



APPENDIX 4-4
**PROPOSED GRID CONNECTION
CONSTRUCTION METHODOLOGY**



CONSTRUCTION METHODOLOGY

Cahermurphy West 110 kV Grid Connection

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1.0 Introduction

The purpose of this document is to outline the construction techniques and methodologies which will be implemented during construction of the proposed 110 kV UGC grid connection from the existing ESB Moneypoint 400kV Substation to the proposed 110kV Cahermurphy Wind Farm Substation. The grid connection will consist entirely of underground cabling (UGC) with the UGC to be installed within a mixture of the public road network and private land. The UGC works will consist of the installation of 6 No. ducts in an excavated trench to accommodate 3 No. power cables, 2 No. fibre communications cable to allow communications between the Wind Farm Substation and Moneypoint 400kV substation and 1 No. earth continuity conductor.

The proposed 110kv onsite Substation and 110Kv UGC grid connection will be subject to a Strategic Infrastructure Development (SID) application to An Bord Pleanála in accordance with section 182A of the Planning and Development Act 2000. As part of a one-project approach, this infrastructure is considered in this report.

This document is intended to be used as an aid to understand the methodologies to be employed during construction and should be read in conjunction with all other specialist reports which accompany the planning application. In addition, this document is in outline form only and will be revised and updated prior to the commencement of any construction activities, detailed Method Statements will be prepared in respect of each aspect of the development.

2.0 Proposed Cahermurphy West 110kV Substation

The proposed 110kV substation will be subject to a Strategic Infrastructure Development (SID) application to An Bord Pleanála. The proposed 110kV substation will be designed and constructed to meet all the required EirGrid standards. An area will be levelled and built to the required level with stone fill material, capped by high quality compacted stone. Two control buildings will be constructed using traditional techniques for constructing small buildings (i.e. concrete block walls, timber and slate tile roof). Foundations will be built for all the proposed electrical infrastructure. All the electrical equipment will be installed to EirGrid requirements. Perimeter fencing will be constructed around the substation compound for security and safety purposes.

Cahermurphy West 110kV substation will be made up of 1 No. Control building, 1 No. Independent Power Producer (IPP) Medium Voltage (MV) Switch room, Transformer compound and Busbar compound.

The control building works will consist of foundation works, block work, roofing, low voltage electrical fit out, cladding and building finishing works. The transformer, gantry and structural steelwork will be installed in the transformer compound. Two cable sealing ends will be installed to incorporate the radial underground circuits in and out of the station. The busbar compound structural steelwork will be erected with lightning masts also installed. Substation electrical equipment will be installed once the control building and compound is complete. Fencing will be erected around the compound for security/protection. Permanent access roads will also be installed to allow trafficking in and out of the proposed substation compound, access road to loop in interface mast structures and internal access road for compound use.

The expected duration of works is expected to be approximately 12 months.

The following section outlines the methodology to be followed during construction works of the new Cahermurphy West 110kV substation.

1. This new substation will be in a compound of circa 78.6m x 144.6m plan area secured by a 2.6m high palisade fence.
2. The substation compound and drainage will be marked out by a qualified engineer.
3. A drainage system will be excavated and installed around the compound area.

4. Topsoil and subsoil will be removed from the footprint of the compound using an excavator. The excavated material will be temporarily stored in adjacent berms for later use during reinstatement works.
5. A layer of geotextile material will be laid over the footprint of the compound.
6. Using an excavator, a base layer of Clause 804 material will be laid followed by a 6F2 capping layer which will provide the finished surface.
7. Each layer will be compacted using a vibrating roller.
8. Earthing cable will be laid underground around the substation for connection to the various electrical components during the electrical fit out phase.
9. The construction of a 10340m² substation compound comprising of approximately 450m² single story 110kV substation control building, 300m² single story MV building and associated outdoor electrical equipment, including 1 no. 33/110kV transformer, associated internal access road, including 2.6m high station perimeter fencing will be built.
10. Permanent access roads will be constructed to allow site vehicular activity in and out of construction area.
11. Adequate lighting will be installed around the compound on the lighting masts within the compound.
12. 110kV cable sealing ends and associated accessories will be required to incorporate the Cahermurphy West to Moneypoint 400kV UGC into the substation. The support structures will be located outdoors.
13. Transformers will be installed in bunded enclosures within the substation compound.

The electrical installation is expected to take 20 weeks and includes the following:

- Delivery and installation of 33/110kV transformer. These are unusually large, and the deliveries will be managed in accordance with regulations governing the movement of large loads.
- Delivery and installation of all other HV equipment.
- Wiring and cabling of HV/LV equipment, protection and control cabinets.
- Commissioning of all newly installed equipment.

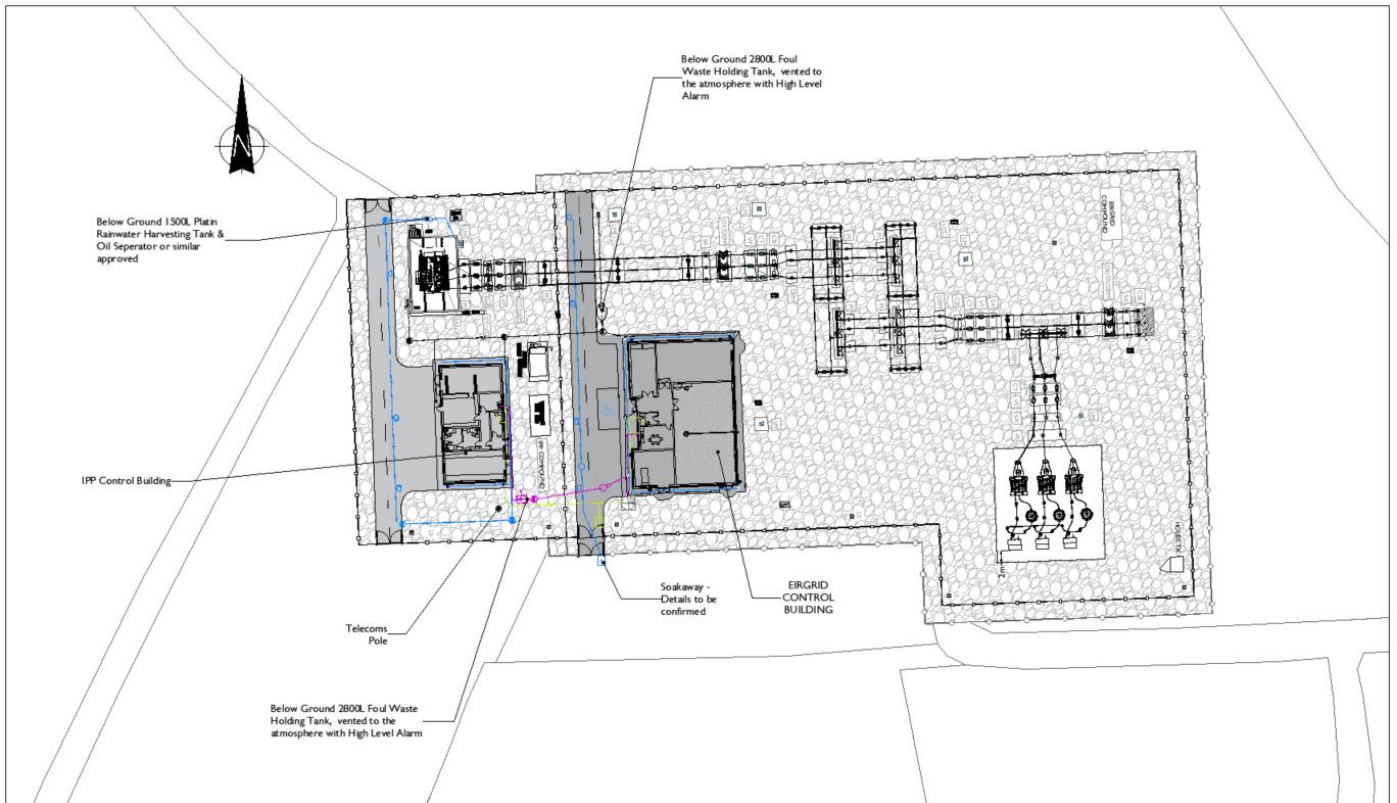


Figure 1 Proposed Cahermurphy West 110kV Substation Infrastructure Layout Plan

3.0 110kV Proposed Grid Connection Route

The UGC route is approximately 25.005 km in length and traverses in a northeast to northwestern direction from the existing ESB Moneypoint 400 kV Substation to the proposed 110 kV Wind Farm Substation utilising public local road networks, existing access tracks, and private land.

The exact location of the HV UGC within the curtilage of the public road and wind farmlands may be subject minor modification following confirmatory site investigations to be undertaken prior to construction. The cable location will take into consideration Clare County Council and all other relevant stakeholders’ requirements. Installation of the underground cable will consider all environmental protection measures forming part of the planning application submitted to An Coimisiún Pleanála for the development at Cahermurphy West and accompanying technical reports.

Figure 2 below outlines the 110kV grid connection UGC route (Orange Route), with the total length of each section type detailed in Table 1.

