200
Access road for 33kV cabling	Assumed 3m (33kV) and 2.5m (110kV) running surface with 4-5m wide development footprint.	18,000	6,000
Access road for 110kV cabling		10,500	2,500
Substation Platform	130 x 65m hardstanding area	19,000	12,000
Proposed Borrow Pit	1 no. borrow pit at substation.	3,500	4,800
Extension to permitted borrow pit	120m x 85m footprint	1,000	2,000
Total		**69,000**	**29,500**
Total Peat & Spoil to be managed		**98,500**	

Note: A bulking factor of 10% has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

It should be noted that the excavated rock volume is not included in the total volume quoted above in Table 4-1 above. It is assumed that the excavated rock volume will be re-used on site as part of the construction works for the development and hence will not require reinstatement on site.

4.3.6.2 Peat and Spoil Usage in Restoration of Borrow Pits

Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads before being placed into the permanent peat storage areas within the borrow pits or reused for landscaping purposes. All excavated peat along the proposed 33kV underground cabling route will be temporarily placed/spread alongside the proposed access road, where possible, and then reused as landscaping on either side of the proposed road. All temporary storage areas will be upslope of founded roads/hardstand areas and will be inspected by a suitably qualified person before material is stored in the area.

Once the required volume of rock has been extracted from the borrow pit area, it is intended to reinstate this area with any surplus peat and overburden excavated from the works areas of the Proposed Development.

The general construction methodology for the construction of the borrow pit, as presented in FTs *Peat & Spoil Management Plan* in Appendix 4-2 of this EIAR, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

As rock is being extracted from the borrow pit, upstands of rock will be left in place, depending on the type of rock, to act as intermediate retaining buttresses. Where this is not achievable, stone buttresses will be constructed within the borrow pit. The upstands or buttresses will form individual restoration areas within the borrow pit which will be filled once the required volume of rock has been extracted from each individual area. The buttresses will be wide enough to allow construction traffic access for the tipping of peat and spoil into the individual cells.

The placement of peat and spoil within the borrow pit will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

The following particular recommendations/best practice guidelines for the placement of peat & in the borrow pit should be considered and taken into account during construction.

- The borrow pit will be an enclosed depression and drainage from this area will be managed effectively using temporary pumping arrangements and settlement ponds.
- Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from borrow pit area.
- Silting ponds (settlement ponds) may be required at the lower side/outfall location of the borrow pit.
- The settlement ponds at the borrow pit will be designed to allow 24hr retention.
- A layer of geogrid to strengthen the surface of the placed peat & spoil within the borrow pit may be required.
- Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat & spoil to be placed safely.
- The height of the rock buttresses constructed should be greater than the height of the placed peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 5m in height are likely to be required.

4.3.6.2.1 Placement of Peat & Spoil alongside Proposed Infrastructure Elements

In some areas of the site of the Proposed Development excavated materials will be placed alongside the proposed infrastructure elements. The following recommendations/best practice guidelines for the placement of peat and spoil alongside the proposed infrastructure elements will be adhered to during the construction of the Proposed Development:

1. *All excavated peat along the proposed 33kV underground cabling route will be temporarily placed/spread alongside the proposed access road, where possible, and then reused as landscaping on either side of the proposed road.*

2. *The placement of excavated peat should be restricted to areas where the peat depth is less than 2m.*

3. *The peat placed adjacent to the proposed infrastructure elements should be restricted to a maximum height of 1m over a up to 10m wide corridor on the upslope side of the proposed infrastructure elements. It should be noted that the designer should define/confirm the maximum restricted height for the placed peat and spoil.*

4. *The placement of excavated peat is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat within the placement areas will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats.*

5. *Where there is any doubt as to the stability of the peat surface then no material shall be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface.*

6. *Where practical, it should be ensured that the surface of the placed peat and spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the peat and spoil should be carried out as placement of peat and spoil within the placement area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat and spoil.*

7. *Finished/shaped side slopes in the placed peat and spoil shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat and spoil are encountered then slacker slopes will be required.*

8. *Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat and spoil within the placement areas.*

9. *Movement monitoring instrumentation may be required adjacent to the access road where peat has been placed. The locations where monitoring is required will be identified by the designer on site.*

10. *Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.*

11. *An interceptor drain will be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will help ensure stability of the placed peat and reduce the likelihood of debris run-off.*

12. *All the above mentioned general guidelines and requirements should be confirmed by the designer prior to construction.*

The management of excavated peat and overburden and the methods of placement and/or reinstatement are described in detail in FT's *Peat and Spoil Management Plan* in Appendix 4-2 of this EIAR.

4.3.7 Tree Felling

4.3.7.1 Tree Felling

Some of the Proposed Development site is located on commercial forestry. As part of the Proposed Development, tree felling will be required within and around the development footprint to allow the construction of the underground cabling, substation, borrow pit and the other ancillary infrastructure. It should be noted that forestry on the site of the Proposed Development was originally planted as a commercial crop and will be felled in the future should the Proposed Development proceed or not.

A total of 21.7 hectares of forestry will be permanently felled within and around the footprint of the Proposed Development. Figure 4-12 shows the extent of the areas to be permanently felled as part of the Proposed Development.

The tree felling activities required as part of the Proposed Development will be the subject of a Limited Felling Licence (LFL) application to the Forest Service, 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.

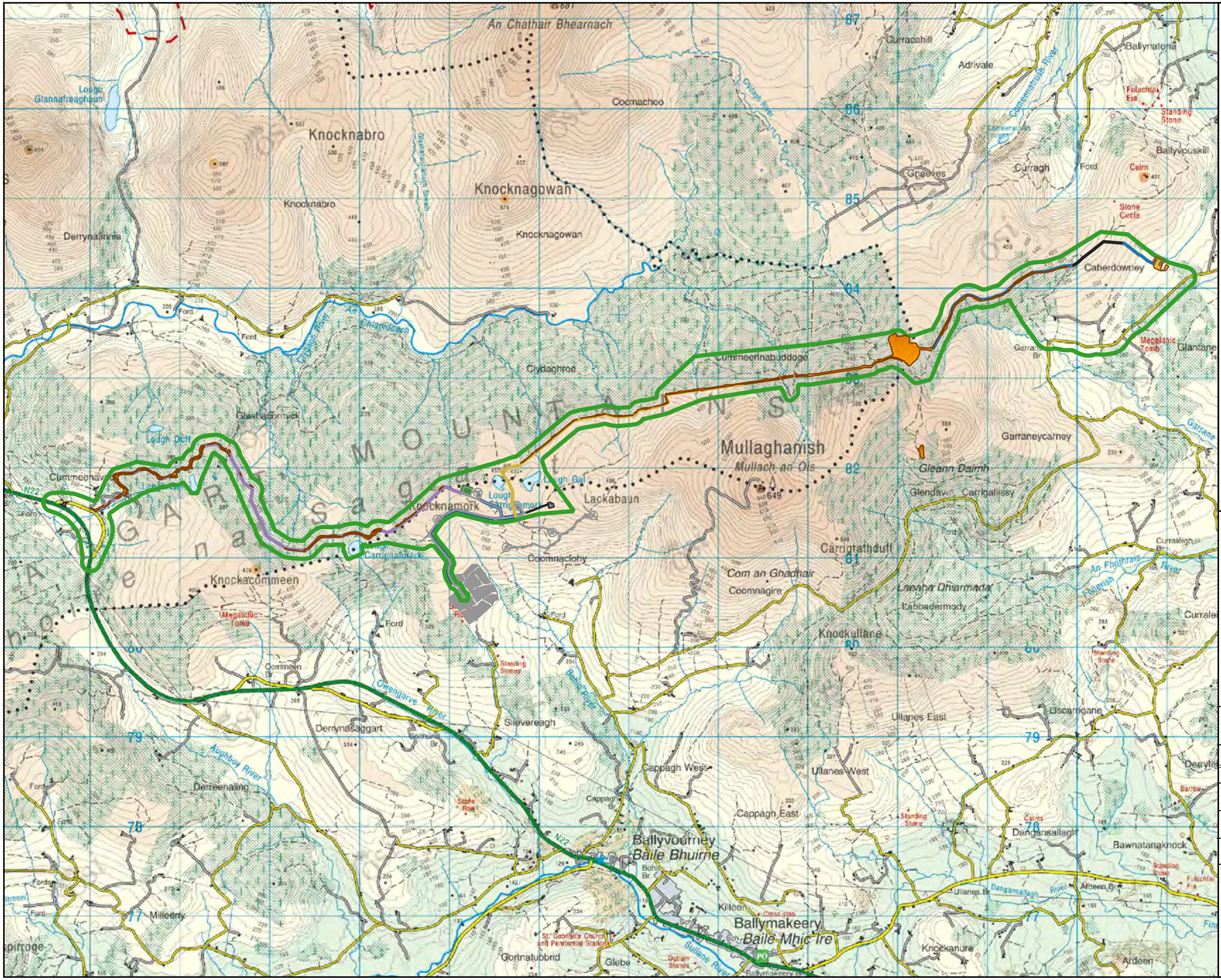
4.3.7.2 Forestry Replanting

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

The estimated 21.7 hectares that will be permanently felled for the footprint of the Proposed Development infrastructure will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that will be issued in respect of the Proposed Development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The replacement of the 21.7 hectares of forestry can occur anywhere in the State subject to licence. The replacement of forestry, felled as part of the Proposed Development, may occur on any lands, within the state, benefitting from Forest Service Technical Approval[1] 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).

