Appendix 2-5 Grid Connection Construction Methodology (TLI)

Construction Methodology

Scart Mountain Wind Farm 110 kV Grid Connection

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List of Abbreviations

Abbreviation	Definition
ABP	An Bord Pleanála (*The Planning Board*)
AIS	Air Insulated Switchgear
BPO	Best Performing Option
CEMP	Construction Environmental Management Plan
EBPO	Emerging Best Performing Option
ECC	Earth Continuity Conductor
ECoW	Ecological Clerk of Works
EIA(R)	Environmental Impact Assessment (Report)
ESBN	Electricity Supply Board Networks
GIS	Gas Insulated Switchgear
GNI	Gas Networks Ireland
GPR	Ground Penetrating Radar
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
HV	High Voltage
IFI	Inland Fisheries Ireland
JB	Joint Bay
MCA	Multi Criteria Assessment
OPW	Office of Public Works
TII	Transport Infrastructure Ireland
TMP	Traffic Management Plan
UGC	Underground Cable
XLPE	Cross-Linked Polyethylene

1 Introduction

1.1 Background

TLI Group ("the Consultant") were engaged by Tobin Consulting Engineers ("the Client") to identify and analyse potential 110 kV grid connection options available for the Scart Mountain Wind Farm Project, which is currently being developed by FuturEnergy Ireland ("the Developer") and will connect to the grid at Dungarvan 110 kV Substation. This project will have an estimated Maximum Export Capacity (MEC) of 67 MW.

1.2 Purpose of this Document

The purpose of this document is to outline and explain the construction techniques and methodologies which will be implemented during construction of the Scart Mountain Wind Farm grid connection to the existing ESB Dungarvan 110 kV Substation. The grid connection will consist entirely of underground cabling (UGC) with the majority of the UGC to be installed within the public road network.

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 cables and 1 no. earth continuity conductor (ECC). The fibre communications cable will allow communications between the proposed Scart Mountain Wind Farm 110 kV Substation and Dungarvan 110 kV Substation.

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 and drawings 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 Proposed Grid Connection Route Summary

The UGC route is approximately 15.5 km in length and will traverse in a south-easterly direction from the proposed Scart Mountain Wind Farm 110 kV Substation to the existing Dungarvan 110 kV Substation with the majority of the cable route situated in the public road network.

The UGC begins by exiting the Scart Mountain 110 kV Substation, located at approximately 4.5 km northeast of Cappoquin. The cable exits under the northern boundary of the substation, travelling east through Coillte lands to reach the L-5056 public road.

The route continues in a south-westerly direction from the townland of Newtown to Scart (Hely) along the L-5056. The route continues south along the R-671 regional road southward for approximately 300 metres before turning on to the L-1032 local road to Modelligo where an undercrossing of the Finisk River is required by means of horizontal directional drilling (HDD). From here, the route continues along the L-5065 local road as far as Colliganmountain to the R-762 regional road.

The route continues south on the R-672 for approximately 1.8 km before turning north on to the L-5103 local road. About 250 metres along this local road, the route enters Coillte lands to under cross the Colligan River by means of HDD. On the eastern side of the Colligan River, the route must cross about 130 metres of private lands before entering the Coillte forestry tracks in Inchindrislawood before reaching the L-3003 local road. The route continues along the L-3003 and L-7001 local roads before joining the N72 national secondary road to access Dungarvan 110 kV Substation's southern road entrance.

The exact location of the UGC within the curtilage of the existing roads, access tracks and private lands may be subject to minor modification following confirmatory site investigations to be undertaken prior to construction. The cable location will take into consideration all other relevant stakeholders' requirements. Installation of the cable will consider all environmental protection measures forming part of the planning application for the development at Scart Mountain Wind Farm and accompanying technical reports.

2.1 Grid Route Overall Location

The overall location of the grid connection route, the Scart Mountain Wind Farm boundary and Dungarvan 110 kV Substation are shown in Figure 2.1 below.