Table 1 - Approximate UGC Route Location of Preliminary Design			
Public Roads	Private Land	Wind farm site	Total
24.008 km	0.837 km	0.160 km	25.005 km

Table 1 - Approximate UGC Route Location of Preliminary Design

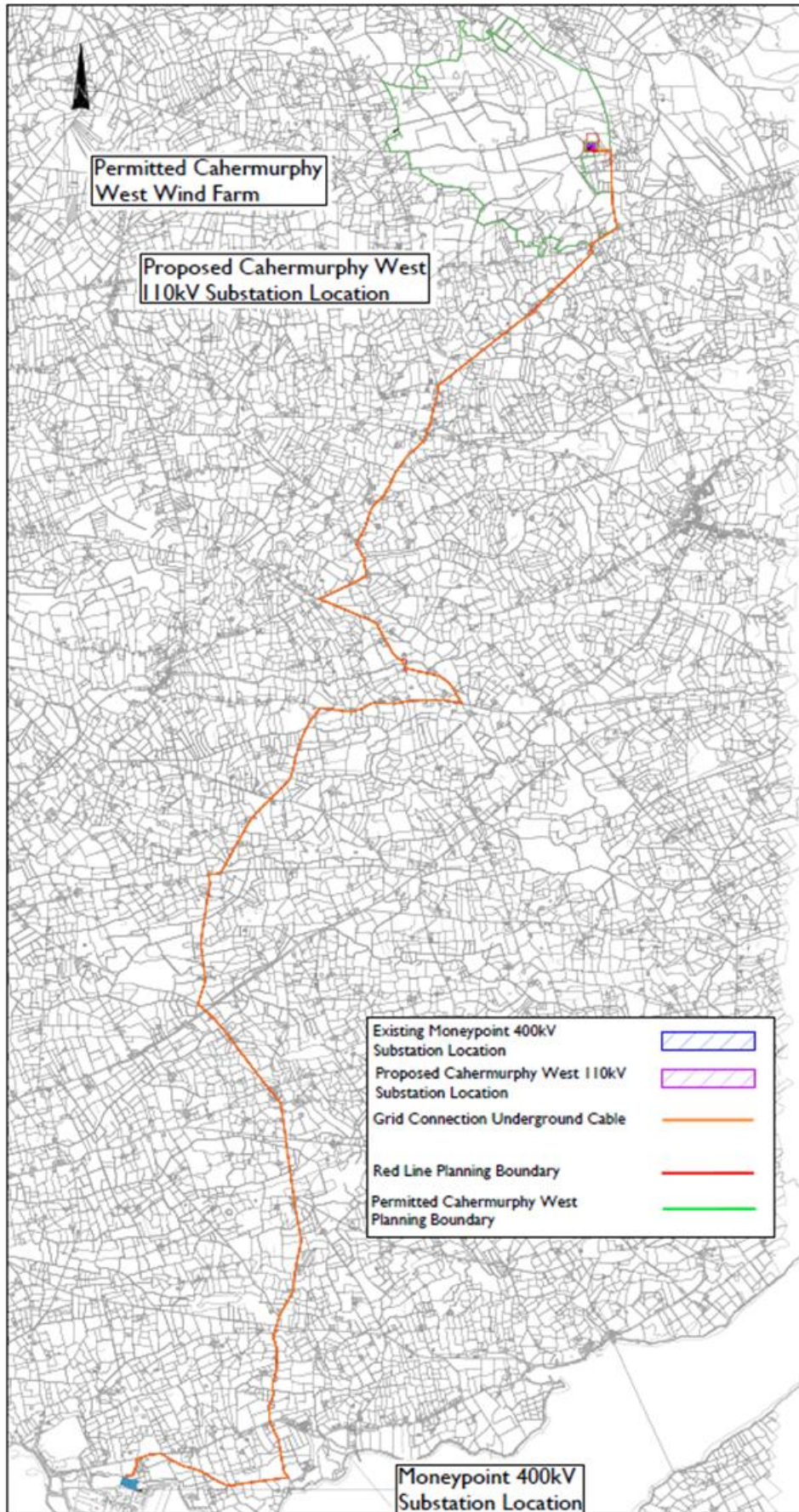


Figure 2 Proposed Grid Connection Route

Table 2 below separates the UGC route into several sections and describes the specific construction requirements of each individual section with access routes to the work areas. All plant and equipment employed on the works will be subject to good site organisation (signage, vehicles parked within works areas etc.) and hygiene (washing down plant and cleaning road surfaces, as required), particularly during construction activities.

Table 2 - Summary of 110 kV Underground Cable Route

Section	Description
<p>Section 1 approx. 9.2 km</p>	<p>UGC from Existing Moneypoint 400kV substation to the N68 National roadway</p> <p>The underground cable route initially begins at Moneypoint 400 kV Substation folio edge in the townland of Carrowdotia South, Co. Clare.</p> <p>The UGC begins by exiting the existing ESB Moneypoint 400kV substation along its northern boundary. The proposed cable will route north along consented private lands (folio no. CE28033) for approx. 817m. The proposed 110kV UGC converges onto the N67 national roadway travelling within the curtilage of this public road for approx. 315m in an eastern direction. Turning in a southern direction along a gradual bend, the proposed 110kV UGC converges onto the (L-6154) local roadway. Proceeding onwards for approx. 1704m.</p> <p>The proposed 110kV UGC takes a left turn in a northern direction, transitioning along the (L-20543) local roadway within the townland of Pouladarree. The proposed 110kV UGC traverses for approx. 750m, until briefly converging onto the N67 national roadway for approx. 10m before converging onto the (L-2054) local roadway within the townland of Doonnaghurroge. The proposed 110kV UGC traverses in a northern direction for approx. 1240m within the curtilage of this public road briefly passing through the (L-2058) local roadway for approx. 10m. The proposed 110kV UGC continues back onto the (L-2054) local roadway in a northern direction for a further distance of approx. 2444m, progressing through the townlands of Dunneill, Derrylough.</p> <p>The proposed 110kV UGC briefly carries through the (R-473) regional roadway for approx. 10m before traversing back onto the (L-2054) local roadway in a northern direction for approx. 686m before briefly traversing the (L-2052) local roadway for approx. 10m within the townland of Knockerry West. The proposed 110kV UGC emerges back onto the (L-2054) local roadway progressing onwards for a further distance of approx. 612m. At this point the proposed 110kV UGC must traverse an existing single arch bridge spanning the Garraunnatooha river. It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the southern side of the structure to the northern side keeping all works within the curtilage of the road corridor. From here the proposed 110kv UGC traverses for a further approx. 104m before encountering a Culvert (Culvert 06). It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the southern side of the structure to the northern side keeping all works within the curtilage of the road corridor. From here the proposed 110kv UGC traverses for a further approx. 508m before briefly carrying through the (N-68) national roadway within the townland of Carraunnatooha. It is proposed to traverse the (N-68) national roadway by means of Horizontal Directional Drill (HDD). It is proposed</p>

to drill from the southern side of the structure to the northern side keeping all works within the curtilage of the road corridor.

Section Features

- *This section contains 13 No. Joint Bays*

The Joint Bays will be located below ground and when finished within the existing carriageway, reinstated as per Purple Book specifications whilst adhering to the EirGrid & ESNB functional specification and as per private landowner reinstatement requirements when installed off the public road. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels.

- Joint Bay 1 (JB-01) will be located approx. 25 m along the proposed cable route north of Moneypoint 400 kV Substation within private lands (folio no. CE28033). (Ch.0m)
 - Joint Bay 2 (JB-02) will be located approx. 264 m northeast of JB-01 along the proposed route of the cable of within the private lands (folio no. CE28033). (Ch.305m)
 - Joint Bay 3 (JB-03) will be located approx. 750 m east of JB-02 along the proposed route within the L-6154. (Ch.1025m)
 - Joint Bay 4 (JB-04) will be located approx. 750 m east of JB-03 along the proposed route within the L-20544. (Ch.1790m)
 - Joint Bay 5 (JB-05) will be located approx. 750 m northeast of JB-04 along the proposed route within the L-20543. (Ch.2540m)
 - Joint Bay 6 (JB-06) will be located approx. 610 m north of JB-05 along the proposed route within the L-2054. (Ch.3150m)
 - Joint Bay 7 (JB-07) will be located approx. 730 m north of JB-06 along the proposed route within the L-2054. (Ch.3880m)
 - Joint Bay 8 (JB-08) will be located approx. 730 m north of JB-07 along the proposed route within the L-2054. (Ch.4605m)
 - Joint Bay 9 (JB-09) will be located approx. 730 m north of JB-08 along the proposed route within the L-2054. (Ch.5325m)
 - Joint Bay 10 (JB-10) will be located approx. 764 m north of JB-09 along the proposed route within the L-2054. (Ch.6100m)
 - Joint Bay 11 (JB-11) will be located approx. 720 m north of JB-10 along the proposed route within the L-2054. (Ch.6820m)
 - Joint Bay 12 (JB-12) will be located approx. 695 m north of JB-11 along the proposed route within the L-2054. (Ch.7520m)
 - Joint Bay 13 (JB-13) will be located approx. 700 m north of JB-12 along the proposed route within the L-2054. (Ch.8220m)
- *This section has 1 No. Bridge crossings:*
 - Bridge 1 has been surveyed with the result of insufficient clearance existing within this structure. To cross this bridge, it will be required to utilise a Horizontal Directional Drill within the L-2054 to cross a satisfactory clearance to the waterway.