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



Map Legend

- EIAR Study Boundary
- Proposed Felling Area
- Access Road (Upgrade & New
- Temp Road
- 33kV Underground Cabling and Access Roads
- 33kV Underground Cabling in the Permitted Development
- 110kV Underground Cabling
- 110kV Cabling and Access Road
- Ballyvouskill 220kV Substation
- Proposed 110kV Substation Location
- Proposed Borrow Pit
- Permitted Borrow Pit Extensi
- Omitted 38kV Electrical Subs and Battery Compound

Drawing Title

Proposed Felling Area

Project Title

Proposed Substation, Underground Cabling & Access Roads to Knocknamork Renewable Energy Development

Drawn By	Checked By
NMcH	EOS
Project No. 210732	Drawing No. Figure 4-12
Scale 1:55000	Date 2022-07-25

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4.3.8 Habitat Enhancement Areas

A short section of the proposed 110kV underground electrical cable is located in a highly disturbed area of peatland habitat. The proposed 110kV underground electrical cable will be located immediately adjacent to an existing track and will follow disturbed ground along its edge and will closely follow degraded habitats that lie adjacent to the existing cable and the degraded peatland that surrounds it. The works will be located within these peatland habitats for a distance of approximately 600m and will involve the disturbance of a strip of habitat approximately 5 metres in width. Whilst the peatlands will be replaced following the works, this has the potential to result in the further degradation of approximately 2,950m^2 of degraded wet heath and upland blanket bog habitat. In acknowledgement of the potential degradation of the habitat, the enhancement of 5,900m^2 of peatland habitat is proposed by felling coniferous forestry that was planted on peatland habitats. This will ensure that there is no potential for net loss of degraded Annex I habitat and will result in an overall net gain in peatland habitat area resulting from the proposed works.

It is proposed to fell and remove approximately 0.6 hectares of non-Annex I Sitka spruce (*P. sitchensis)* dominated conifer plantation that is located on a peat substrate. The removal of conifer trees will enable the reversion of the area back to Annex I Wet Heath over time. In its current state, lands within the proposed compensation site are classified as conifer plantation.

Management prescriptions to be implemented by the applicant include:

- Trees shall be removed from the enhancement area along with all brash.
- Dry forestry drains located within the area will be blocked to assist in restoring peatland hydrological conditions.
- All areas of restored vegetation will be monitored post-restoration. Monitoring results will be reported within an Annual Environmental Report with any criteria failures identified and corrective actions implemented.
- Following the felling of the trees and blocking of the forestry drains, permanent vegetation monitoring plots will be established within the enhancement area. The monitoring plot locations will be selected using stratified random sampling. This will allow the monitoring plots to be representative of microtopography and vegetation cover.
- Monitoring plots will be surveyed and classified using the relevé method as per the National Survey of Upland Habitats (Perrin et al., 2014) with plot sizes being 2m x 2m. Biotic and abiotic parameters that form baseline indicators of ecological and hydrological condition of the bog will be recorded.
- Monitoring plots will be marked out permanently using fencing posts and their location recorded using GIS. The number of monitoring plots will be determined by the level of plant community heterogeneity identified during the baseline survey. However, it is envisaged that a minimum of three 2m x 2m monitoring plots will be established across the enhancement area.
- Vegetation monitoring will be carried out in years 1, 3, 5 and 10 after restoration. Results will be analysed and a report of the findings will be produced. The enhancement plan will be regularly updated and amended where necessary to improve the efficacy of the enhancement work.

Full details of the peatland enhancement proposals are provided in Section 6.7.3.1 of Chapter 6 Biodiversity.

4.3.9 Site Activities

4.3.9.1 Environmental Management

All proposed activities on the site of the Proposed Development will be provided for in an environmental management plan. A Construction and Environmental Management Plan (CEMP) has been prepared for the Proposed Development and is included in Appendix 4-3 of this EIAR. The CEMP includes details of drainage, peat and overburden management and waste management and outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to complete the works in an appropriate manner . In the event that 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.

4.3.9.2 Refuelling

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

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

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

4.3.9.3 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks.

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

The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area. 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 and Plate 4-4 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 4-1 Concrete washout area

Plate 4-2 Concrete washout area

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

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

- Concrete trucks will not be washed out on the site but will be directed back to their batching plant for washout.
- Site roads will initially be constructed with a subgrade and compacted with the use of a roller to allow concrete delivery trucks access all areas where the concrete will be needed. The final wearing course for the site roads will not be provided until all bases have been poured. No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport.
- The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.
- Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site.

4.3.9.4 Concrete Pouring

The concrete pours that will be required to construct the Proposed Development, will be planned days or weeks in advance. Special procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These may include:

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

4.3.9.5 Dust Suppression

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

4.3.9.6 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. 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 using on-site materials before other road-going trucks begin to make regular or frequent deliveries to the site (e.g. with steel or concrete). The site roads will be well finished with compacted hardcore, and so the public road-going vehicles will not be travelling over soft or muddy ground where they might pick up mud or dirt.

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

4.3.9.7 Waste Management

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

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

The Act requires that any waste related activity must have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the 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 site of the Proposed Development via an existing access track off the remaining section of the old N22 alignment to the southwest of the site. This entrance will be widened to facilitate the delivery of the construction materials and turbine components to the Permitted Development. A temporary access road will also be required from the N22 to the old N22 alignment to facilitate the delivery of abnormally large wind turbine vehicle loads. The use of this temporary access road will be carefully managed and the route will be blocked with traffic bollards when not in use for turbine deliveries. It is also proposed that general HGV construction traffic will access the east of the site via the L5226 Local Road.

The site entrance to the southwest of the site 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 site entrance for the safe egress of traffic. The Proposed Development will result in a permanent upgrade of this current site access road from the old N22 road, which will also form the entrance to the Permitted Development during the operational phase.

The locations of the site access is shown on the site layout drawing in Figure 4-1 A Traffic Management Plan is included in Chapter 13 Material Assets and the CEMP in Appendix 4-3 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.

4.5 Site Drainage

4.5.1 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 in peat-dominated environments, and the number of best practice guidance documents referred to in the References section of the EIAR.

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. 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. 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.

4.5.2 Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the Proposed Development. 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 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.

4.5.3 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.
- No alteration of natural watercourses.
- Maintain the existing hydrology of the site.
- Blocking of existing manmade forestry 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 4-13 below.