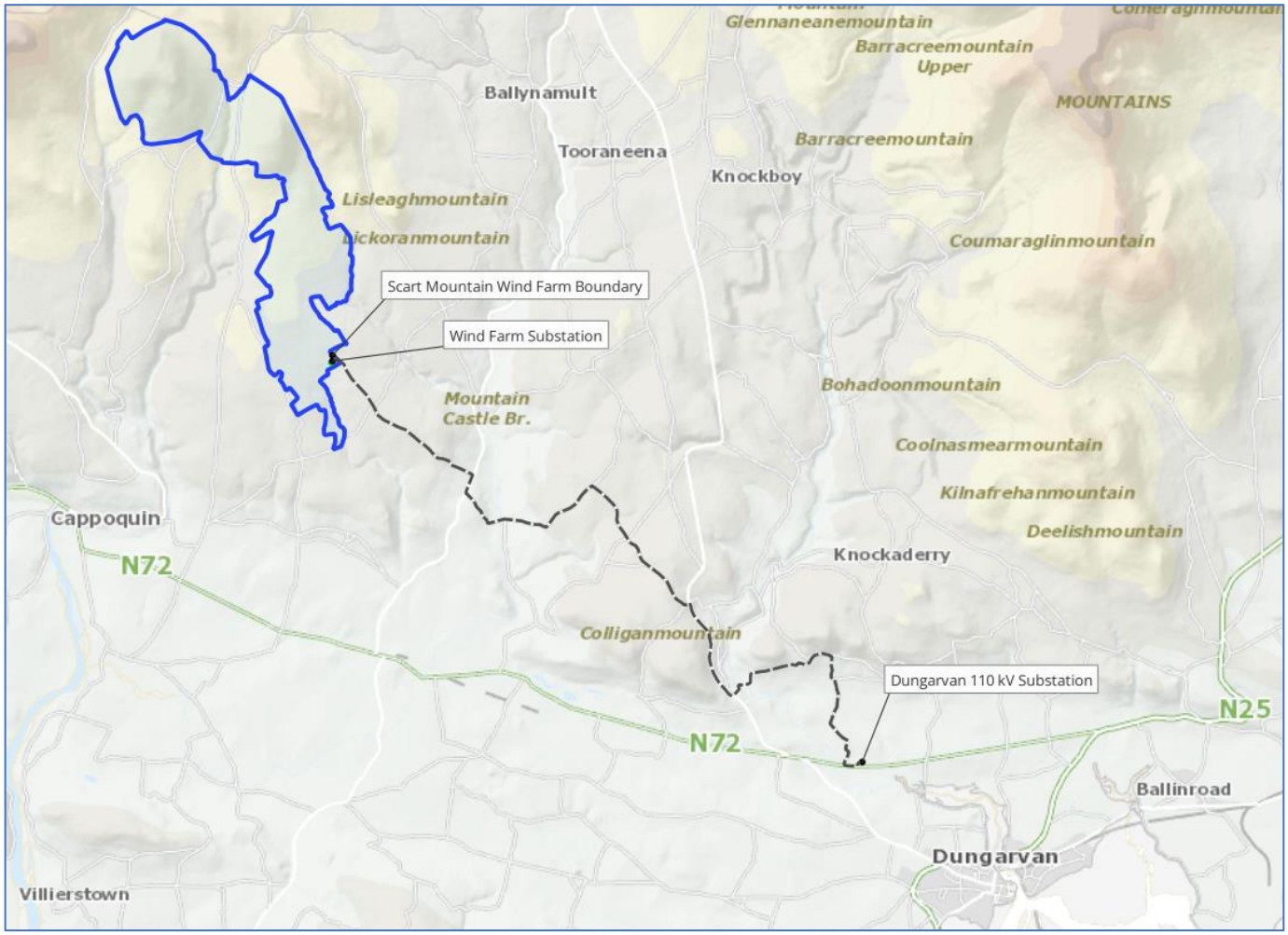

Figure 2.1: Map Indicating overall location of Scart Mountain Wind Farm and Grid Connection Route

2.2 Grid Route Summary

Table 2.1 below gives a summary of the grid connection route's location regarding public road network road types and private land ownership.

Description	Route Length
National Roads	0.2 km
Regional Roads	2.2 km
Local Primary Roads	1.2 km
Local Secondary Roads	9.7 km
Total Road Network	**13.3 km**
Coillte Lands	1.7 km
Private Lands	0.5 km
Total Off Road Network	**2.2 km**
Total Route Length	**15.5 km**

Table 2.1: Grid Connection Route Summary

2.3 Section-by-Section Summary

As an aid to understanding, the grid route has been broken into nine shorter sections as shown Table 2.2 below. Each of these route sections is described in further detail in the Sections 2.3.1 to 2.3.8 below.

Ref	Section Description	Route Length
Section 1	Wind Farm Substation joining to L-5056 from Newtown to Scart (Hely) junction with R-671	3.2 km
Section 2	Short section of R-671 from junctions of L-5056 and L-1032	0.3 km
Section 3	L-1032 and L-5056 through Modelligo to junction with L-5067 in Lisroe	2.8 km
Section 4	L-5056 from Lisroe to junction with R-672 at Colliganmountain	2.8 km
Section 5	R-672 from Colliganmountain to junction with L-5103	1.9 km
Section 6	From L-5103 junction entering Coillte lands to undercross Colligan River into private lands	0.6 km
Section 7	Coillte lands in Inchindrislawood to entrance on L-3003	1.2 km
Section 8	From Coillte entrance on L-3003, continuing on L-7001 to Killadangan and joining short section of N72 to entrance of Dungarvan 110 kV Substation	2.7 km
Total		**15.5 km**

Table 2.2: Grid Connection Route Section Summary

2.3.1 Route Section 1 Summary (Chainage 0 m to 3,200 m)

This grid connection route begins within the proposed Scart Mountain Wind Farm 110 kV Substation and exits under the fence following an existing Coillte forestry track to join the L-5056 local road. The grid connection route follows the L-5056 from Newtown to the R-671 junction in Scart (Hely).

Features:

No watercourses are encountered on this section.

The route crosses through the zone of notification for National Monuments Service (NMS) Sites and Monument Record (SMR) number WA022-011----. Please refer to the archaeological assessments which accompany this report for full details.

Joint Bay 01 (JB-01) will be located approx. at chainage mark 640 m on this section. It is proposed that this Joint Bay will be installed within the L-5056 local road.

Joint Bay 02 (JB-02) will be located approx. at chainage mark 1400 m on this section. It is proposed that this Joint Bay will be installed within the L-5056 local road.

Joint Bay 03 (JB-03) will be located approx. at chainage mark 2170 m on this section. It is proposed that this Joint Bay will be installed within the L-5056 local road.

Joint Bay 04 (JB-05) will be located approx. at chainage mark 2900 m on this section. It is proposed that this Joint Bay will be installed within the L-5056 local road.