	<ul style="list-style-type: none"> • <i>This section has 6 No. culvert crossings:</i> • A culvert schedule has been prepared to identify under or over methods to cross these existing structures. Please see the following drawings: 05935-DR-268/269. • <i>This section will require EIR crossings:</i> <p>Existing EIR infrastructure will be encountered along the cable route, and crossing schedules will be produced at detailed design stage to identify under or over methods to cross these existing buried services.</p> <ul style="list-style-type: none"> • <i>This section will require a number of Uisce Éireann service crossings:</i> <p>Existing Uisce Éireann infrastructure will be encountered, and the crossing schedules will be prepared at detailed design to identify under or over methods to cross these existing buried services. Consultation with Uisce Éireann will be required to ensure compliance at detailed design and construction phase.</p>
<p>Section 2 approx. 11.3 km</p>	<p>UGC from N68 National roadway to R484 Regional roadway</p> <p>The proposed 110kV UGC merges onto the (L-2050) local roadway, travelling within the curtilage of this public road in a northwestern direction. The UGC progresses through a minor bend around a gradual right turn before progressing in a northeastern direction for an approx. 1100m within the townlands of Tullagower, Gowerhass before encountering a Culvert (Culvert 08). It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the southern side of the structure to the northern side keeping all works within the curtilage of the road corridor. The UGC progresses in a northeastern direction for a further approx. 685m.</p> <p>The proposed 110kV UGC takes a right turn in an eastern direction onto the (L-6132) local roadway for approx. 150m before taking a left turn in a northern direction onto the (L-6130) local roadway for approx. 1140m before encountering the (L-2056) local roadway within the townland of Brisla West. The proposed 110kV UGC briefly traverses across this local roadway before emerging back onto the (L-6130) local roadway, progressing onwards for approx. 1050m within the townland of Brisla East before encountering a Culvert (Culvert 12). It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the southern side of the structure to the northern side keeping all works within the curtilage of the road corridor. The proposed 110Kv UGC progresses for a further approx. 275m.</p> <p>The proposed 110kV UGC takes a right turn in an eastern direction within the townland of Teernagloghane, traversing along the (L-6118) Local roadway for approx. 160m. At this point the proposed 110kV UGC must traverse an existing triple arch bridge spanning the Doonbeg river within the townland of Clooncullin. It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the western side of the structure within private lands (folio no. CE29234) to the eastern side within private lands (folio no. CE29234). From here the proposed 110kV UGC continues east within the (L-6118) Local roadway for approx. 1.67km.</p> <p>The proposed 110kV UGC takes a left turn in a western direction traversing along the (L-2044) Local roadway for approx. 934m. At this point the proposed 110kV UGC must traverse an existing single arch bridge spanning the Kilmihil stream within the townland of Clooncullin. It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill</p>

from the southern side of the structure within private lands (folio no. CE18488) to the northern side within private lands (folio no. CE4595). From here the proposed 110kV UGC continues northwest along the (L-2044) Local roadway for approx. 1.42km within the townland of Kilmacduane East.

The proposed 110kV UGC takes a right turn in an eastern direction traversing along the (L-2074) Local roadway for approx. 477m. At this point the proposed 110kV UGC must traverse an existing single arch bridge spanning the Kilmihil stream within the townland of Kilmacduane East. There is insufficient cover within the decking of the bridge for it to be traversed. Therefore, it is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the western side of the structure within the road corridor to the eastern side, remaining within the road corridor keeping all works within the curtilage of the road corridor. From here the proposed 110kV UGC continues north along the (L-6182) Local roadway for approx. 382m within the townland of Clooneeddan. At this point the proposed 110kV UGC must traverse an existing single arch bridge spanning the Kilmihil stream. It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the southern side of the structure within the road corridor to the northern side, remaining within the road corridor. From here the proposed 110kV UGC continues northeast along the (L-6182) Local roadway for approx. 1.85km before the (R-484) regional road within the townland of Leitrim.

Section Features

- *This section contains 16 No. Joint Bays*

The Joint Bays will be located below ground and when finished within the existing carriageway, reinstated as per Purple Book specifications whilst adhering to the EirGrid & ESNB functional specification and as per private landowner reinstatement requirements when installed off the public road. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels.

- Joint Bay 14 (JB-14) will be located approx. 776 m northwest of JB-13 along the proposed route of the cable of within the L-2050. (Ch.9000m)
- Joint Bay 15 (JB-15) will be located approx. 750 m north of JB-14 along the proposed route within the L-2050. (Ch.9750m)
- Joint Bay 16 (JB-16) will be located approx. 759 m north of JB-15 along the proposed route within the L-2050. (Ch.10500m)
- Joint Bay 17 (JB-17) will be located approx. 741 m northeast of JB-16 along the proposed route within the L-6130. (Ch.11250m)
- Joint Bay 18 (JB-18) will be located approx. 750 m northeast of JB-17 along the proposed route within the L-6130. (Ch.12000m)
- Joint Bay 19 (JB-19) will be located approx. 750 m northeast of JB-18 along the proposed route within the L-6130. (Ch.12750m)
- Joint Bay 20 (JB-20) will be located approx. 750 m north of JB-19 along the proposed route within the L-6118. (Ch.13495m)
- Joint Bay 21 (JB-21) will be located approx. 755 m east of JB-20 along the proposed route within the L-6118. (Ch.14250m)
- Joint Bay 22 (JB-22) will be located approx. 610 m east of JB-21 along the proposed route within the L-6118. (Ch.14850m)

- Joint Bay 23 (JB-23) will be located approx. 610 m north of JB-22 along the proposed route within the L-2044. (Ch.15475m)
- Joint Bay 24 (JB-24) will be located approx. 610 m northwest of JB-23 along the proposed route within the L-2044. (Ch.16090m)
- Joint Bay 25 (JB-25) will be located approx. 740 m northwest of JB-24 along the proposed route within the L-2044. (Ch.16820m)
- Joint Bay 26 (JB-26) will be located approx. 740 m northwest of JB-25 along the proposed route within the L-2074. (Ch.17550m)
- Joint Bay 27 (JB-27) will be located approx. 740 m northeast of JB-26 along the proposed route within the L-6182. (Ch.18300m)
- Joint Bay 28 (JB-28) will be located approx. 630 m northeast of JB-27 along the proposed route within the L-6182. (Ch.18925m)
- Joint Bay 29 (JB-29) will be located approx. 720 m northeast of JB-28 along the proposed route within the L-6182. (Ch.19650m)

- *This section has 4 No. Bridge crossings:*

- Bridge 2 has been surveyed with the result of insufficient clearance existing within this structure. To cross this bridge, it will be required to utilise a Horizontal Directional Drill within the L-6118 to cross a satisfactory clearance to the waterway
- Bridge 3 has been surveyed with the result of insufficient clearance existing within this structure. To cross this bridge, it will be required to utilise a Horizontal Directional Drill within the L-2044 to cross a satisfactory clearance to the waterway
- Bridge 4 has been surveyed with the result of sufficient clearance existing within this structure. To cross this bridge, it will be required to utilise a flat formation crossing within the L-2074 to cross a satisfactory clearance to the road level
- Bridge 5 has been surveyed with the result of insufficient clearance existing within this structure. To cross this bridge, it will be required to utilise a Horizontal Directional Drill within the L-6182 to cross a satisfactory clearance to the waterway

- *This section has 6 No. culvert crossings:*

A culvert schedule has been prepared to identify under or over methods to cross these existing structures. Please see the following drawings: 05935-DR-268/269/270.

- *This section will require EIR crossings:*

Existing EIR infrastructure will be encountered along the cable route, and crossing schedules will be produced at detailed design stage to identify under or over methods to cross these existing buried services.

- *This section will require a number of Uisce Éireann service crossings:*

Existing Uisce Éireann infrastructure will be encountered, and the crossing schedules will be prepared at detailed design to identify under or over methods to cross these existing buried services. Consultation with Uisce Éireann will be required to ensure compliance at detailed design and construction phase.