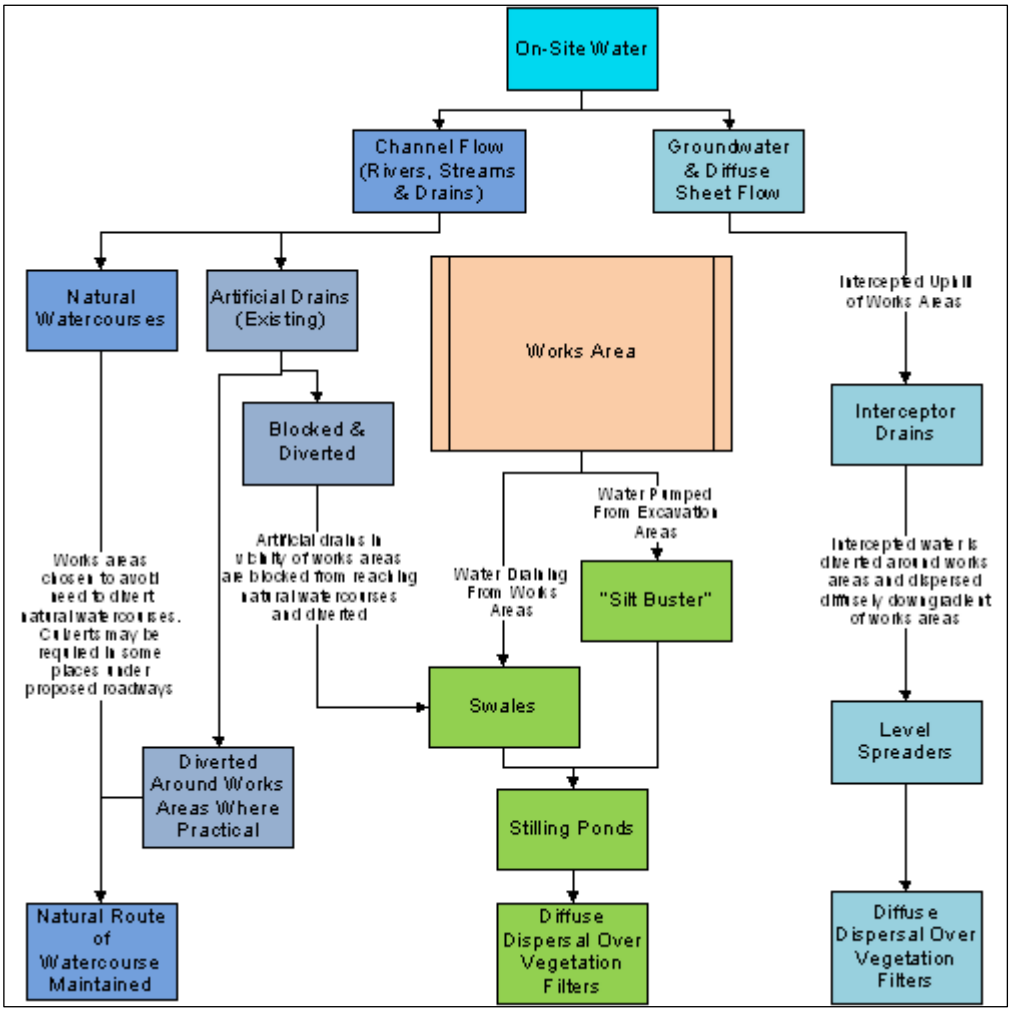


Figure 4-13 Proposed Development Drainage Process Flow

4.5.4 Drainage Design

A drainage design for the Proposed Development, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 4-4 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.

4.5.4.1 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, substations, 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 4-14 below shows an illustrative drawing of an interceptor drain.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.5.4.3 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.

4.5.4.2 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 4-14 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.

4.5.4.3 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 4-14, below, shows illustrative examples of check dams.

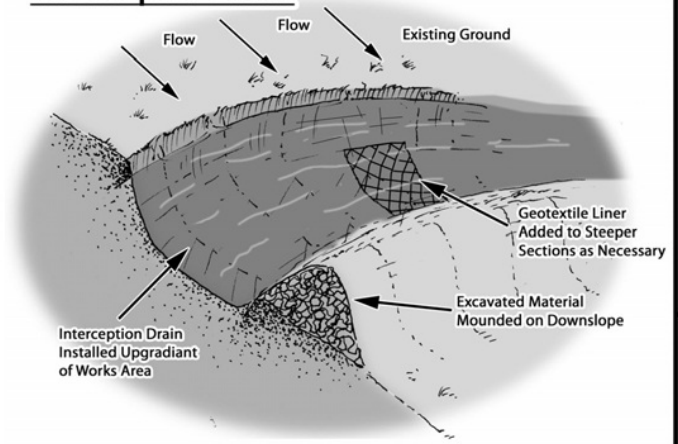
The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges 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.

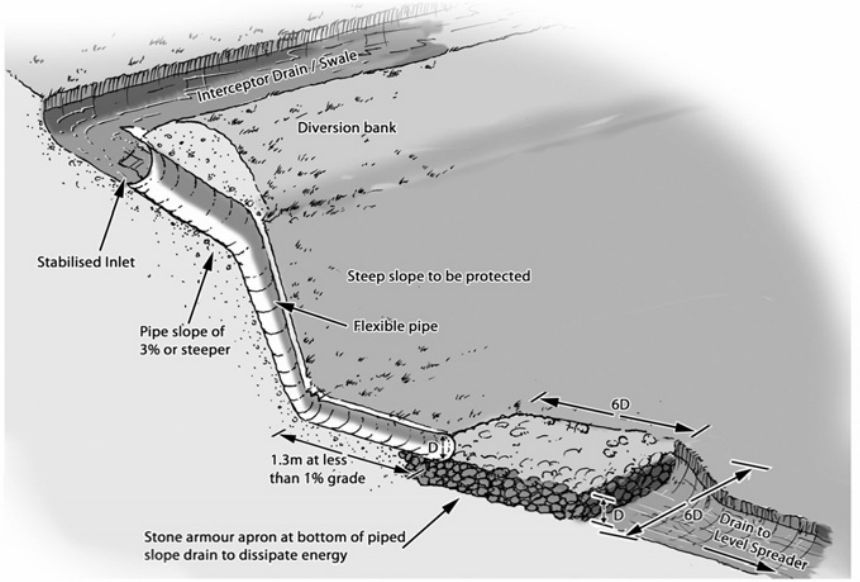
Drainage Design Measures

Interceptor Drain

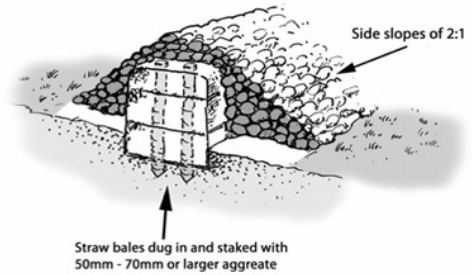


Check Dam (Stone Dam in Drain)

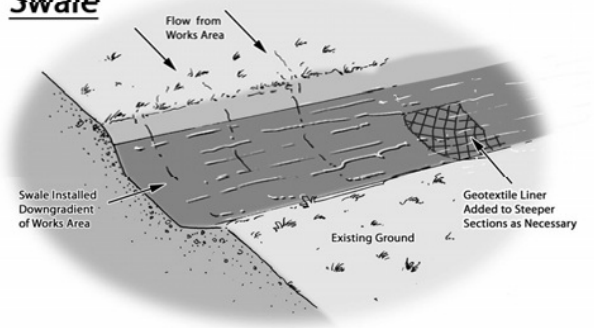
Slope Pipe Drain



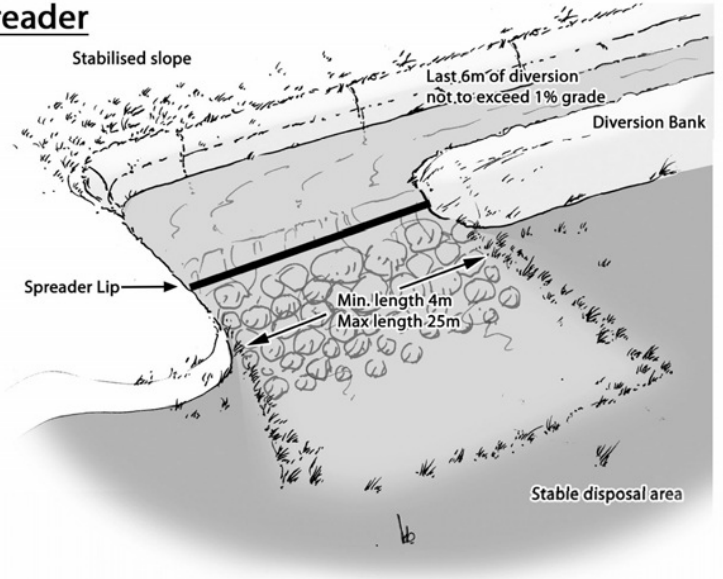
Check Dam
(Straw Bale & Stone Dam - Cross Section)



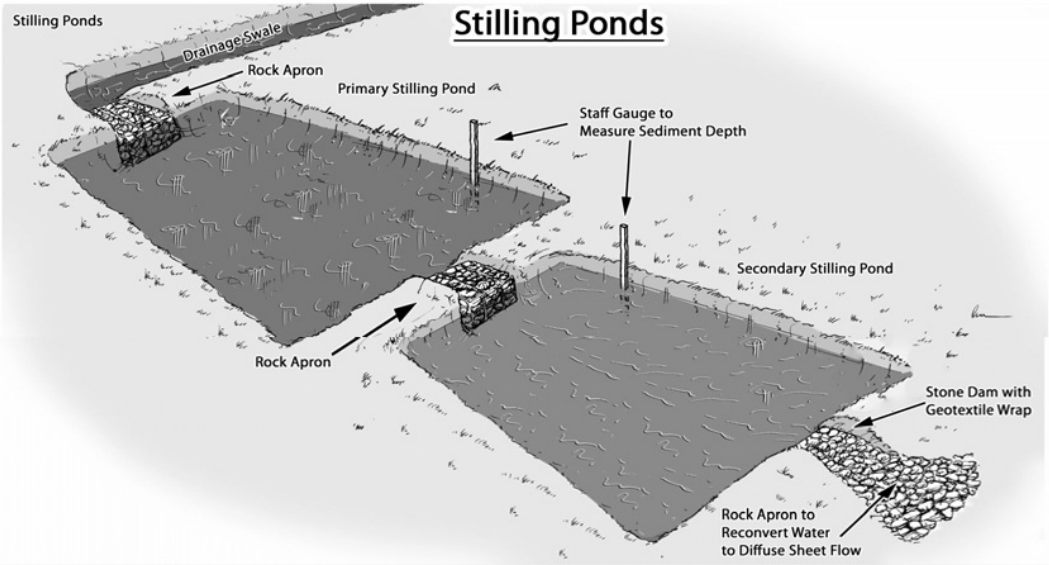
Swale



Level Spreader



Stilling Ponds



Drawing Title	Drainage Design Measures	Drawing No.	Figure 4-14	Scale	NTS
Project Title	Proposed Substation, Underground Cabling & Access Roads to Knocknamork Renewable Energy Development			Date	25.07.2022
Drawn By	NMcH	Checked By	EOS	Project No.	210732

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4.5.4.4 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 4-14, 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 4.5.4.5 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.