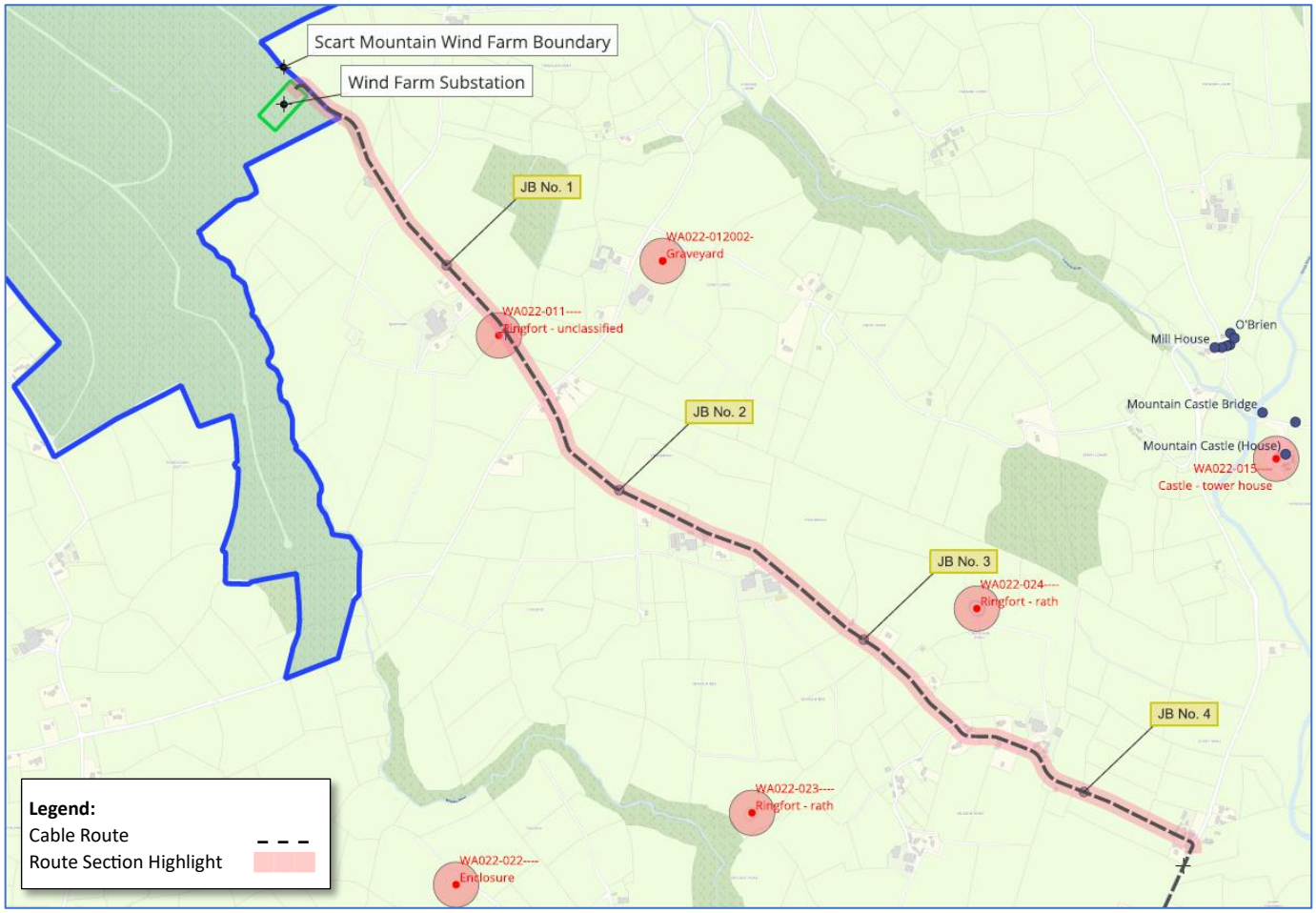

Figure 2.2: Route Section 1 Location Map

2.3.2 Route Section 2 Summary (Chainage 3200 m to 3550 m)

This section of the grid connection route follows the R-671 regional road from the junction of the L-5056 to the L-1032 in the townland of Scart (Hely).

Features:

One watercourse is encountered on this section of the grid connection route and will be undercrossed by means of horizonal directional drilling (HDD) under the culverted stream.

This section will contain no joint bays.

Figure 2.3: Route Section 2 Location Map

2.3.3 Route Section 3 Summary (Chainage 3550 m to 6350 m)

This section of the grid connection route follows the L-5065 local road from the junction of the R-671 in the townland of Scart (Hely) to the T-junction in Lisroe.

Features:

One major watercourse, the Finisk River, is encountered on this section of the grid connection route and will be undercrossed by means of horizonal directional drilling (HDD) under the Modelligo Bridge and Finisk River.

The route crosses through the zone of notification for National Monuments Service (NMS) Sites and Monument Record (SMR) numbers WA022-026001- and WA022-026002-. Please refer to the archaeological assessments which accompany this application for full details.

Joint Bay 05 (JB-05) will be located approx. at chainage mark 3640 m on this section. It is proposed that this Joint Bay will be installed within the L-1032 local road.

Joint Bay 06 (JB-06) will be located approx. at chainage mark 4370 m on this section. It is proposed that this Joint Bay will be installed within the L-1032 local road.

Joint Bay 07 (JB-07) will be located approx. at chainage mark 5090 m on this section. It is proposed that this Joint Bay will be installed within the L-5065 local road.

Joint Bay 08 (JB-08) will be located approx. at chainage mark 5860 m on this section. It is proposed that this Joint Bay will be installed within the L-5065 local road.

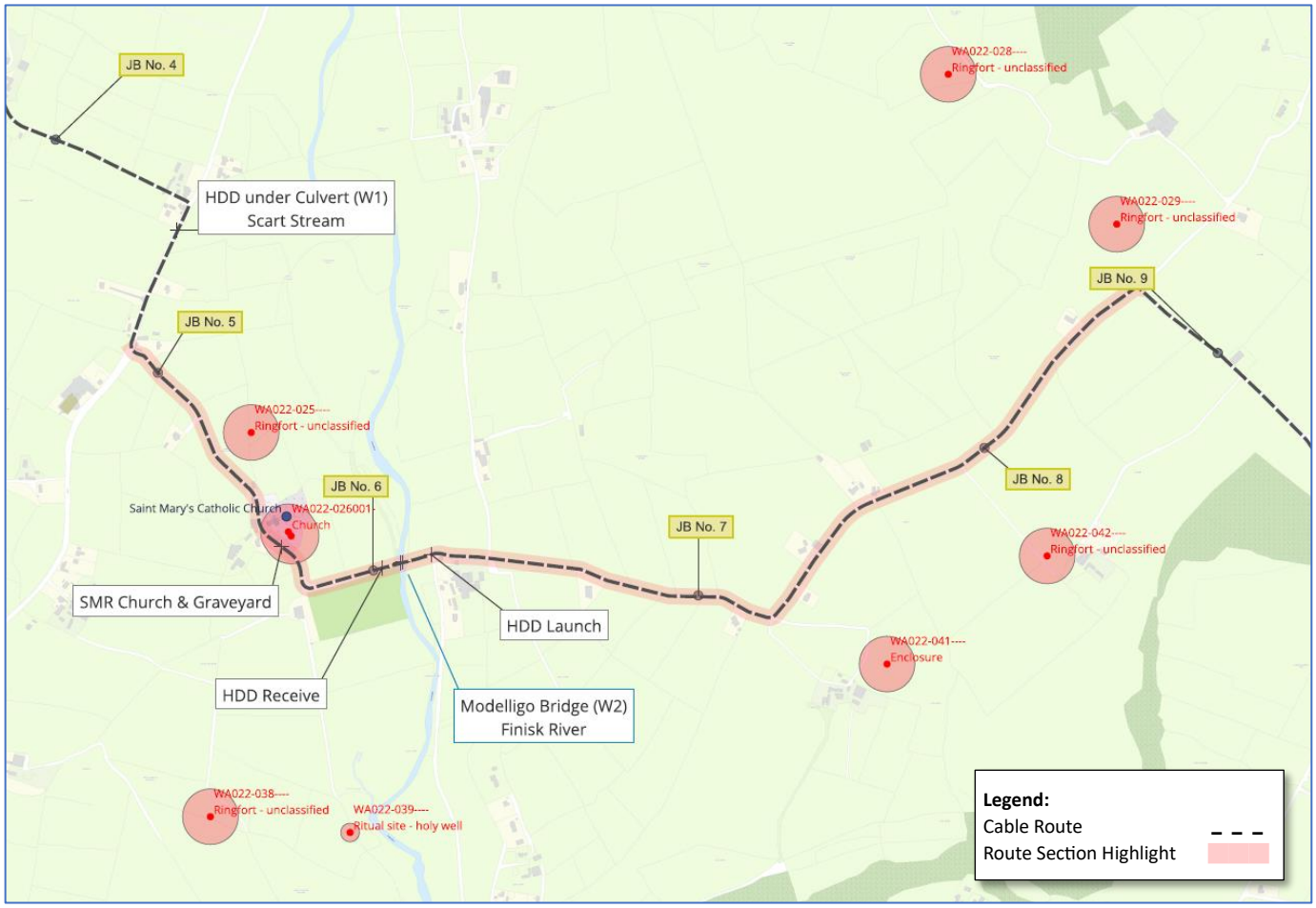

Figure 2.4: Route Section 3 Location Map

2.3.4 Route Section 4 Summary (Chainage 6350 m to 9120 m)

This section of the grid connection route follows the L-5065 local road from the T-junction in Lisroe to the junction with the R-672 in the townland of Colliganmountain.