<p>Section 3</p> <p>approx. 4.5 km</p>	<p>R484 Regional roadway to Cahermurphy West Substation</p> <p>The proposed 110kV UGC routes north for approx. 10m across the (R-484) Regional roadway onto the (L-6194) Local roadway. Travelling within the curtilage of this public road within the townland of Sheeaun in a northern direction for approx. 665m. The proposed 110kV UGC carries right in a northeastern direction onto the (L-6186) Local roadway for approx. 525m within the townland of Cloonwhite South before encountering a Culvert (Culvert 13). It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the southern side of the structure to the northern side keeping all works within the curtilage of the road corridor. The UGC progresses in a northeastern direction for a further approx. 955m.</p> <p>At this point the proposed 110kV UGC must traverse an existing single arch bridge spanning the Creegh stream. It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the southern side of the structure within private lands (folio no. CE41336F) to the northern side within private lands (folio no. CE10781). From here the proposed 110kV UGC continues northeast along the (L-6186) Local roadway for approx. 1.1km before reaching the (L-2082) local road within the townland of Cahermurphy.</p> <p>The proposed 110kV UGC crosses the (L-2082) local roadway for approx. 10m before entering the private lands (folio no. CE19397F). The proposed 110kV UGC continues in a northern direction for approx. 155m before entering onto the (L-2048) local roadway. The proposed 110kV traverses this local roadway for approx. 265m in an eastern direction before taking a left turn in a northern direction onto the (L-6254) local roadway. From here the proposed 110kV UGC traverses for a further approx. 433m before encountering a Culvert (Culvert 17). It is proposed to traverse this structure and watercourse by means of Horizontal Directional Drill (HDD). It is proposed to drill from the southern side of the structure to the northern side keeping all works within the curtilage of the road corridor. The UGC progresses in a northeastern direction for a further approx. 82m taking a left turn in a western direction into Cahermurphy West planning boundary. The proposed 110kV UGC routes along an access track for approx. 215m before reaching Cahermurphy West Substation.</p> <p><u>Section Features</u></p> <ul style="list-style-type: none"> • <i>This section contains 7 No. Joint Bays</i> <p>The joint bays will be located below ground and finished/reinstated to the required ESB specification. Each joint bay will have an associated communication chamber which will have a surface access hatch matching existing ground levels. The final location of the joint bays and C2 Chambers may be subject to minor modification and can only be determined once consultation with ESB and detailed site investigation works have been carried out. The final positions will need to be agreed with ESB as part of the design approval process.</p> <ul style="list-style-type: none"> • Joint Bay 30 (JB-30) will be located approx. 720 m northwest of JB-29 along the proposed route within the L-6194. (Ch.20375m) • Joint Bay 31 (JB-31) will be located approx. 720 m northwest of JB-30 along the proposed route of the cable of within the L-6186. (Ch.21090m) • Joint Bay 32 (JB-32) will be located approx. 600 m northwest of JB-31 along the proposed route within the L-6186. (Ch.21690m) • Joint Bay 33 (JB-33) will be located approx. 680 m northwest of JB-32 along the proposed route within private lands (folio no. CE15357F). (Ch.22375m)
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- Joint Bay 34 (JB-34) will be located approx. 680 m northwest of JB-33 along the proposed route within the L-6186. (Ch.23050m)
- Joint Bay 35 (JB-35) will be located approx. 645 m northeast of JB-34 along the proposed route within the L-62048. (Ch.23750m)
- Joint Bay 36 (JB-36) will be located approx. 680 m northeast of JB-35 along the proposed route within the L-6254. (Ch.24425m)

- *This section has 1 No. Bridge crossings:*

- Bridge 6 has been surveyed with the result of insufficient clearance existing within this structure. To cross this bridge, it will be required to utilise a Horizontal Directional Drill within the private land to cross a satisfactory clearance to the waterway

- *This section has 6 No. culvert crossings:*

A culvert schedule has been prepared to identify under or over methods to cross these existing structures. Please see the following drawings: 05935-DR-268/270

- *This section will require EIR crossings:*

Existing EIR infrastructure will be encountered along the cable route, and crossing schedules will be produced at detailed design stage to identify under or over methods to cross these existing buried services.

Note: The precise location of the cable route may be subject to change as result of existing services/utility locations, ground conditions and any environmental constraints.

4.0 Preliminary Site Investigations

It will be required to carry out Preliminary site investigations along the cable route prior to construction in order to confirm design assumptions.

4.1 UGC Grid Connection Route

Slit trenches at locations of major service crossings (full road/track width) for the UGC route. Trial holes along the grid connection route to ascertain ground conditions and thermal resistivity of the soil. Trial holes at all chamber positions to ascertain ground conditions and thermal resistivity of the soil.

Equipment:

- 4x4 vehicle
- Concrete vibrator
- Wheeled dumper
- Soil compactor
- 360° tracked excavator (only rubber tracked machines will be allowed on public roads)

5.0 Access Routes to Work Area

The majority of the underground cable route will be installed within the existing public road. Where the cable route is located offroad in private lands, the contractor(s) will be required to utilise the local public road network in the vicinity of the work area and from there utilise private access tracks, where appropriate.

A detailed Traffic Management Plan will be prepared and agreed with Clare County Council, prior to the commencement of construction. Some work areas will require a road closure where it is not possible to safely implement a Stop/Go system. Where road closures are necessary, a suitable diversion will be implemented using appropriate signage, following consultation with Clare County Council.

Careful and considered local consultation will be carried out, to minimise the amount of disturbance caused during works. Prior to the commencement of construction, the contractor will assess all access routes and determine any additional access requirements which will be incorporated as part of the method statement. All plant and equipment employed during the works (e.g., diggers, tracked machines, footwear etc.) will be inspected prior to arrival on site and on leaving site and cleaned where necessary to prevent the spread of invasive aquatic / riparian species.

Where access tracks are unavailable through offroad privately owned lands, it is proposed to install access tracks along the proposed underground cable route to enable future access to allow for maintenance of the proposed cable.

6.0 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with Clare County Council. All work on public roads will be subject to the approval of a road opening license application by Clare County Council. The contractor will prepare a detailed traffic management plan for inclusion as part of the road opening applications. Where road widths allow, the UGC installation works will allow for one side of the road to be open to traffic at all times by means of a 'Stop/Go' type traffic management system, where a minimum 2.5m roadway will be maintained at all times.

Where it is not possible to implement a 'Stop/Go' system a full road closure will be required. Temporary traffic signals will be implemented to allow road users safely pass through the works area by channelling them onto the open side of the road. Typically, the UGC will be installed in 150 m sections, and no more than 100 m will be excavated without the majority of the previous section being reinstated. Where the construction requires the crossing of a road, works on one carriageway will be completed before the second carriageway is opened, to maintain traffic flows.

All construction vehicles will be parked within the works area so as not to cause additional obstruction or inconvenience to road users or residents. The traffic signals will be in place prior to the works commencing and will remain in place until after the works are completed. The public road will be checked regularly and maintained free of mud and debris. Road sweeping will be carried out as appropriate to ensure construction traffic does not adversely affect the local road condition.

In the event of emergency, steel plates, which will be available on site, can be put in place across the excavation to allow traffic to flow on both sides of the road.

All traffic management measures will comply with those outlined within the accompanying planning and environmental report and will be incorporated into a detailed Traffic Management Plan to be prepared, in consultation with both Clare County Council prior to the commencement of UGC construction.

7.0 Road Opening Licence

The UGC grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from Clare County Council. A Traffic Management Plan (TMP) will be agreed with Clare County Council prior to the commencement of the development. The TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with Clare County Council in advance of the preparation of the TMP.

8.0 Construction Hours

Standard working hours for construction will be 8.00am to 8.00pm Monday to Friday and 8.00am to 6.00pm on Saturday (if required), with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency. All site personnel will be required to wear project notification labelling on high visibility vests and head protection so that they can be easily identified by all workers on-site.

9.0 UGC Construction Methodology (SID Application to An Coimisiún Pleanála)

The underground 110kV grid connection ducting will consist of 1 No. trench, the trench will contain 3 No. 160mm diameter HDPE power ducts, 2 No. 125mm diameter HDPE communications ducts and 1 no. 125mm diameter earth continuity duct to be installed in an excavated trench, typically 825mm wide by 1315mm deep, with variations on this design to adapt to service crossings and watercourse crossings, etc. The communications duct will accommodate a fibre cable to allow communications between the Cahermurphy West 110kV substation and Moneypoint 400kV substation. The inclusion of 1 No. earth continuity conductor duct will also be required. The ducts will be installed, the trench reinstated in accordance with landowner/ Clare County Council specification. Once all are satisfied, then the electrical cabling/fibre cable is pulled through the installed ducts in approximately 750/850m sections. Construction method statements and templates will be implemented to ensure that the underground HV ducting is installed in accordance with the correct requirements, materials, and specifications of ESBN and EirGrid.

9.1 Trenching Methodology

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

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures included within the planning application and accompanying reports and as required by planning conditions where relevant;
- All existing underground services shall be identified on site prior to the commencement of construction works;
- At watercourse crossings, the contractor will be required to adhere to the environmental control measures outlined within the planning application and accompanying reports, the construction contractor will prepare a detailed Construction Environmental Management Plan (CEMP) prior to the commencement of construction, the CEMP will be used to clearly document for construction staff the proposed mitigation, as set out in the application, and any subsequent planning conditions that may be imposed. The CEMP document will be prepared in line with best practice construction methodologies including the following measures;
- Where the ducting routes intersect with culverts, the culvert will remain in place (where possible) and the ducting will be installed either above or below the culvert to provide minimum separation distances in accordance with ESB and Irish Water specifications;
- In the event that culverts require removal for ducting installation, it is proposed that a suitable method of damming the water source and pumping the water around the work area would be set out in a method statement and agreed with the relevant stakeholders. Once the ducts are installed the culvert will be reinstated to match

existing levels and dimensions. If works of this nature are required, the contractor will liaise with Inland Fisheries Ireland in advance of works;

- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be located a minimum of 15m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW);
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site;
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature;
- Where required, grass will be reinstated by either seeding or by replacing with grass turves;
- No more than a 100m section of trench will be opened at any one time. The second 100m will only be excavated once the majority of reinstatement has been completed on the first;
- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section;
- Where the ducting is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;

Equipment:

- 1 Excavator Operator;
- 2-3 General Operatives;
- 1 no. tracked excavator (only rubber tracked machines will be allowed on public roads);
- 1 no. dumper or tractor and trailer.