4.5.4.5 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 4-14, 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.

4.5.4.6 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.

4.5.4.7 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 4-14, 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.

4.5.4.8 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 4-15 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.

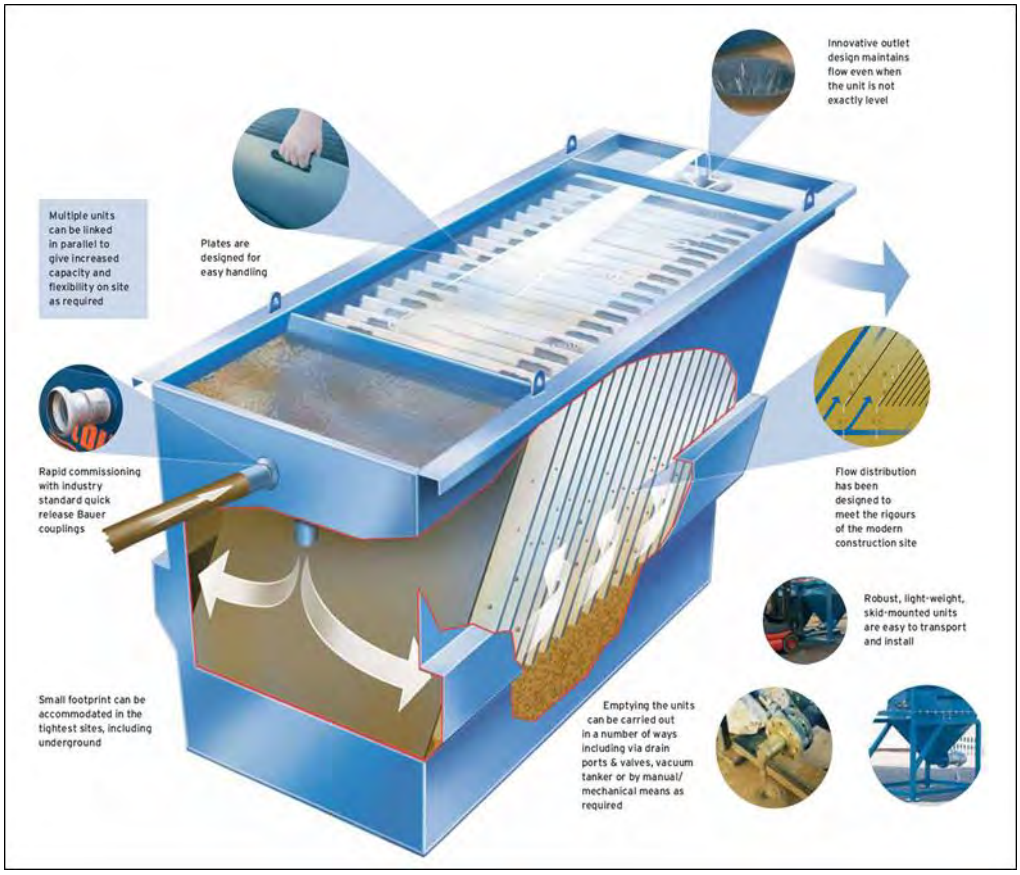


Figure 4-15 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

4.5.4.9 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 peaty silt into the stream.

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

Plate 4-4 Silt bag under inspection

4.5.4.10 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.

4.5.4.11 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.

4.5.4.12 Silt Fences

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

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.

4.5.4.13 Forestry Felling Drainage

Tree felling to facilitate the Proposed Development will not be undertaken simultaneously with construction groundworks. Felling to facilitate construction works will take place prior to groundworks commencing. A Harvest Management Plan is included in Appendix 4-5.

During tree felling there is a potential to generate peat particles and silts in surface water runoff due to tracking of machinery and disturbance of the peat surface etc, however mitigation is provided in Section 8.5.2.1 of Chapter 8 Hydrology and Hydrogeology with regard surface water quality protection for this activity which is summarised below. Also, prior to the commencement of tree felling for subsequent road construction the following key temporary drainage measures will be installed:

- All existing dry forestry drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using forestry check dams/silt traps;
- Clean water interceptor 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 felling 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 felling works.

- Prior to the commencement of works, review and agree 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.

All relevant measures set out in the *Forestry & Freshwater Pearl Mussel Requirements, Forestry & Water Quality Guidelines, Forest Harvesting & the Environment Guidelines and the Forest Protection Guidelines* will apply. To protect watercourses, the following measures will be adhered to during all keyhole/tree felling activities.

- Works will be overseen by an ECoW as described above.
- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the borrow pits All new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion or where felling inside the 50 metre buffer is required, it will be necessary to install double or triple silt fencing;

- All drainage channels will taper out before entering the 50m buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside a local 50 metre watercourse buffer. Straw bales and check dams will be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of roads and culverts will be on-going through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted:
- Trees will be cut manually from along streams and using machinery to extract whole trees;
- Travel only perpendicular to and away from stream; and
- Please refer to Harvest Management Plan included in Appendix 4-5.

4.5.5 Borrow Pit Drainage

While surface water will be contained in the borrow pit areas, the design proposal is to control the level of water in the borrow pit area by creating a single point outlet from the basin-like area that will ensure the water does not overtop the pit area. Run-off from the proposed borrow pit areas will be controlled via a single outlet that will be installed at the edge of the borrow pit. The single outfall point will be constructed to control runoff from the borrow pit and its immediate surrounds. Interceptor drains will already have been installed upgradient of the borrow pit area before any extraction begins.

During the construction phase of the project, it will be necessary to keep the borrow pit area free of standing water while rock is still being extracted. This will be achieved by using a mobile pump, which will pump water into the same series of drains, settlement ponds with a level spreader, siltbuster or equivalent, which will receive the water from the single outlet.

4.5.6 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 transported to the on-site borrow pit, 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 4.4.4.12, 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.

4.5.7 Site and Drainage Management

4.5.7.1 Preparative Site Drainage Management

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

4.5.7.2 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.

4.5.7.3 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.

4.5.8 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 supervising 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 project to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the Proposed 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 Construction Management

4.6.1 Construction Phasing and Timing

It is estimated that the construction phase of the entire renewable energy development (i.e. the Permitted Development and the Proposed Development) will take approximately 18 months. 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.

4.6.2 Construction Sequencing

The construction phase for the entire renewable energy development can be broken down into three main phases, 1) civil engineering works - 10 months, 2) electrical works - 6 months, and 3) turbine erection, solar panel installation and commissioning - 8 months. The main task items under each of the three phases are outlined below.

Civil Engineering Works

- Clear and hardcore area for temporary site offices. Install same.
- Provide bunded area for oil tanks.
- Construct new site roads and hard-standings and crane pads, and level substation platform.
- 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.
- Construct bases/plinths for transformer.
- Excavate trenches for site cables, lay cables and backfill. Provide ducts at road crossings.

- Erect fencing at transformer compound.
- Erection of fencing around solar array site.
- Backfill tower foundations and cover with previously stored topsoil.

Electrical Works

- Construct bases/plinths for substation compound.
- Install external electrical equipment at substation.
- Install transformer at compound.
- Installation of solar array structures including control cabins and solar array support/mounting structures.
- Erect stock proof and palisade fencing around substation area.
- Install electrical and communication cabling.

Turbine and Meteorological Mast Erection, Solar Panel Installation and Commissioning

- Erect towers, nacelles and blades.
- Install solar panels.
- 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 4-16 below, where the 1st January has been selected as an arbitrary start date for construction activities.