Features:

One watercourse, the Ballykerrin Middle Stream is encountered on this section of the grid connection route and will be undercrossed by means of horizonal directional drilling (HDD).

Joint Bay 09 (JB-09) will be located approx. at chainage mark 6570 m on this section. It is proposed that this Joint Bay will be installed within the L-5065 local road.

Joint Bay 10 (JB-10) will be located approx. at chainage mark 7350 m on this section. It is proposed that this Joint Bay will be installed within the L-5065 local road.

Joint Bay 11 (JB-11) will be located approx. at chainage mark 8140 m on this section. It is proposed that this Joint Bay will be installed within the L-5065 local road.

Joint Bay 12 (JB-12) will be located approx. at chainage mark 8930 m on this section. It is proposed that this Joint Bay will be installed within the L-5065 local road.

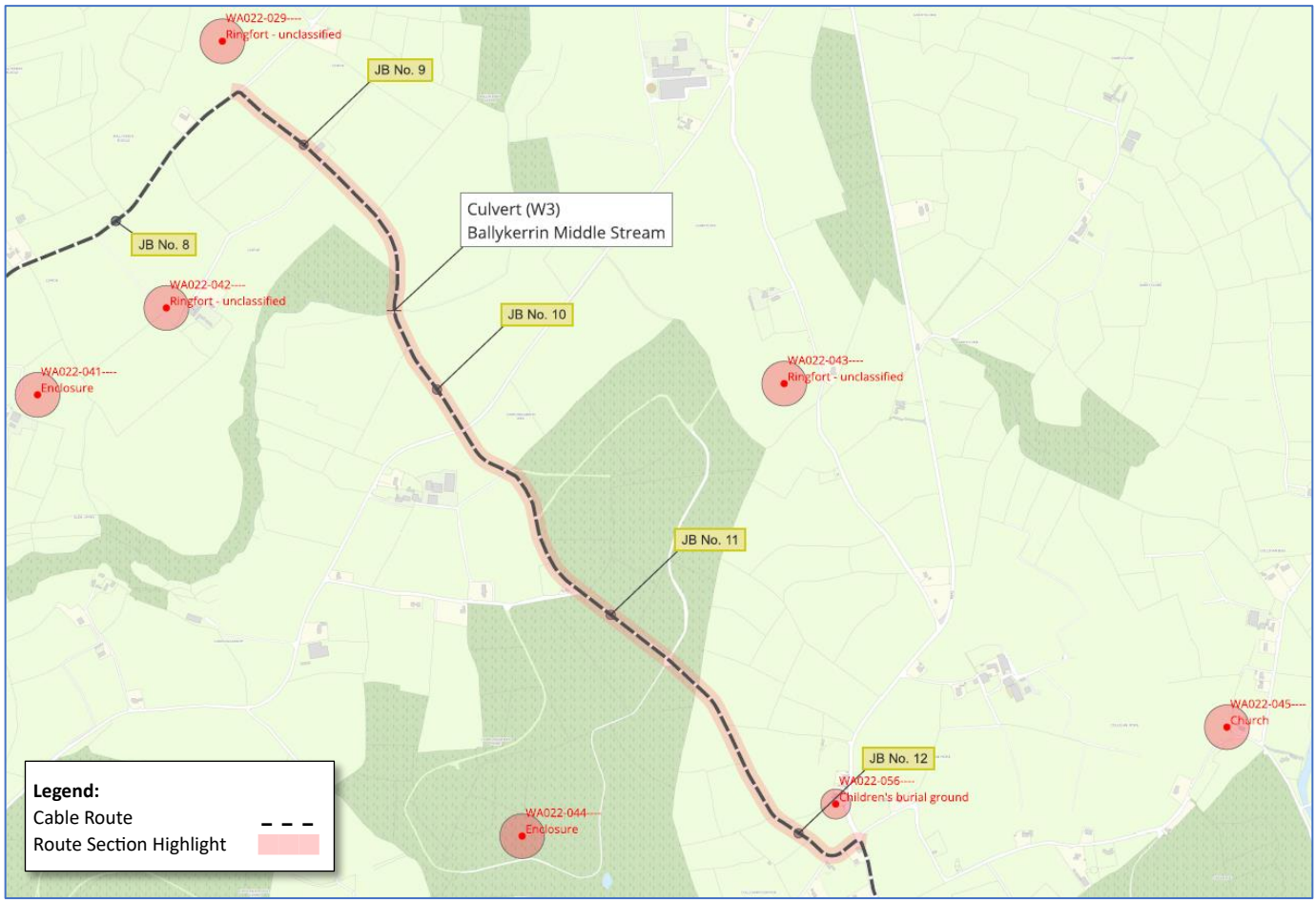

Figure 2.5: Route Section 4 Location Map

2.3.5 Route Section 5 Summary (Chainage 9120 m to 10970 m)

This section of the grid connection route follows the R-672 regional road from junction with the L-5065 in Colliganmountain to the junction with the L-5103 in the townland of Colliganwood where the route enters private lands.

Features:

Joint Bay 13 (JB-13) will be located approx. at chainage mark 9720 m on this section. It is proposed that this Joint Bay will be installed within the R-672 regional road.

Joint Bay 14 (JB-14) will be located approx. at chainage mark 10330 m on this section. It is proposed that this Joint Bay will be installed within the R-672 regional road.