Materials:

- Ready-mix Concrete (delivered to site);
- Trench backfilling material (excavated material and aggregates) to relevant specifications;
- 160mm & 125mm diameter HDPE ducting;
- Temporary Surface Reinstatement Materials.



Figure 3 Typical 110kV Underground Duct Installation

9.2 Ducting Installation Methodology

For the trenching and ducting works the following step by step methodology will apply:

1. Grade, smooth and trim trench floor when the required 1315mm depth and 825mm width have been obtained.
2. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with the specification and compact it so that the compacted thickness is as per the drawings.
3. Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing. Fit a secure cap / bung to the end of each duct run to prevent the ingress of dirt or water.
4. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
5. Place protection strips on compacted CBGM B directly over the ducts.
6. Lay the top row of ducts onto the freshly compacted CBGM B including the protection strips above the bottom row of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.
7. Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.
8. Place red protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.
9. Place and thoroughly compact CBGM B material or Clause 804 backfill or soil backfill as specified and place warning tape at the depth shown on the drawings.
10. For concrete and asphalt/bitmac road sections, carry out immediate permanent reinstatement in accordance with the specification and to the approval of the local authority and/or private landowners, unless otherwise agreed with local authorities.
11. Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes. All the works should be witnessed by ESNB Clerk of Works (CoW) as required.

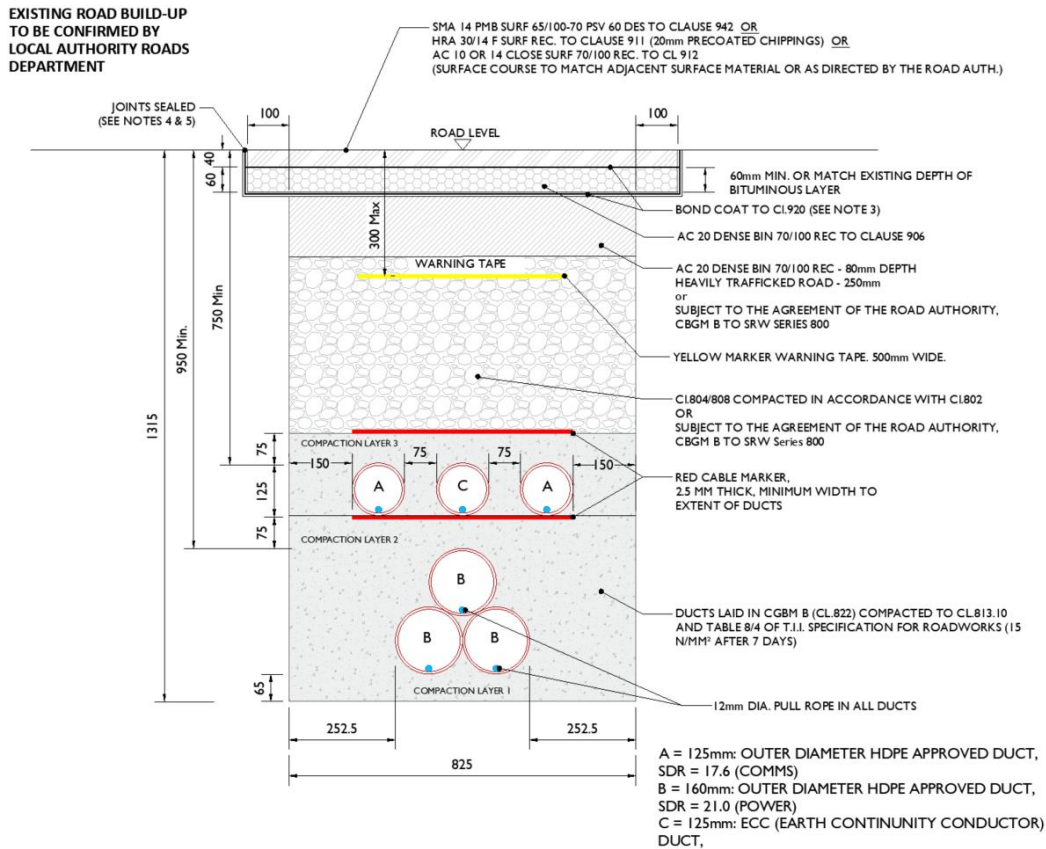


Figure 4 110kV Ducts in Local Road Permanent Reinstatement (SD4) with ECC

9.3 Marker posts

Surface cable markers will be placed along the route where cable depth is unavoidably shallow, due to constraints such as existing services, to indicate the precise location of the UGC. These markers will be metallic plates in accordance with ESNB and EirGrid standards.

Marker posts will be used on non-roadway routes to delineate the cable route and joint bay positions. Corrosion proof aluminium triangular danger sign, with 700mm base, and with centred lightning symbol, on engineering grade fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker post shall also be placed in the event that burial depth is not to standard. Siting of marker posts to be dictated by ESNB as part of the detailed design process.

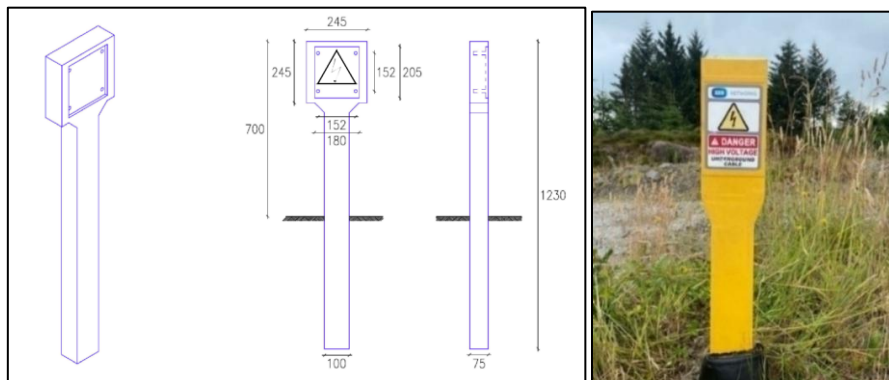


Figure 5 Typical ESB Marker Posts Example

9.4 Managing Excess Material from Trench

All excavated material will be temporarily stored adjacent to the trench prior to re-use in the trench reinstatement (where applicable). Stockpiles will be restricted to less than 2m in height. Excavated tar from the public road network will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility.

9.5 Storage of Plant and Machinery

All plant, machinery and equipment will be stored on site within the UGC works area or within the temporary construction compounds to be located within the Cahermurphy West site. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds

9.6 Joint Bays and Associated Chambers

Before starting construction, the area around the edge of the joint bay which will be used by heavy vehicles will be surfaced with a terram cover (if required) and stone aggregate to minimise ground damage. Any drains within the temporary works area will be culverted and check dams made from stone or sandbags covered with terram will be inserted upstream and downstream of these culverts to intercept any solids generated during the insertion or which wash out during the works. If the ground slopes from the working area toward a watercourse or if there is evidence of solids washing off the works area toward nearby watercourses or drains, a silt fence with straw bales, will be interposed between the works area and the watercourse.

All excavated material will be stored near the excavations and reused for reinstatement works. Any soil required for reinstatement that will be temporarily stockpiled on site will be placed at least 15m back from the nearest watercourse on level ground and will be ringed at the base by silt fencing and be regularly monitored by a designated competent person for signs of solids escape. In which case an additional line of silt fencing with straw bales will be added in line with the relevant environmental control measures.

If the joint bay/slab needs to be dewatered, this will be pumped to a percolation area if the soil is not saturated, otherwise a settlement tank will be used to remove any solids from the dewatering process to comply with the environmental control measures.

The risk of concrete reaching surface waters is considered very low given that all concrete will be poured into the pit excavated for the joint slab so that spills will be contained. The basic requirement therefore is that all pouring operations be constantly supervised to prevent accidental spillages occurring outside the pit.

Temporary storage of cement bound sand (if required) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g. using sandbags and geotextile sheeting or silt fencing to contain any solids in run-off.

9.7 Joint Bays and Associated Chambers (SID Application to An Coimisiún Pleanála)

Joint Bays are to be installed approximately every 650m - 850m along the UGC route to facilitate the jointing of 2 No. lengths of 110kV UGC. Joint Bays are typically 6m x 2.5m x 2.05m pre-cast concrete structures installed below finished ground level. Joint Bays will be located in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this may not always be possible.

In association with joint bays, Communication Chambers will be required at every joint slab location to facilitate communication links. Earth Sheath Link Chambers are also required at every joint bay along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground power cables, so that the circulating

currents and induced voltages are eliminated or reduced. Earth Sheath Link Chambers and Communication Chambers are located in close proximity to joint bays. Earth Sheath Link Chambers and Communication Chambers will typically be pre-cast concrete structures with an access cover at finished surface level.

The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers is subject to detailed design. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions.