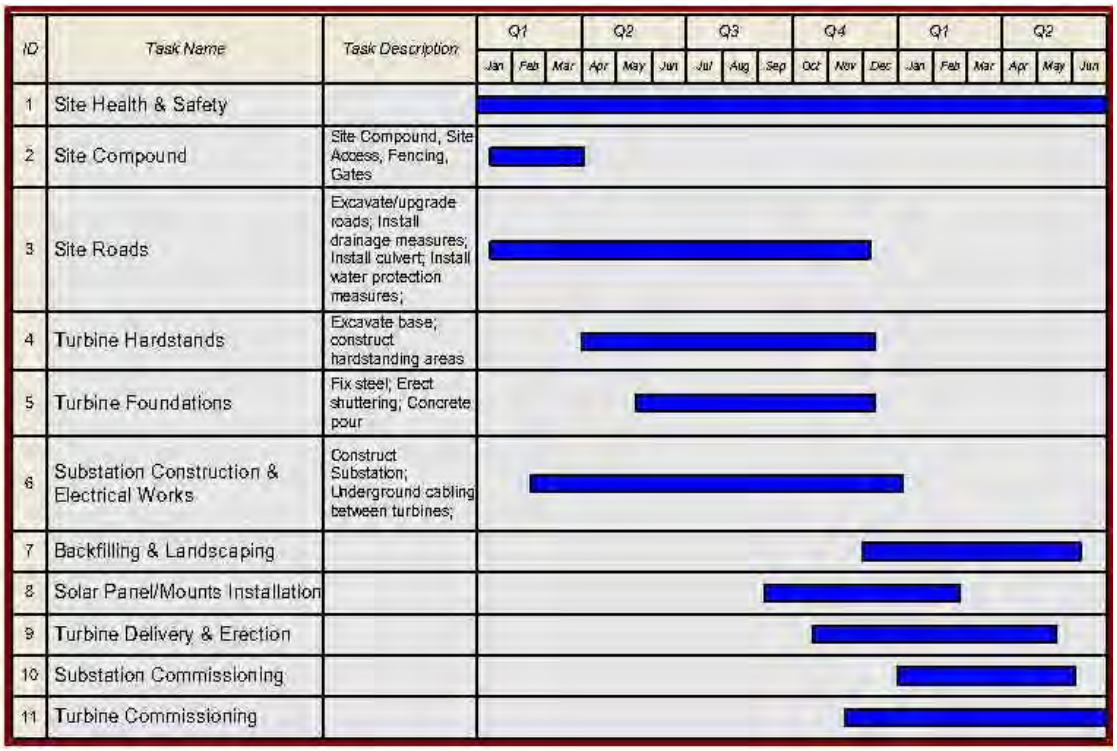


Figure 4-16 Indicative Construction Schedule

4.6.3 Construction Phase Monitoring and Oversight

The requirement for a Construction and Environmental Management Plan (CEMP) to be prepared in advance of any construction works commencing on any development site and submitted for agreement to the Planning Authority is now well-established. The proposed procedures for the implementation of the mitigation measures outlined in such a CEMP and their effectiveness and completion is typically audited by way of a Construction and Environmental Management Plan Audit Report. The CEMP Audit Report effectively lists all mitigation measures prescribed in any of the planning documentation and all conditions attached to the grant of planning permission and allows them to be audited on a systematic and regular basis. The first assessment is a simply Yes/No question, has the mitigation measure been employed on-site or not? Following confirmation that the mitigation measure has been implemented, the effectiveness of the mitigation measures has to be the subject of regular review and audit during the full construction stage of the project. If some remedial actions are needed to improve the effectiveness of the mitigation measure, then these are notified to the site staff immediately during the audit site visit, and in writing by way of the circulation of the audit report. Depending on the importance and urgency of rectifying the issue, the construction site manager is given a timeframe by when the remedial works need to be completed.

A CEMP has been prepared for the Proposed Development, and is included in Appendix 4-3 of this EIAR. The CEMP includes details of drainage, peat and overburden management, waste management etc, and describes how the above-mentioned Audit Report will function and be 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 the Audit Report. 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

This section describes the construction methodologies that will be used for the proposed electrical substation, underground cabling works and access roads (new and upgraded). Further details are also provided in the Construction and Environmental Management Plan (CEMP) included as Appendix 4-3 of this EIAR.

4.7.1 Site Roads

4.7.1.1 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 project will be implemented around the works area;
- The road layout has been designed to avoid crossings of natural watercourses where possible;

- Where existing culverts are to be upgraded or extended, the works will be carried out to follow a method statement to be prepared in consultation with Inland Fisheries Ireland;
- The access tracks will be of single-track design with an overall width of between 2.5 and 6m (depending on the location within the Proposed Development site);
- Peat will be stripped and temporarily stockpiled for re-use as required. Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.
- All peat excavated will be used as part of the borrow pit restoration or in reinstatement areas. Topsoil will be temporarily stockpiled locally for reuse for landscaping;
- The subsoil will be excavated down to a suitable formation layer of either firm clay or bedrock;
- The road will be constructed using well-graded 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;
- For excavations in overburden and peat, side slopes shall not generally be greater than 1(V): 2 or 3(H), respectively. Slacker slopes may be required if localised areas of weaker peat are encountered 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.

4.7.1.2 Upgrading of Existing Site Access Road

Approximately 5km 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 and the spoil used for the restoration of borrow pits or in reinstatement areas and landscaping;
- All drainage measures prescribed in the detailed drainage design for the project will be implemented around the works area;
- Well-graded imported granular fill will be spread and compacted in layers up to 200mm to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used. These layers of granular fill will be brought to the same level as the top of the existing road surface;
- 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.

4.7.2 Electrical Substation and Control Buildings

The proposed substation will be constructed by the following methodology:

- The area of the onsite substation will be marked out using ranging rods or wooden posts and the soil and overburden stripped and removed to nearby temporary storage area for later use in landscaping. Any excess material will be sent to the proposed borrow pit, for reinstatement purposes;
- The dimensions of the substation area have been designed to meet the current requirements of the ESB/ Eirgrid;
- The required level platform will be established and finished with well-graded imported granular fill, compacted in layers and finished with a suitable capping layer to the desired level;
- The substation platform will serve as a construction compound containing welfare facilities, car parking and site offices. Temporary port-a-loo toilets 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. Upon completion of the substation compound the welfare facilities will be removed off-site;
- The electrical substation compound will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- Two control buildings will be built within the 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 damp proof course 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 buildings for this operation;
- The concrete roof slabs will be lifted into position using an adequately sized mobile crane;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather;
- The substation plinths will be shuttered and poured with reinforced concrete. An anti-bleeding admixture will be included in the concrete mix;
- The electrical equipment will be installed on the concrete plinths and commissioned;
- Perimeter fencing will be erected.

4.7.3 Underground Cable Trench

The underground cable will be laid beneath the surface of the site and/or road using the following methodology:

- Before works commence, surveying will take place along the proposed cable route, with all existing culverts identified. All relevant bodies i.e. ESB, Cork County

Council, Kerry County Council etc. will be contacted and all drawings for all existing services sought.

- When the cable is located on roads, a traffic management plan will be set up 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.
- The cable ducts will be concrete surrounded where they pass under the road and under drains or culverts.
- 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.
- 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.
- For the section of 110kV underground cabling to be installed in the degraded peatland habitat area, the peatlands will be replaced following the works in this area. The following methodology to be implemented in this area:
    - Temporary fences will be erected surrounding the proposed works area to prevent encroachment outside this area.
    - An existing track and the route of the existing cable that lies adjacent to the proposed cabling will be used as part of the working area in order to minimise impacts on the surrounding peatlands.
    - Low ground pressure wide-track machinery will be used and will be operated adjacent to the proposed 110kV underground cabling trench and existing track, with no access to areas that are not immediately adjacent to the proposed cabling route.
    - At the outset, the turves with their existing vegetation will be stripped and stored the right way up on the adjacent track and disturbed habitat.
    - The cabling will be laid as per the methodology set out in Chapter 4 of this EIAR, Description.
    - The turves will be replaced on top of the newly installed cabling and the temporary fence removed.

- Temporary fences will be put in place in all areas where works are taking place in close proximity to peatland habitats to avoid temporary or permanent encroachment onto them.

- 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.

Plate 4-5 Typical Cable Trench View

4.7.3.1 Existing Underground Services

Any underground services encountered along the cable routes 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 where adjacent services are within 600mm, with marker tape on the side of the trench. Please refer to Section 4.7.3.3 below for cable crossing methodologies. Back fill around any utility services will be with dead sand/pea shingle where appropriate.