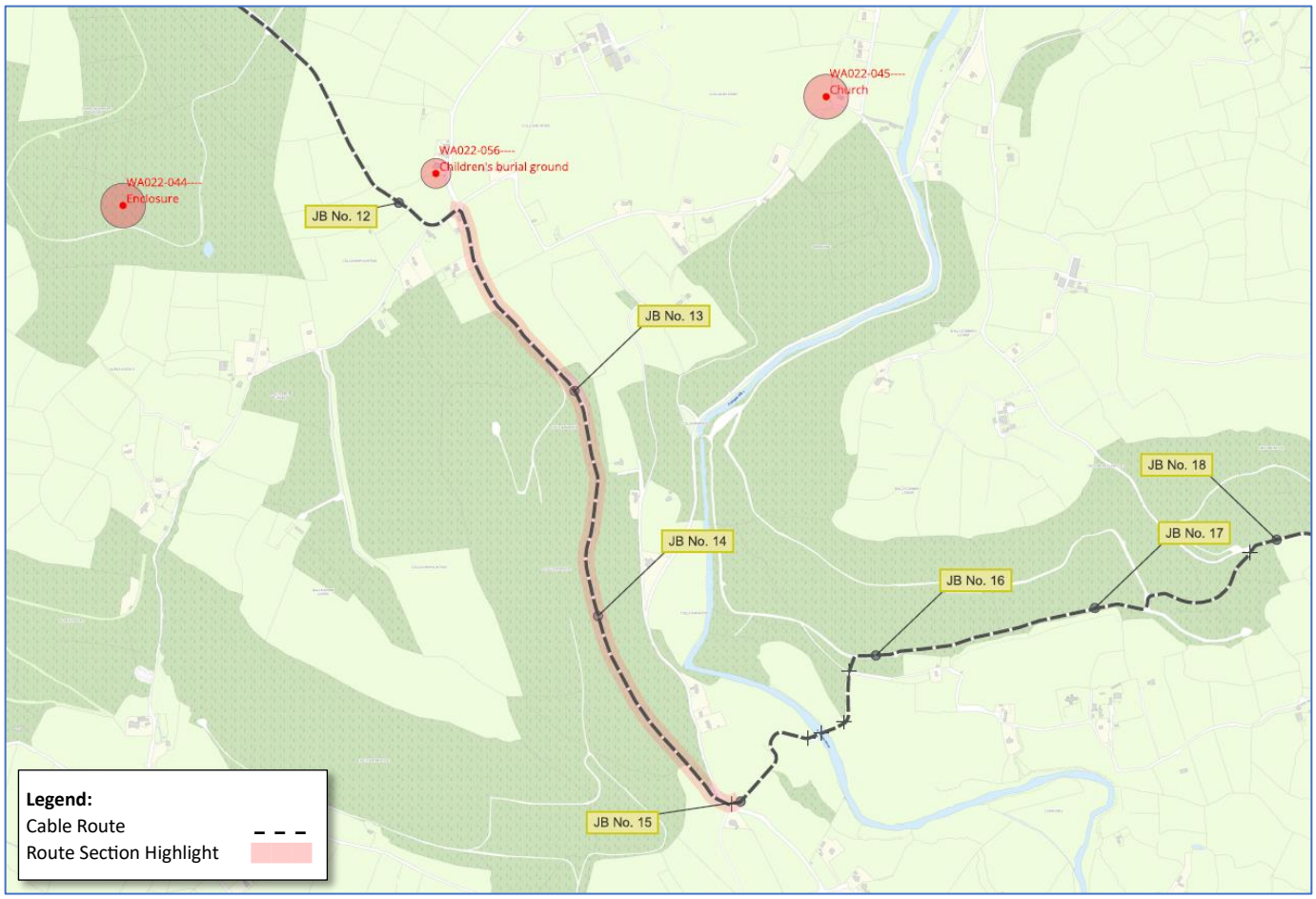

Figure 2.6: Route Section 5 Location Map

2.3.6 Route Section 6 Summary (Chainage 10970 m to 11560 m)

This section of the grid connection route is within private lands to achieve a crossing of the Colligan River. From the R672, the route follows an existing access track to the launch area for a HDD undercrossing of the Colligan River. The reception area for this HDD will be situated in private lands on the eastern bank of this river to allow a drilled undercrossing of the river. Within the private lands on the eastern side of the river, the route continues in a new access track to the Coillte lands in the townland of Inchindrislawood.

Features:

One major watercourse, the Colligan River, is encountered on this section of the grid connection route and will be undercrossed by means of horizonal directional drilling (HDD).

Joint Bay 15 (JB-15) will be located approx. at chainage mark 10990 m on this section. It is proposed that this Joint Bay will be installed within private lands just off the R-672 regional road.

Figure 2.7: Route Section 6 Location Map

2.3.7 Route Section 7 Summary (Chainage 11560 m to 12800 m)

This section of the grid connection route follows existing forestry tracks within Coillte lands in the townland of Inchindrislawood as far the L-3003 local road.

Features:

Joint Bay 16 (JB-16) will be located approx. at chainage mark 11660 m on this section. It is proposed that this Joint Bay will be installed within the forestry track in Coillte lands .

Joint Bay 17 (JB-17) will be located approx. at chainage mark 12260 m on this section. It is proposed that this Joint Bay will be installed within the forestry track in Coillte lands.

Figure 2.8: Route Section 7 Location Map

2.3.8 Route Section 8 Summary (Chainage 12800 m to 15500 m)

This section of the grid connection route follows the L-3003 local road from junction entrance of the Coillte lands in the townland of Inchindrislawood as far as the junction with the L-7001 local road. From here the route follows the L-7001 in a southerly direction. A short section of the N72 road is required at to arrive at the entrance of Dungarvan 110 kV Substation.

Features:

Joint Bay 18 (JB-18) will be located approx. at chainage mark 12860 m on this section. It is proposed that this Joint Bay will be installed within the L-3003 local road.

Joint Bay 19 (JB-19) will be located approx. at chainage mark 13470 m on this section. It is proposed that this Joint Bay will be installed within the L-7001 local road.

Joint Bay 20 (JB-20) will be located approx. at chainage mark 14050 m on this section. It is proposed that this Joint Bay will be installed within the L-7001 local road.

Joint Bay 21 (JB-21) will be located approx. at chainage mark 14680 m on this section. It is proposed that this Joint Bay will be installed within the L-7001 local road.

Joint Bay 22 (JB-22) will be located approx. at chainage mark 15220 m on this section. It is proposed that this Joint Bay will be installed within the L-7001 local road.