The following steps outline the methodology for joint bay construction and reinstatement:

1. The contractor will excavate a pit for joint bay construction, including for a sump in one corner.
2. Grade and smooth floor; then lay a 50 mm depth thick sand on 200 mm thick Clause 804 granular material.
3. Place pre-cast concrete sections on sand bedding.
4. Where joint bays are located under the road surface the joint bay will be backfilled with compacted layers of Clause 804 and the road surface temporarily reinstated as specified by the local authority.
5. Precast concrete covers may be used as temporary reinstatement of joint bays at off road locations. These covers are placed over the constructed joint bay and are then removed at the cable installation stage of the project.
6. At a later date to facilitate cable installation and jointing, reinstate traffic management signage, secure individual sites, re-excavate three consecutive joint bays and store excavated material for reuse.



Figure 9 Typical Cable Pulling Drum Set Up

Once the “two sections” of cable are pulled into the joint bay, a jointing container is positioned over the joint bay and the cable jointing procedure is carried out in this controlled environment. Following the completion of jointing and duct sealing works in the joint slab, place and thoroughly compact cement-bound sand in approximately 200 mm layers to the level of the cable joint base to provide vertical support. Install additional layers of cement-bound sand and compact each layer until the cement-bound sand is level with the top of the joint. Install an additional 100 mm cement-bound sand layer. Install cable protection strip. Backfill with cement-bound sand to a depth of 250 mm below surface and carry out permanent reinstatement including placement of warning tape at 300 mm depth below finished surface.

10.0 Relocation of Existing Services

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

10.1 Underground Cables

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

10.2 Water Mains

Uisce Eireann will need to be consulted and advised on details of the project proposals in the form of a completed Building-over or Near an Irish Water Asset Application Form and associated technical information largely comprising drawings and schedules with details of proposed crossings etc with as much available information as possible. Uisce Eireann will be involved in the early engagement on projects that may involve any infrastructure which may be located near their assets with the intention of identifying as early as possible, if bespoke design measures or diversions are necessary.

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

11.0 Major Watercourse Crossing

Where the cable route intersects with existing watercourses, a detailed construction method statement will be prepared by the Contractor prior to the commencement of construction and is to be approved by the Local Authority and relevant environmental agencies. Crossing existing culverts will be implemented using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. The culvert crossing methods are detailed below, and more detailed culvert crossing drawings are available.

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

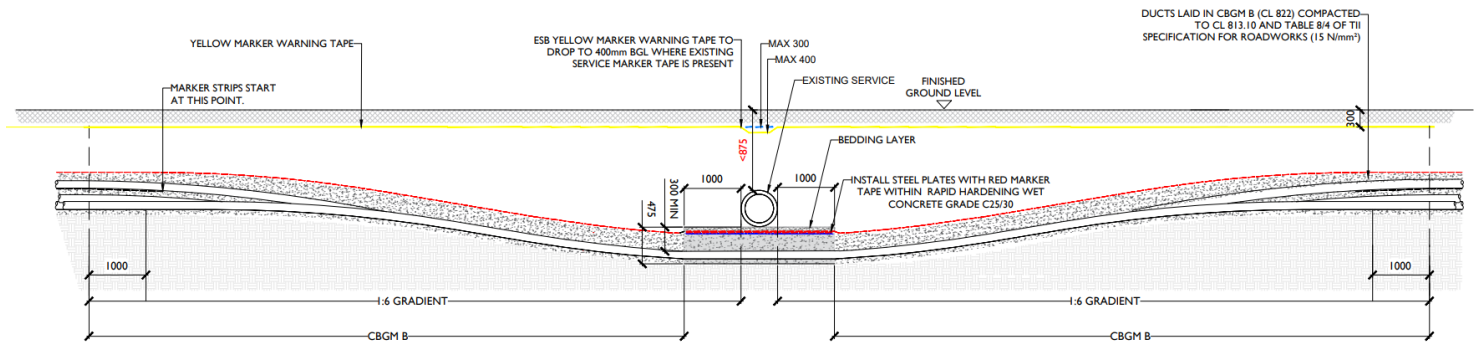


Figure 10 MV UGC Culvert Undercrossing

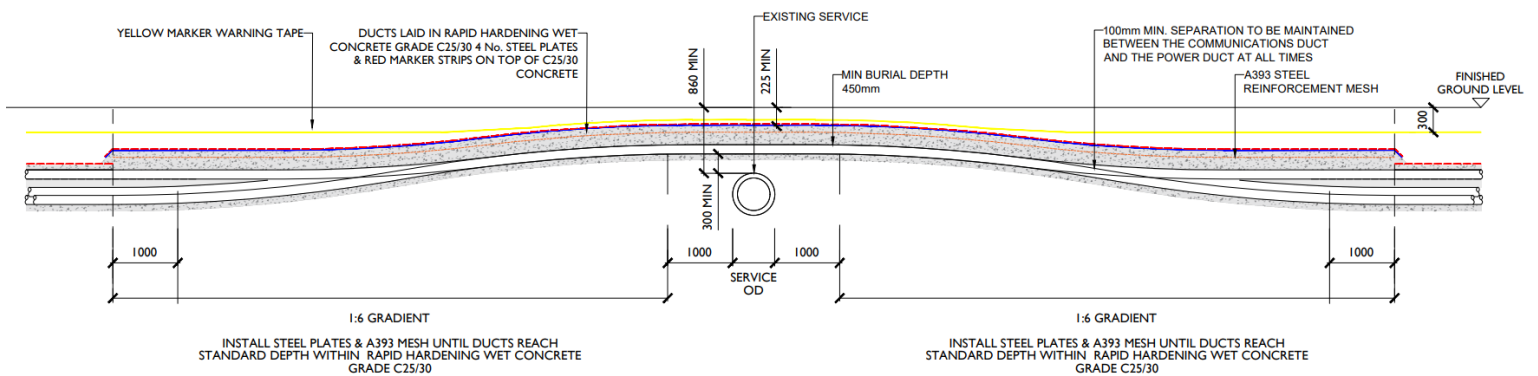


Figure 11 MV UGC Culvert Overcrossing

11.1 Bridge 1 – Horizontal Directional Drilling

ITM Coordinates: 505042, 657474

The Garraunatooha river is located to the south of the existing N-68 National roadway (Ch.8100m). The river flows in an east to west direction. The L-2054 traverses above the watercourse by means of a single arch bridge. The bridge has insufficient room to install the cable with a minimum of 450mm cover to top of ducts, therefore it is proposed to utilise a to Horizontal Directional Drill (HDD) to traverse below the watercourse and bridge structure. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the southern side of the structure within the curtilage of the public road (L-2054), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the northern side of the structure within the curtilage of the public road (L-2054). The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-280.



Figure 12 Bridge 1 (L-2054)

11.2 Culvert 6 – Horizontal Directional Drilling

ITM Coordinates: 504815, 657783

Culvert 6 located within L-2054 has been surveyed to be a double stone clapper culvert (Ch.8500m). There is insufficient room to install the cable with a minimum of 450mm cover to top of ducts above the keystone of the culvert, therefore it is proposed to utilise a to Horizontal Directional Drill (HDD) to traverse below the watercourse and culvert structure due to the bottomless construction of this culvert. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the southern side of the structure within the curtilage of the public road (L-2054), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the northern side of the structure within the curtilage of the public road (L-2054). The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-281.



Figure 13 Culvert 6 (L-2054)

11.3 (N-68) National Road – Horizontal Directional Drilling

ITM Coordinates: 504624, 657973

The (N-68) National Road located between the L-2054 and L-2050 (Ch.8750m). It is proposed to utilise a Horizontal Directional Drill (HDD) to traverse below the National Road as the least intrusive method of crossing. The proposed HDD will be implemented to bore a minimum of 5000mm beneath the road surface, adhering to the Transport Infrastructure Ireland) TII protocol guidelines (DN-STR-03012-06, section 5.5 services), see figure 14.

5.5 Services

Service ducts / pipes (including drainage pipes) shall not be located on or adjacent to any external face of a structure. The attachment of service ducts / pipes (including drainage pipes) to the exterior of any structure shall not be permitted.

Electricity cables 10kV or greater shall not be located on or over road structures, including buried structures. Where electricity cables 10kV or greater are required to cross a road structure they shall pass below the structure, at a sufficient depth so as to remove the potential for any impacts on the structure during operation.

Figure 14 Extract from TII Document DN-STR-03012

The HDD works are proposed to launch the drill shot from the southern side of the structure on within the curtilage of the public road (L-2054), travel beneath the (N-68) National Road and for the drill shot to exit to a receptor pit on the northern side of the structure within the curtilage of the public road (L-2050). The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-282.



Figure 15 National Road (N-68)

11.4 Culvert 8 – Horizontal Directional Drilling

ITM Coordinates: 504612, 659144

Culvert 8 located within L-2050 has been surveyed to be a single stone clapper culvert (Ch.9975m). There is insufficient room to install the cable with a minimum of 450mm cover to top of ducts above the keystone of the culvert, therefore it is proposed to utilise a Horizontal Directional Drill (HDD) to traverse below the watercourse and culvert structure due to the bottomless construction of this culvert. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the southern side of the structure within the curtilage of the public road (L-2050), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the northern side of the structure within the curtilage of the public road (L-2050). The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-283.