4.7.3.2 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 underground ducting route generally between 600 to 1000 metres intervals or as otherwise required by ESB/ electrical requirements. An alternative method for cable jointing is to create a localised widening in the cable trench which is supported by sandbags to facilitate the installation of the cabling.

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. The proposed location of joint bays along the underground cabling routes are presented in Drawing Nos. 210732-18 and 210732-19 included in Appendix 4-1 to this EIAR. It is noted that once the cable installation is complete, the cables will be permanently covered and will not be perceptible.

4.7.3.3 Underground Cable Watercourse/Culvert Crossings

There are a total of 36 identified watercourse and existing culvert crossings along the proposed 33kV and 110kV underground electrical cabling route, of which 6 no. are EPA/OSI mapped crossings. The remaining crossings are classified as culverts over minor channels or manmade drains. The construction methodology for the 6 no. EPA/OSI mapped crossings has been designed to eliminate the requirement for in-stream works with 5 no. of 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 and Section 4.3.3 above. A list of the EPA/OSI mapped crossings along the underground cable route and the proposed crossing method at each location is provided in Table 4-2 below.

The crossing methodologies employed at the other culvert and manmade drain crossings along the underground cable 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 EPA/OSI mapped crossing locations are shown in Figure 4-17. The crossing locations for all culvert and drain crossings are also shown on the underground cable route drawings included as Appendix 4-1. Details of all culvert and drain crossing are also provided in Appendix 4-6 of this EIAR.

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

Where culverts require upgrading, the Applicant will commission a survey of culverts, the results of which will be forwarded to the Planning 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.

4.7.3.3.1 *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 4-18.

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 corripipe (see Section 4.3.3 above).

4.7.3.3.2 *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 4-19.

4.7.3.3.3 *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 pavement level. 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 4-20.

Where no crossing currently exists, the cable will pass over the watercourse in a clear span bridge (see Section 4.3.3 above) or corrugated steel arch bridge (see Section 4.3.3 above).

Where required existing culvert crossings will be extended using corripipe (see Section 4.3.3 above).

4.7.3.3.4 Directional Drilling – Option D

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

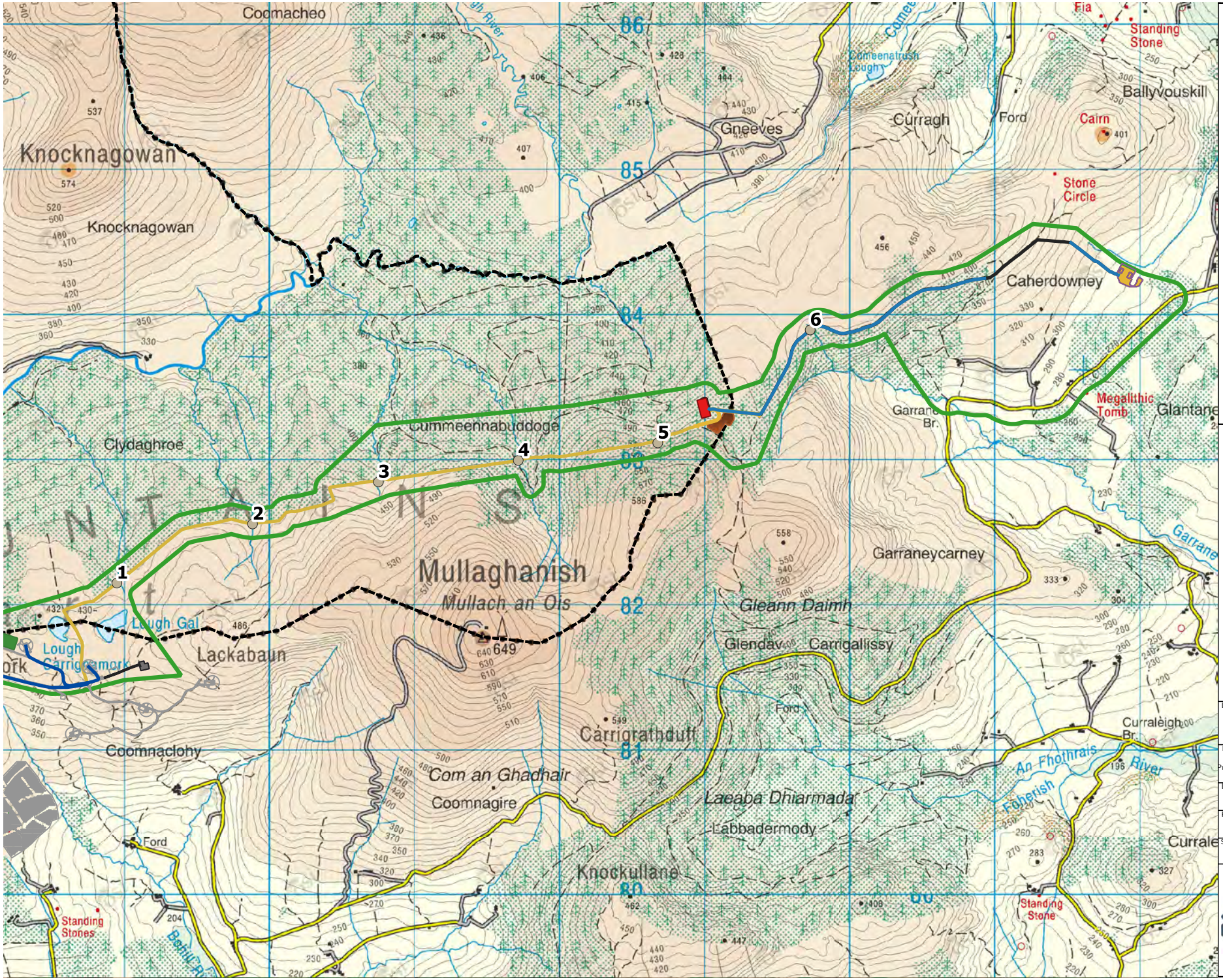
DD is a method of drilling under obstacles such as bridges, culverts, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible.

The DD method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, will be utilised for the horizontal directional drilling at watercourse/culvert crossings listed in Table 4-2 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 4-21.



Map Legend

- EIAR Study Boundary
- Access Road (Upgrade & New)
- 33kV Underground Cabling in the Permitted Development
- 110kV Underground Cabling
- 110kV Cabling and Access Road
- Ballyvouskill 220kV Substation
- Proposed 110kV Substation Location
- Proposed Borrow Pit
- Permitted Borrow Pit Extension
- Omitted 38kV Electrical Substation and Battery Compound
- EPA Marked Watercourse Crossings

Drawing Title

Watercourse Crossings

Project Title

Proposed Substation, Underground Cabling & Access Roads to Knocknamork Renewable Energy Development

Drawn By	Checked By
NMcH	EOS
Project No.	Drawing No.
210732	Figure 4-17
Scale	Date
1:8000	14.07.2022

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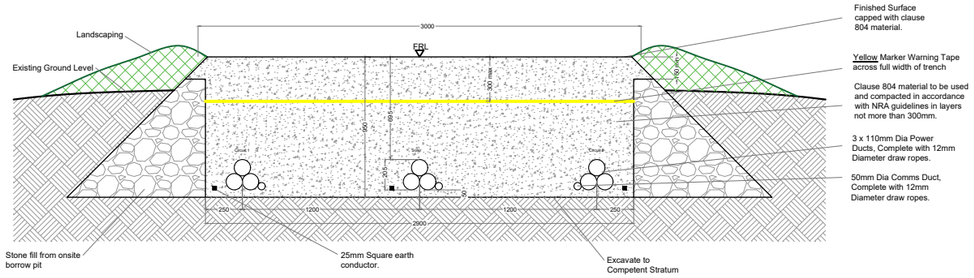

Option A - Cabling Cross Section - 33kV

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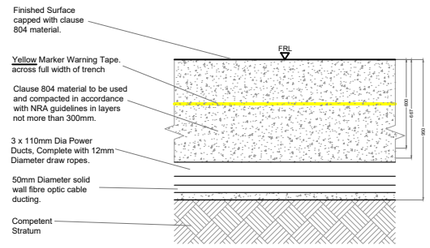

Option A - Cabling Cross Section - 33kV

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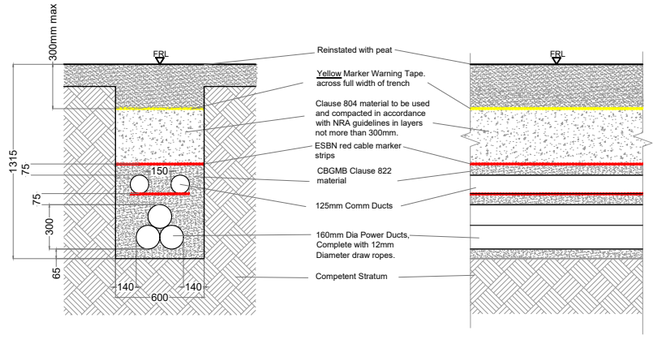

Option A - Cross section - 110kV

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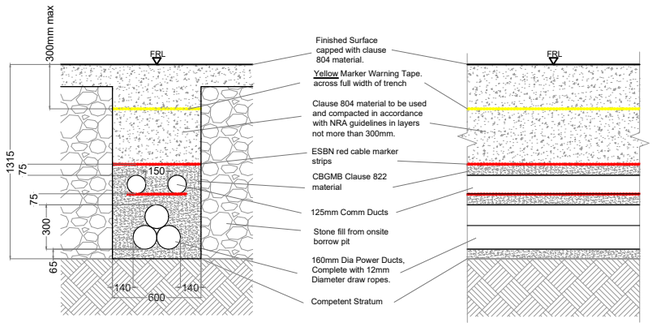

Option A - Cross section - 110kV

SCALE 1:20

Note:

All dimensions are in millimetres, unless noted otherwise.