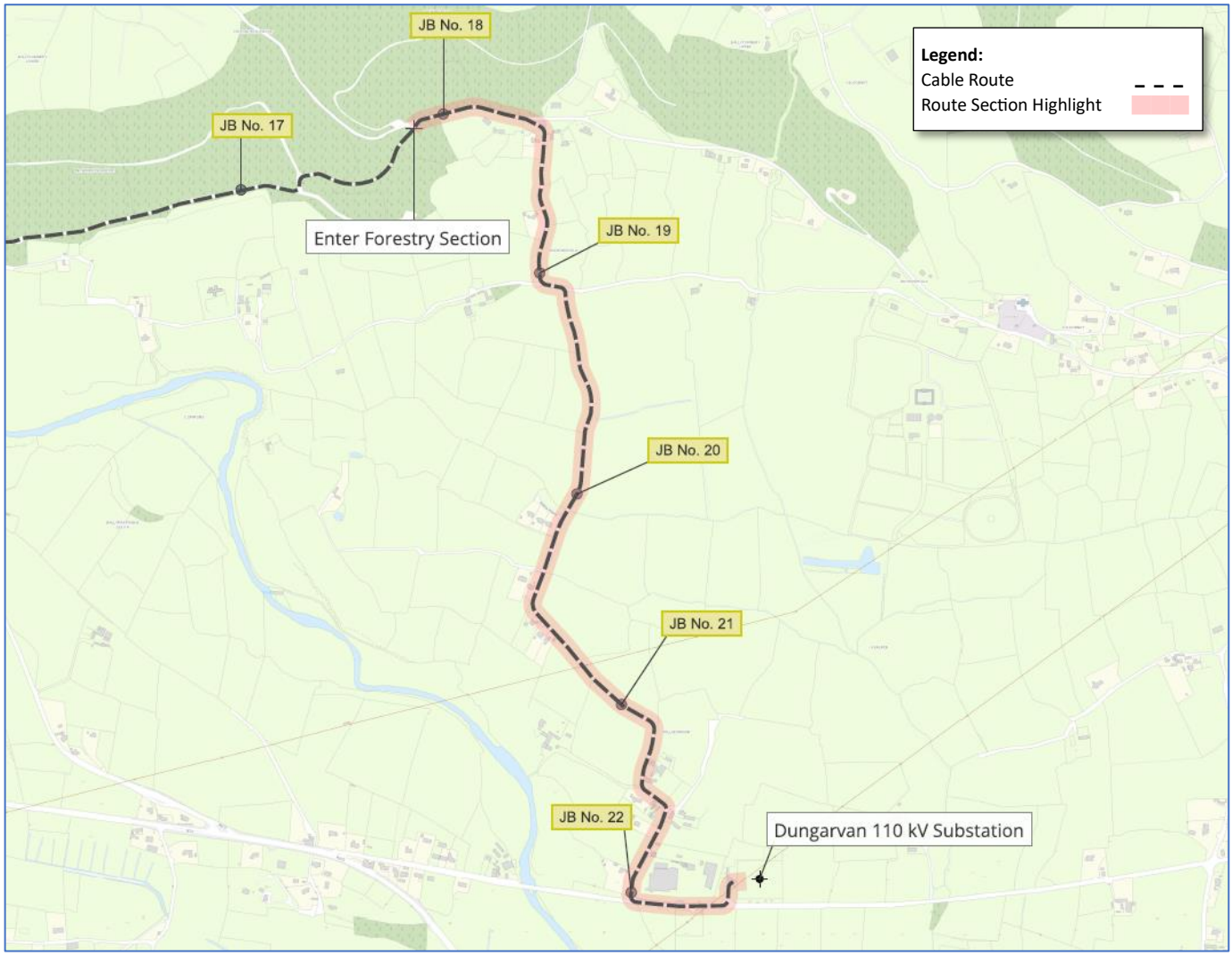

Figure 2.9: Route Section 8 Location Map

3 Preliminary Site Investigations

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

The following items may be carried out for the grid connection cable route:

- Slit trenches at locations of service crossings. (Full Road/track width).
- Trial holes along the route to ascertain ground conditions and thermal resistivity of the soil.
- Trial holes at any potential joint bay positions to ascertain ground conditions and thermal resistivity of the soil.

Traffic Management: No known traffic management requirements

Equipment:

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

4 Access Routes to Work Area

Most of the underground cable route will be installed within the public road network Where the cable route is located on private lands, contractor(s) will be required to utilise the private access roads, where appropriate as agreed.

A Traffic Management Plan (TMP) will be prepared and agreed with the various stakeholders who have a wayleave agreement along the affected construction area, 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 Waterford City and 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.

5 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 Waterford City and County Council. All work on public roads will be subject to the approval of a road opening license application by Waterford City and 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 metre sections, and no more than 100 metres will be excavated without most 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. Any traffic signals required 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 EIAR and will be incorporated into a detailed Traffic Management Plan to be prepared, in consultation with Waterford City and County Council prior to the commencement of UGC construction.

6 Road Opening Licence

The UG grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-15 from both Waterford City and County Council. A Traffic Management Plan (TMP) will be agreed with Waterford City and 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 Waterford City and County Council in advance of the preparation of the TMP.

7 Construction Hours

Standard working hours for construction will be 8:00 - 20:00 Monday to Friday, and 8:00 - 18:00 on Saturday (if required), with no works on Sundays or bank holidays except in exceptional circumstances or in the event of an emergency.

8 UGC Construction Methodology

The UGC will consist of 3 no. 160 mm diameter HDPE power cable ducts, 2 no. 125 mm diameter HDPE communications duct and a 63 mm Earth Continuity Conductor duct to be installed in an excavated trench between the proposed wind farm substation and existing Dungarvan 110 kV Substation. The standard trench is 825 mm wide, 1315 mm deep, with variations in this design to adapt to service crossings and watercourse crossings, etc., where applicable. The power cable ducts will accommodate one power cable per duct. The communications duct will accommodate a fibre cable to allow communications between the substations. The ducts will be installed, the trench reinstated in accordance with the private third-party landowners and Waterford City and County Council specifications. Once all are satisfied, then the electrical cabling/fibre cable is pulled through the installed ducts in up to approximately 700 to 900 m sections. Construction method statements and templates will be implemented to ensure that the UGC is installed in accordance with the correct requirements, materials, and specifications of ESBN and EirGrid.

8.1 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 EIAR and as required by planning conditions where relevant.
- All existing underground services along the UGC route shall be confirmed 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 EIAR, the detailed Construction Environmental Management Plan (CEMP) and best practice construction methodologies.
- Where the cable route intersects 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 ESBN and Uisce Éireann specifications.
- If culverts require removal for ducting installation, a suitable method of damming the water source and pumping the water around the work area will 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 (IFI) in advance of works.
- Traffic management measures will be implemented in accordance with those included in Section 14.1 of the EIAR, and a detailed Traffic Management Plan will be prepared and agreed with the local authority.
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2 m in height. Stockpiles will be located a minimum of 50 m 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 to the on-site borrow pit.

- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement.
- 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 100-metre section of trench will be opened at any one time. The second 100-metre section will only be excavated once most of the reinstatement has been completed on the first section.
- The excavation, installation and reinstatement process will take on average of two days to complete a 100-metre section.
- Where the cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together.
- Following the installation of ducting, pulling the cable will take approximately one day between each joint bay. The jointing of cables will take approximately 1 week per joint bay location.

Figure 8.1: Typical 110 kV Underground Duct Installation

8.2 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 1315 mm depth and 825 mm 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 cable 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 cable protection strips above the bottom row of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.
7. Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.

8. Place red cable 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 (Figure 8.2).
11. For unsurfaced/grass sections, backfill with suitable excavated material to ground level leaving at least 100 mm topsoil or match existing level at the top to allow for seeding or replace turves as per the specification of the local authority or landowner (Figure 8.3).
12. Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12 mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes in preparation for cable installation later. All the works should be witnessed by ESBN Clerk of Works (CoW) as required.

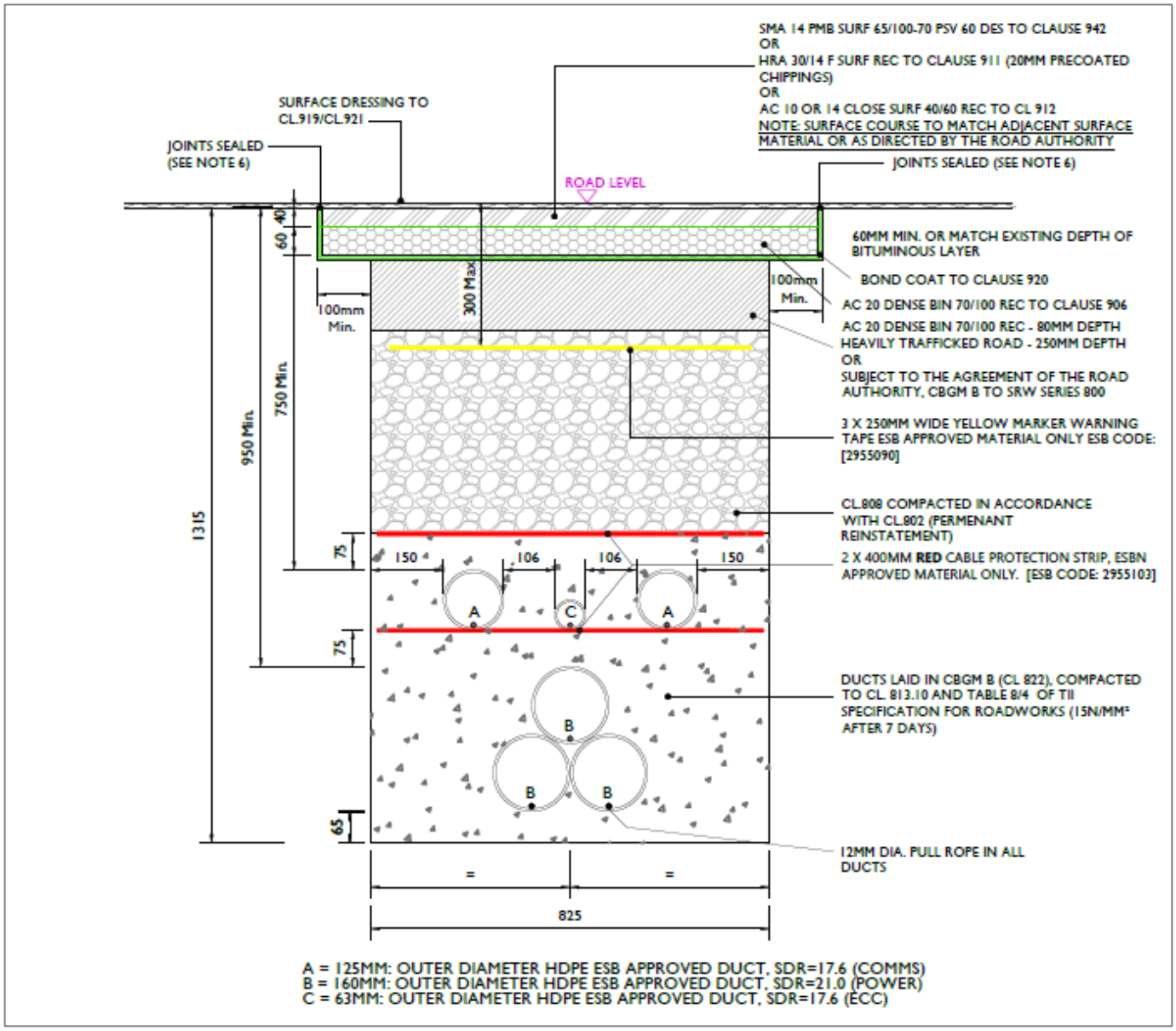

Figure 8.2: Typical Trench in Roadway

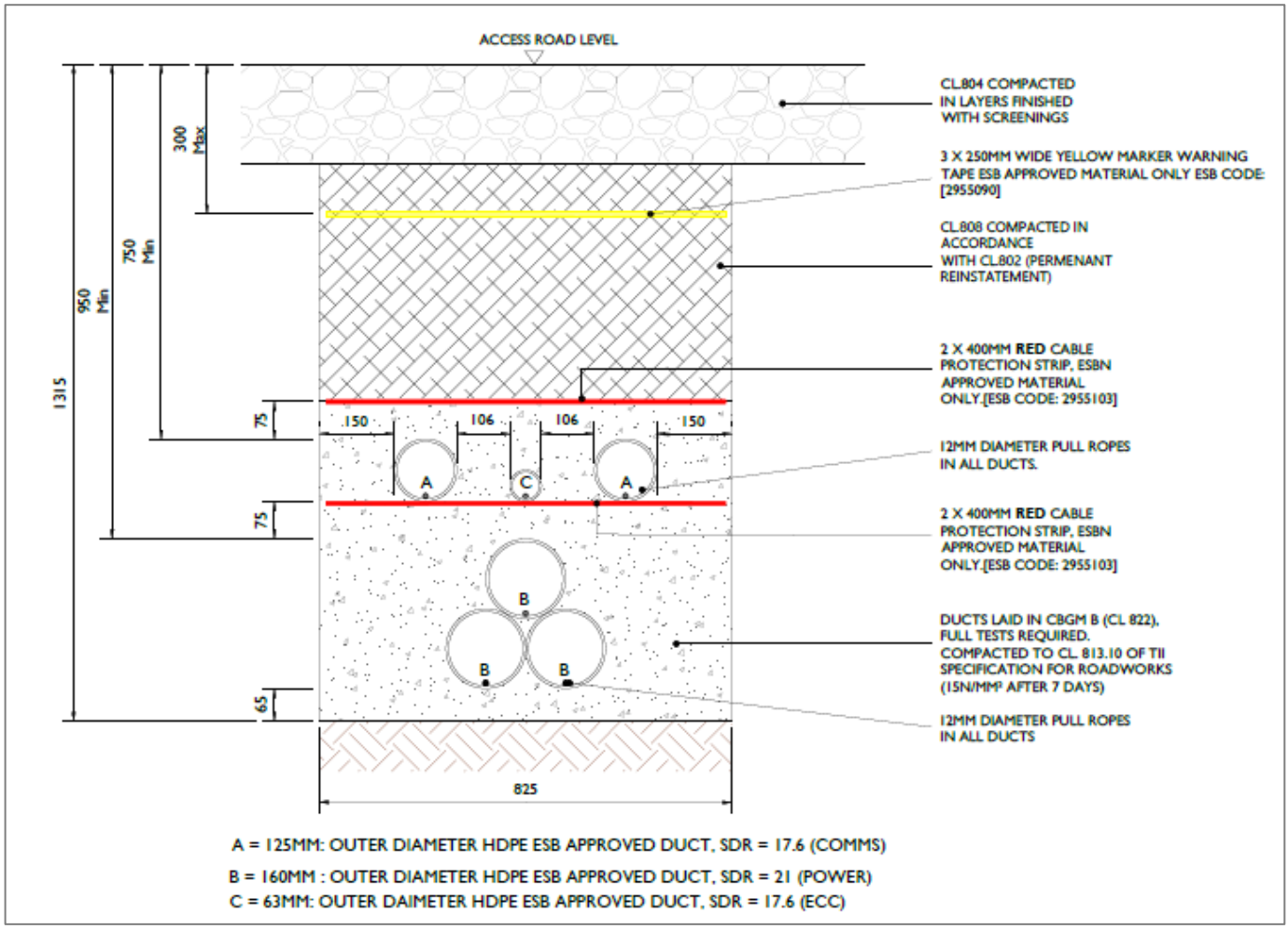

Figure 8.3: Typical Trench in Off-Road Section

Equipment:

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

Materials:

- Sand for pipe bedding.
- Ready-mix Concrete where necessary (delivered to site).
- Trench backfilling material (excavated material and aggregates) to relevant specifications.
- 160 mm & 125 mm diameter HDPE ducting.
- 63 mm diameter HDPE ducting.
- Temporary Surface Reinstatement Materials.

8.3 UGC Installation on Private Land

Where the cable is to be laid in previously green-field areas, the exact location of the cable trench will depend on several factors such as width of track, bends along the track and crossings. Where the existing tracks need to be widened, stone will be brought in to build up the area to the same level of the existing track. The excess material from the track will be used elsewhere on reinstatement works or removed from site and disposed of at a licenced facility.

On existing private roads or access tracks, the cable trench will be installed in the non-trafficked strip between the wheel marks. The cable will be micro-sited based on the presence of exiting utilities and the nature of the road and the adjoining terrain.

8.4 Cable Pulling