Figure 16 Culvert 8 (L-2050)

11.5 Culvert 12 – Horizontal Directional Drilling

ITM Coordinates: 505892, 661551

Culvert 12 located within L-6130 has been surveyed to be a concrete culvert (Ch.12900m). There is insufficient room to install the cable with a minimum of 450mm cover to top of ducts above the keystone of the culvert, therefore it is proposed to utilise a to Horizontal Directional Drill (HDD) to traverse below the watercourse and culvert structure due to the bottomless construction of this culvert. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the southern side of the structure within the curtilage of the public road (L-6130), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the northern side of the structure within the curtilage of the public road (L-3130). The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-284.

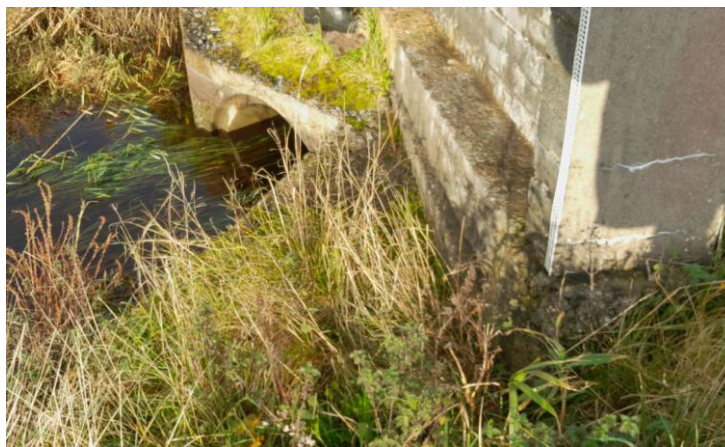


Figure 17 Culvert 12 (L-6130)

11.6 Bridge 2 – Horizontal Directional Drilling

ITM Coordinates: 506225, 661798

The Doonbeg River is located to the north of the existing N-68 National roadway (Ch.13325m). The river flows in a south to north direction. The L-6118 traverses above the watercourse by means of a single arch bridge. The bridge has insufficient room to install the cable with a minimum of 450mm cover to top of ducts, therefore it is proposed to utilise a to Horizontal Directional Drill (HDD) to traverse below the watercourse and bridge structure. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the western side of the structure within private lands (folio no. CE29234), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the eastern side of the structure within private lands (folio no. CE29234).The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-285.



Figure 18 Bridge 2 (L-6118)

11.7 Bridge 3 – Horizontal Directional Drilling

ITM Coordinates: 507141, 662349

The Kilmihil stream is located to the north of the existing N-68 National roadway (Ch.15950m). The river flows in an east to west direction. The L-2044 traverses above the watercourse by means of a single arch bridge. The bridge has insufficient room to install the cable with a minimum of 450mm cover to top of ducts, therefore it is proposed to utilise a to Horizontal Directional Drill (HDD) to traverse below the watercourse and bridge structure. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the southern side of the structure within private lands (folio no. CE18488), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the northern side of the structure within private lands (folio no. CE4595).The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-286.



Figure 19 Bridge 3 (L-2044)

11.7 Bridge 4 – Horizontal Directional Drilling

ITM Coordinates: 506482, 663380

The Kilmihil stream is located to the north of the existing N-68 National roadway (Ch.17850m). The river flows in an east to west direction. The L-2044 traverses above the watercourse by means of a single arch bridge. The bridge has insufficient room to install the cable with a minimum of 450mm cover to top of ducts, therefore it is proposed to utilise a to Horizontal Directional Drill (HDD) to traverse below the watercourse and bridge structure. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the southern side of the structure within the curtilage of the public road (L-2074), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the northern side of the structure within the curtilage of the public road (L-6182). The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-287.



Figure 20 Bridge 4 (L-2044)

11.8 Bridge 5 – Horizontal Directional Drilling

ITM Coordinates: 506639, 663671

The Kilmihil stream is located to the north of the existing N-68 National roadway (Ch.18225m). The river flows in an east to west direction. The L-6182 traverses above the watercourse by means of a single arch bridge. The bridge has insufficient room to install the cable with a minimum of 450mm cover to top of ducts, therefore it is proposed to utilise a Horizontal Directional Drill (HDD) to traverse below the watercourse and bridge structure. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the southern side of the structure within the curtilage of the public road (L-6182), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the northern side of the structure within the curtilage of the public road (L-6182). The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-288.



Figure 21 Bridge 5 (L-6182)

11.9 Culvert 13 – Horizontal Directional Drilling

ITM Coordinates: 507985, 666223

Culvert 13 located within L-6186 has been surveyed to be a single stone clapper culvert (Ch.21275m). There is insufficient room to install the cable with a minimum of 450mm cover to top of ducts above the keystone of the culvert, therefore it is proposed to utilise a to Horizontal Directional Drill (HDD) to traverse below the watercourse and culvert structure due to the bottomless construction of this culvert. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the southern side of the structure within the curtilage of the public road (L-6186), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the northern side of the structure within the curtilage of the public road (L-6186). The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-289.



Figure 22 Culvert 13 (L-6186)

12 Bridge 6 – Horizontal Directional Drilling

ITM Coordinates: 508786, 666858

The Creegh Stream is located to the South of the Proposed Cahermurphy West Wind Farm (Ch.22300m). The river flows in a south to north direction. The L-6186 traverses above the watercourse by means of a single arch bridge. The bridge has insufficient room to install the cable with a minimum of 450mm cover to top of ducts, therefore it is proposed to utilise a Horizontal Directional Drill (HDD) to traverse below the watercourse and bridge structure. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the west side of the structure within private lands (folio no. CE41336F), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the eastern side of the structure within private lands (folio no. CE10781).The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-290.

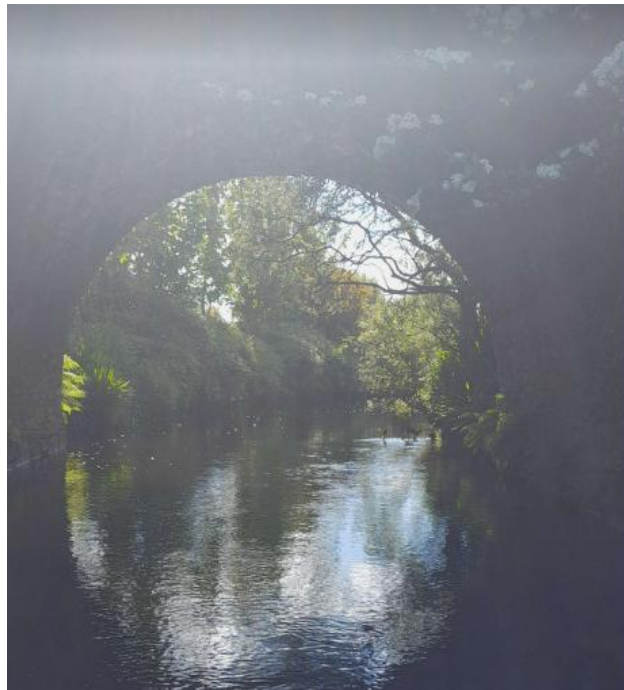


Figure 23 Bridge 6 (L-6186)

12.1 Culvert 17 – Horizontal Directional Drilling

ITM Coordinates: 509748, 668775

Culvert 17 located within L-6254 has been surveyed to be a concrete culvert (Ch.24725m). There is insufficient room to install the cable with a minimum of 450mm cover to top of ducts above the keystone of the culvert, therefore it is proposed to utilise a to Horizontal Directional Drill (HDD) to traverse below the watercourse and culvert structure due to the bottomless construction of this culvert. The proposed HDD will be implemented to bore a minimum of 1500mm beneath the watercourse bed as per Inland Fisheries Ireland (IFI) specifications.

The HDD works are proposed to launch the drill shot from the southern side of the structure within the curtilage of the public road (L-6254), travel beneath the watercourse bed and for the drill shot to exit to a receptor pit on the northern side of the structure within the curtilage of the public road (L-6254). The methodology for HDD is outlined in Section 13 below. Ref drawing 05935-DR-291.



Figure 24 Culvert 17 (L-6254)

13.0 Horizontal Directional Drilling (HDD)

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles, such as bridges, railways, watercourses, 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. There is a watercourse crossing and motorway crossing along the 110kV UGC route which will be performed using HDD, so that this obstacle is traversed in the least intrusive manner possible.

The proposed drilling methodology is as follows:

- A works area of circa 20m² for the HDD entry side, and circa 40m² on the HDD exit side, will be required for the HDD equipment and vehicles. These areas will be fenced off during the HDD implementation.
- The drilling rig and fluid handling units will be located on the designated entry side of the watercourse and will be appropriately bunded using sandbags, which will contain any fluid spills and stormwater run-off.
- Entry and exit pits (approximately 2m (width) x 3m (length) x 1m depth) will be excavated using an excavator. The excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
- The HDD pilot bore will be undertaken using a wireline guidance system. Assembly will be set up by the drilling team and steering engineer.
- The pilot bore will be drilled to the pre-determined profile and alignment under the watercourse crossing.
- The steering engineer and drill team will monitor the drilling works to ensure that modelled stresses and pressures are not exceeded.
- The drilled cuttings will be flushed back by drilling fluid to the entry pit and treated for re-use.
- Once the first pilot hole has been completed, a hole-opener or back-reamer will be fitted in the exit side which will then be pulled back to the entry side as part of the pre-reaming/hole opening process to enlarge the hole to the needed size.
- When the pre-reaming/hole opening/hole cleaning has been completed, a reamer of slightly smaller diameter than the final cut will be installed on the drill string to which the ducts will be attached for installation.
- The drilling fluid will be disposed of to a licensed facility. The interior of the ducts will be cleaned, and the ducts will be proven to ascertain their suitability. Their installed location will be mapped.
- The entry and exit pit areas will be reinstated to the specification of the landowner and any requirements of Clare County Council.
- A joint bay/transition chamber/transition coupler will be installed on either side of the drill shot, following the horizontal directional drilling procedure, which will serve as interface between the HDD ducts and the standard ducts.