All dimensions to be checked on site and any discrepancy to be reported to the engineer.

Figured dimensions only to be used, drawings not to be scaled. If in doubt ask.

For illustration purposes only. Exact size and appearance of unit subject to manufacturer selection.

DRAWING TITLE:

Standard Formation Crossing over Culvert - Option A

PROJECT TITLE: Knocknamork Grid Connection Infrastructure

DRAWING BY:	CHECKED BY:
Joseph O Brien	Meabhann Crowe
PROJECT No.: 210732	DRAWING No.: Fig 4-18
SCALE: 1:20 @ A1	DATE: 25.07.2022

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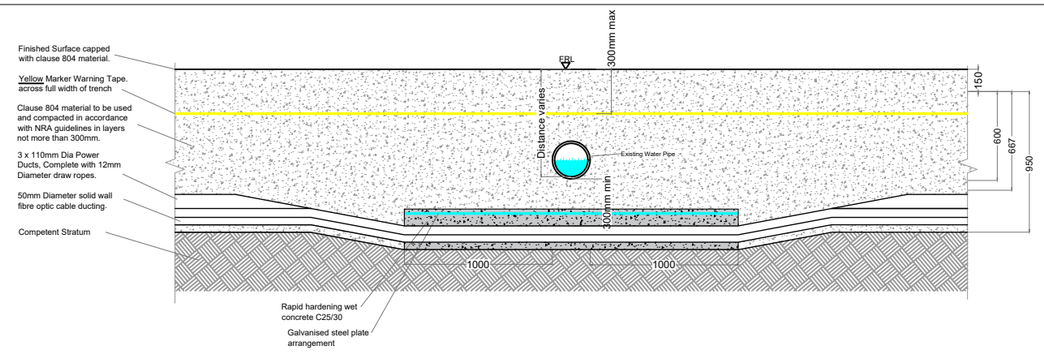

Option B - Flat bed under existing pipe - 33kV

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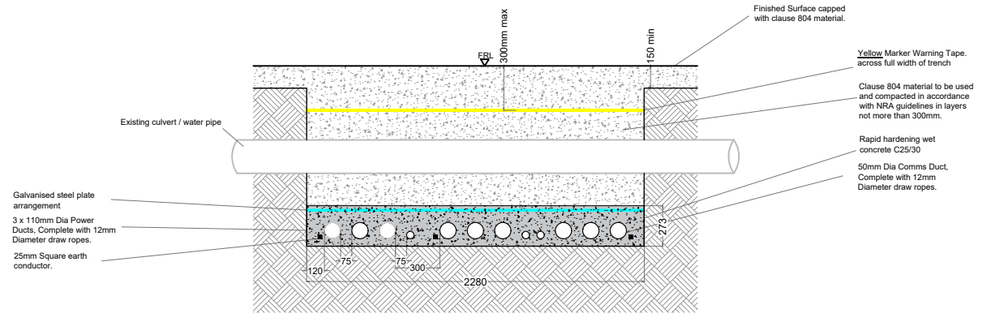

Option B - Flat bed under existing pipe - 33kV

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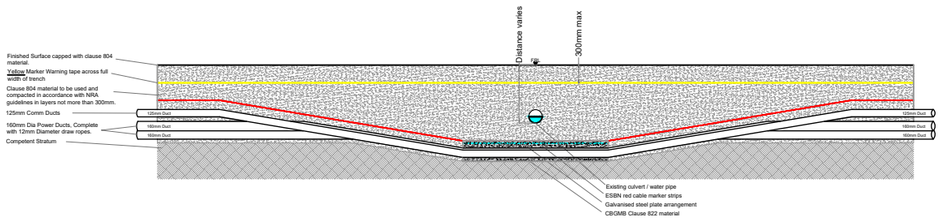
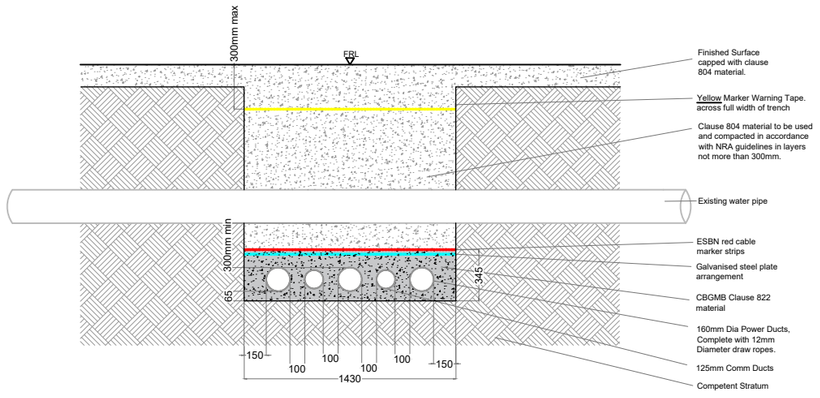


Option B - Flat bed under existing pipe - 110kV

SCALE 1:50



Option B - Flat bed under existing pipe - 110kV

SCALE 1:20

Note:

All dimensions are in millimetres, unless noted otherwise.

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For illustration purposes only. Exact size and appearance of unit subject to manufacturer selection.

DRAWING TITLE:
Standard Formation Crossing over Culvert - Option B

PROJECT TITLE: Knocknamork Grid Connection Infrastructure

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 210732	DRAWING No.: Fig 4-19
SCALE: As Shown @ A1	DATE: 25.07.2022

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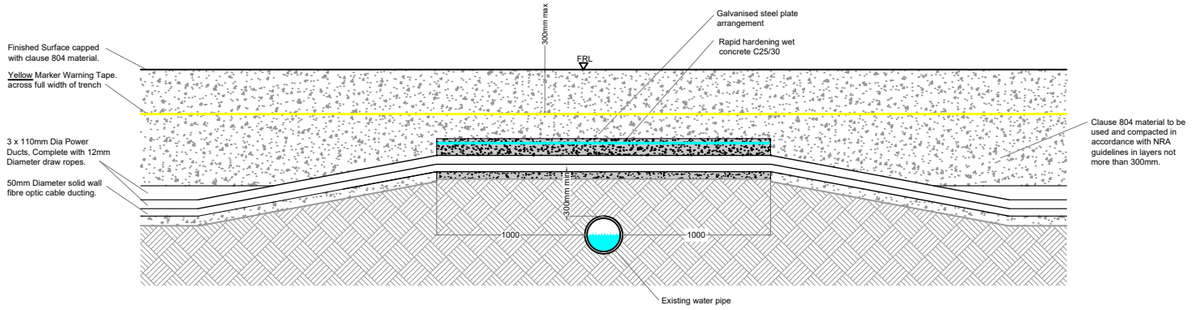
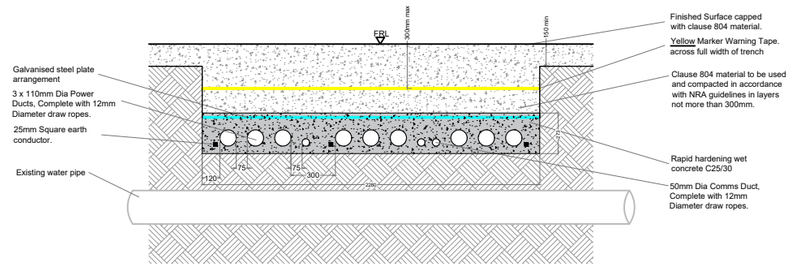


Option C - Flat bed over existing pipe - 33kV

SCALE 1:20



Option C - Flat bed over existing pipe - 33kV

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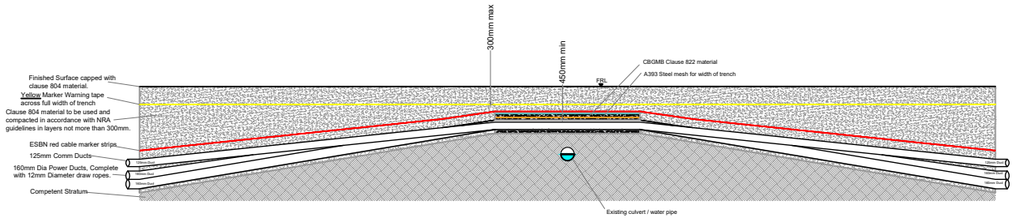
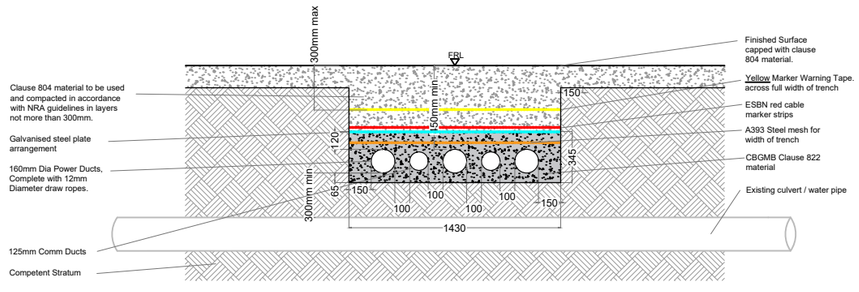


Option C - Flat bed over existing pipe - 110kV

SCALE 1:50



Option C - Flat bed over existing pipe - 110kV

SCALE 1:20

Note:

All dimensions are in millimetres, unless noted otherwise.

All dimensions to be checked on site and any discrepancy to be reported to the engineer.

Figured dimensions only to be used, drawings not to be scaled. If in doubt ask.

For illustration purposes only. Exact size and appearance of unit subject to manufacturer selection.

DRAWING TITLE:
Shallow Formation Crossing over Culvert - Option C

PROJECT TITLE:
Knocknamork Grid Connection Infrastructure

DRAWING BY:	CHECKED BY:
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PROJECT No.: 210732	DRAWING No.: Fig 4-20
SCALE: 1:20 @ A1	DATE: 25.07.2022

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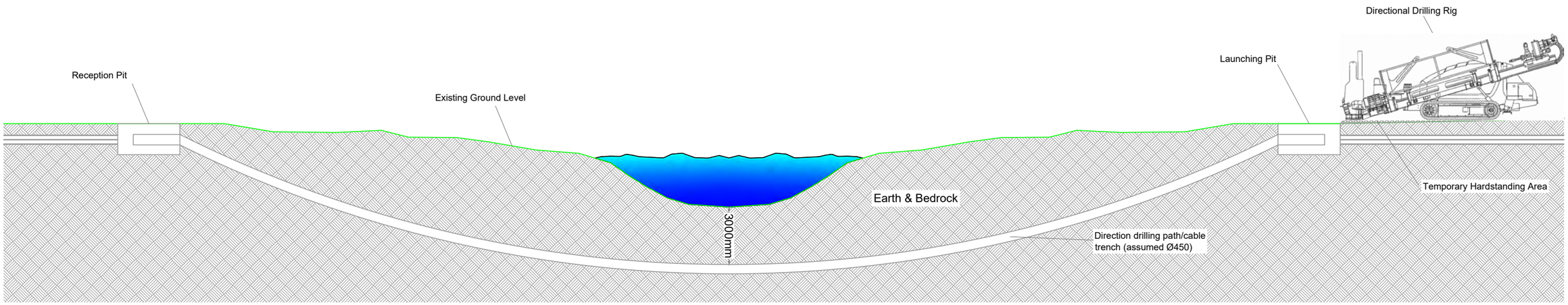

Option D - Typical Horizontal Directional Drill - Cross Section

SCALE: 1:200

DRAWING TITLE:
Option D - Typical Horizontal Directional Drill - Cross Section

PROJECT TITLE:
Knocknamork Grid Connection Infrastructure

DRAWING BY:	CHECKED BY:
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PROJECT No.: 210732	DRAWING No.: Fig 4-21
SCALE: 1:200 @ A3	DATE: 25.07.2022

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Table 4-2 Underground Cable Route – Watercourse Crossings Methodology

Watercourse Crossing Reference No.	Watercourse Type	Width of Channel (m)	Cover from Road Level to Top of Culvert (m)	Crossing Option Description	Watercourse Crossing Option	Extent of In-Channel Works
1	Open channel	0.5	-	Where no crossing currently exists, the cable will pass over the watercourse over a bottomless box culvert or pre-cast concrete slab in a standard trefoil arrangement.	Option A/ Option C	None. No in-stream works required.
2	Open channel	1.2	-	Where no crossing currently exists, the cable will pass over the watercourse over a bottomless box culvert or pre-cast concrete slab in a standard trefoil arrangement.	Option A/ Option C	None. No in-stream works required.
3	Open channel	1	-	Where no crossing currently exists, the cable will pass over the watercourse over a bottomless box culvert or pre-cast concrete slab in a standard trefoil arrangement.	Option A/ Option C	None. No in-stream works required.
4	Open channel	2.0	-	Where no crossing currently exists, the cable will pass over the watercourse over a bottomless box culvert or pre-cast concrete slab in a standard trefoil arrangement.	Option A/ Option C	None. No in-stream works required.
5	Open channel	1.5	-	Where no crossing currently exists, the cable will pass over the watercourse over a bottomless box culvert or pre-cast concrete slab in a standard trefoil arrangement.	Option A/ Option C	None. No in-stream works required.

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
6	600 mm diameter concrete pipe	-	1.6	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.

4.8 Operation

The proposed substation components will require periodic maintenance throughout the operational phase. It is proposed to manage wastewater from the staff welfare facilities in the control building by means of a sealed underground storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. Hydrocarbons and oils will be present during the operation of the substation however these will be stored in an appropriately bunded area. The operation of a substation is not a recognized source of environmental emissions or nuisance and so there will be no adverse effects associated with its operation.

The site tracks will also require periodic maintenance. Although the level of activity required for the maintenance of the Proposed Development is not significant, the impacts associated with traffic volumes for this period are assessed in Chapter 13.

It is not foreseen that any works will be required during the operational phase of the underground cabling element and therefore there is no potential for effects on any environmental media.

4.9 Decommissioning

It is not intended that the on-site electrical substation will be removed at the end of the useful life of the Permitted Development, as permanent planning permission is being sought for the substation. By the time the decommissioning of the Permitted Development is to be considered, the proposed 110kV substation and the proposed underground electrical cabling (110kV) from the proposed 110kV electrical substation to the existing 220kV Ballyvouskill will likely form an integral part of the local electricity network, with a number of supply connections and possibly some additional generation connection. Therefore, it is intended that the proposed 110kV substation and underground electrical cabling (110kV) will be retained as a permanent structure and will not be decommissioned.

The underground electrical cabling (33kV) connecting the Permitted Development to the proposed 110kV electrical substation will be removed from the underground cable ducting at the end of the useful life of the renewable energy development. The cabling will be pulled from the cable duct using a mechanical winch which will extract the cable and re-roll it on to a cable drum. This will be undertaken at each of the joint bays/pull pits along the underground cabling route. The original pulling pits 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 for an underground element that is not visible.

During the construction of the Proposed Development, a number of road and junction improvements and temporary works will be completed to provide access to the site during materials delivery. All these accommodation areas will be re-used during decommissioning. This includes the re-instatement and re-establishment of the temporary access road from the N22 to the old N22 alignment to facilitate the removal of abnormally large vehicle loads. The use of this temporary access road will be carefully managed, and the route will be blocked with traffic bollards when not in use for component removal. On completion of the component removal from the site, the temporary accommodation area will be fully re-instated.

Site roadways could be in use for purposes other than the operation of the development by the time the decommissioning of the Permitted Development is to be considered, and therefore it may be more appropriate to leave the site roads in situ for future use. It is envisaged that the roads will provide a useful means of extracting the commercial forestry crop which exists on the site, along with general agricultural use. The environmental assessments undertaken as part of this EIAR have concluded that once the mitigation proposals as outlined in the EIAR are implemented during the decommissioning phase of the Proposed Development, there will be no cumulative negative effects and therefore there is

no potential for any cumulative impacts with the decommissioning of the Permitted Development or any other permitted or proposed developments in the environment.

A Decommissioning Plan has been prepared (Appendix 4-7) 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 be 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 each relevant section of this EIAR.