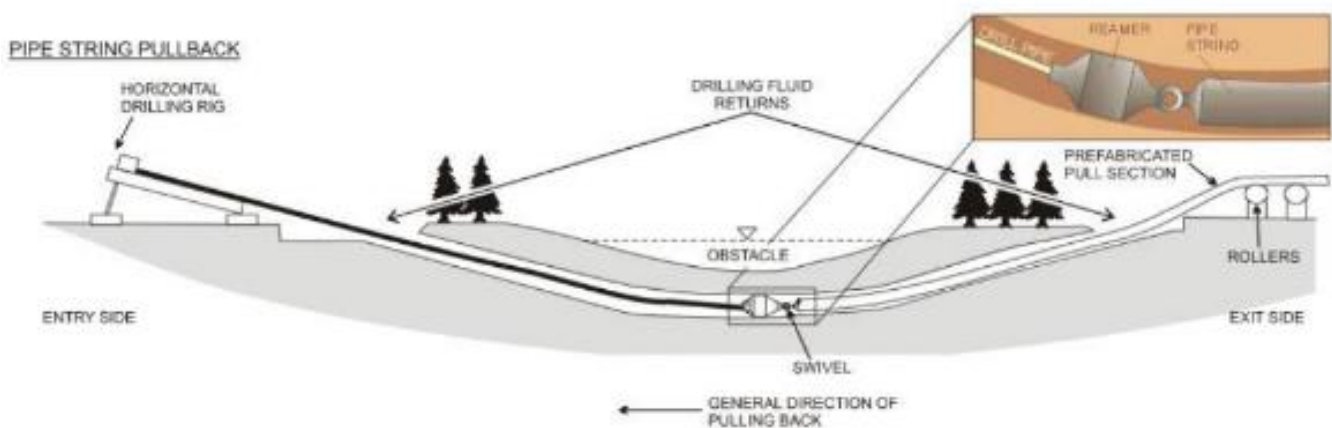


Figure 25 Typical HDD Installation

14.0 Reinstatement of Private Land

Once all construction works are complete, the temporary work areas will be reinstated with excavated soil and either seeded out with native species, allowed to vegetate naturally or reinstated with excavated grass turves and will be restored to their original condition. This work will be carried out in consultation with the landowner and in line with any relevant measures outlined in the planning application, CEMP and planning conditions.

14.0 Best Practice Design and Construction & Environmental Management Methodology

Prior to commencement of construction works the contractor will draw up detailed Method Statements which will be informed by this Planning Stage Construction Methodology, environmental protection measures included within the CEMP, and the guidance documents and best practice measures listed below. This method statement will be adhered to by the contractors and will be overseen by the Project Manager, Environmental Manager and ECoW where relevant.

The following documents will contribute to the preparation of the method statements in addition to those measures below: -

- Inland Fisheries Ireland (2016) *Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters*. Inland Fisheries Ireland, Dublin,
- *National Roads Authority (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*. National Roads Authority, Dublin;
- E. Murnane, A. Heap and A. Swain. (2006) *Control of water pollution from linear construction projects*. Technical guidance (C648). CIRIA;
- E. Murnane et al., (2006) *Control of water pollution from linear construction projects*. Site guide (C649). CIRIA.
- Murphy, D. (2004) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*. Eastern Regional Fisheries Board, Dublin;
- H. Masters-Williams et al (2001) *Control of water pollution from construction sites. Guidance for consultants and contractors (C532)*;
- Enterprise Ireland (unknown). *Best Practice Guide (BPGCS005) Oil storage guidelines*;
- Law, C. and D'Aleo, S. (2016) *Environmental good practice on site pocket book*. (C762) 4th edition. CIRIA;
- CIRIA *Environmental Good Practice on Site (fourth edition) (C741) 2015*.

The works will be carried out by employing accepted good work practices during construction, and environmental management measures such as those discussed below. Please note that the following measures will be supplemented by further specific environmental protection measures that will be included in method statements prepared for specific tasks during the works and will form part of the detailed CEMP.

- All materials shall be stored at the temporary compound within the Cahermurphy West site and transported to the works zone immediately prior to construction;
- Where drains and watercourses are crossed with underground cables, the release of sediment will be prevented through the implementation of best practice construction methodologies.
- Weather conditions will be considered when planning construction activities to minimise risk of run off from site;
- Provision of 50m exclusion zones and barriers (silt fences) between any excavated material and any surface water features to prevent sediment washing into the receiving water environment;
- If dewatering is required as part of the works e.g. in trenches for underground cabling or in wet areas, water must be treated prior to discharge;
- The contractor shall ensure that silt fences are regularly inspected and maintained during the construction phase;

- If very wet ground must be accessed during the construction process bog mats/aluminium panel tracks will be used to enable access to these areas by machinery. However, works will be scheduled to minimise access requirements during winter months;
- The contractor shall ensure that all personnel working on site are trained in pollution incident control response. A regular review of weather forecasts of heavy rainfall is required, with the Contractor required to prepare a contingency plan for before and after such events;
- The contractor will carry out visual examinations of local watercourses from the works during the construction phase to ensure that sediment is not above baseline conditions. In the unlikely event of water quality concerns, the Environmental Manager and ECoW will be consulted;
- Excavations will be left open for minimal periods to avoid acting as a conduit for surface water flows.
- Only emergency breakdown maintenance will be carried out on site. Emergency procedures and spillage kits will be available and construction staff will be familiar with emergency procedures.
- Appropriate containment facilities will be provided to ensure that any spills from vehicles are contained and removed off site. Adequate stocks of absorbent materials, such as sand or commercially available spill kits shall be available;
- Concrete or potential concrete contaminated water run-off will not be allowed to enter any watercourses. Any pouring of concrete (delivered to site ready mixed) will only be carried out in dry weather. Washout of concrete trucks shall be strictly confined to a designated and controlled wash-out area within the Cahermurphy West site; remote from watercourses, drainage channels and other surface water features;
- Entry by plant equipment, machinery, vehicles and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or wastewater into watercourses;
- Cabins, containers, workshops, plant, materials storage and storage tanks shall not be located near any surface water channels and will be located beyond the 50m hydrological buffer at all times.

15.0 Implementation of Environmental Protection Measures

All environmental protection measures contained within the NIS (Natura Impact Statement) which accompanies the planning application will be incorporated into the final CEMP (Construction Environmental Management Plan) and construction method statements prior to the commencement of development and will be implemented in full during the construction phase. The Project Manager and Site Manager will be responsible for the implementation of measures following consultation with the Environmental Manager and ECoW where necessary.

16.0 Invasive Species Best Practices Measures

Invasive species can be introduced into a location by contaminated plant, machinery, and equipment which were previously used in locations that contained invasive species. Good site organisation and hygiene management shall be maintained always on-site, and best practice measures will be implemented, as follows:

- The contractor will prepare an Invasive Species Action Plan to be implemented during construction, and all personnel will be made aware of the requirements contained within;
- Plant and machinery will be inspected upon arrival and departure from the site and cleaned/washed as necessary to prevent the spread of invasive aquatic/ riparian species such as Japanese knotweed *Fallopia japonica* and Himalayan Balsam *Impatiens glandulifera*. A sign off sheet will be maintained by the contractor to confirm the implementation of measures;
- Site hygiene signage will be erected in relation to the management of non-native invasive material.

17.0 Waste Management

All waste products (general waste, plastic, timber, etc.) arising during the construction phase will be managed and disposed of in accordance with the provisions of the Waste Management Act 1996 and associated amendments and regulations, and a Waste Management Plan will be prepared by the contractor before the commencement of construction. All waste material will be disposed of at a fully licensed facility.

18.0 Archaeology

The following are the mitigation measures which will be carried out during construction where required;

- Any specific mitigation measures outlined in the Cultural Heritage Report will be adopted.
- If required a project archaeologist will be appointed to oversee the project.
- Demarcation of protective buffer zones around cultural heritage sites where there is a potential for disturbance during the construction phase and inclusion of the same in site induction.

19.0 Programme

Estimates for the duration of the construction works are included in the table below. Please note that some of the elements are likely to happen concurrently, therefore the overall start-to-finish duration is estimated to be twelve months.

Table 5: Estimated Construction Duration	
Development Element	Estimated Construction Duration
Cahermurphy West 110kV Substation	18 months
110kV UGC Cable route	12 months
Horizontal Directional Drilling	3 months

Table 3 - Estimated Construction Duration