Once the ducting is installed the electrical cables (situated on a drum) are pulled through the ducting by a specialised mechanical winch. The winch will also monitor the tension on the cables being pulled so as not to damage the cables. A guide rope is installed with the ducting to assist in the cable pulling process. The guide rope also is used for proving the ducts by attaching a mandrel, a sponge or brush, for cleaning the duct installed. Cable lubricant is applied to the outside of the cables being pulled through the duct. The lubricant assists in the pulling process by removing friction between the cable and the rollers. This not only speeds up the process but also prevents snagging and therefore damage to the cable.

8.5 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 ESBN 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 700 mm 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 ESBN as part of the detailed design process (Figure 8.4).

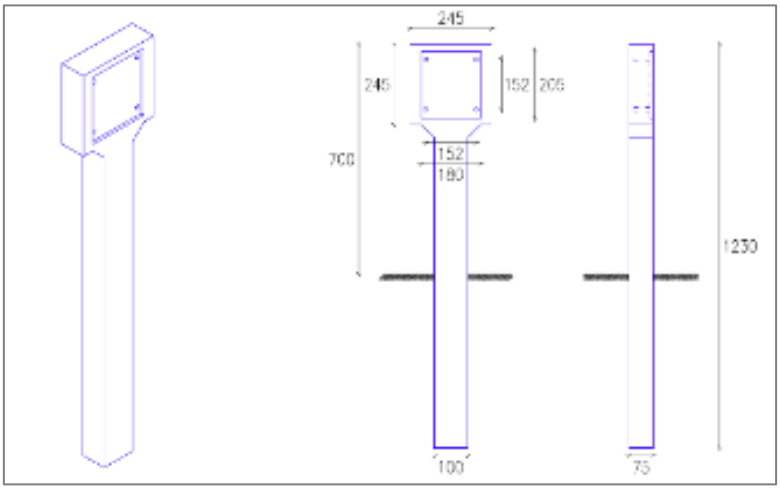

Figure 8.4: Typical ESB Marker Post Example

8.6 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 2 m in height. Where excess material exists, it may be used in the reinstatement of the borrow pit as part of the proposed 110 kV substation. 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.

8.7 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 compound to be located nearby to the proposed wind farm substation. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds.

8.8 Joint Bays and Associated Chambers

Joints bays are to be installed approximately every 700 m – 900 m along the UGC route to facilitate the jointing of two lengths of underground cable. Joint bays are typically 2.6 m x 6 m x 1.75 m pre-cast concrete structures installed below finished ground level (Figure 8.5). Where possible joint bays will be in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this will not always be possible.

In association with joint bays, communication chambers are required at every joint bay location to facilitate communication links between the proposed 110 kV wind farm substation and the existing 110 kV node at Dungarvan 110 kV Substation. 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 approval by ESBN/EirGrid. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions. The marker posts will consist of a corrosion-proof aluminium triangular danger sign, with a 750 mm base, and with a centred lightning symbol, on engineering grade fluorescent yellow background. They will be installed inadequately sized concrete foundations and will also be placed where the cable has not been buried to the standard depth, due to existing road conditions. Drawings of the joint bays and communication chambers are included within this planning package.

Equipment:

- 360° tracked excavator (wheeled excavator where required)
- 1 no. tracked dumper or tractor and trailer

Materials:

- Sand for pipe bedding
- Ready-mix Concrete where necessary (delivered to site)
- Trench backfilling material (excavated material and aggregates) to relevant specifications
- Precast Chamber Units / Construction materials for chambers
- Cable ducting

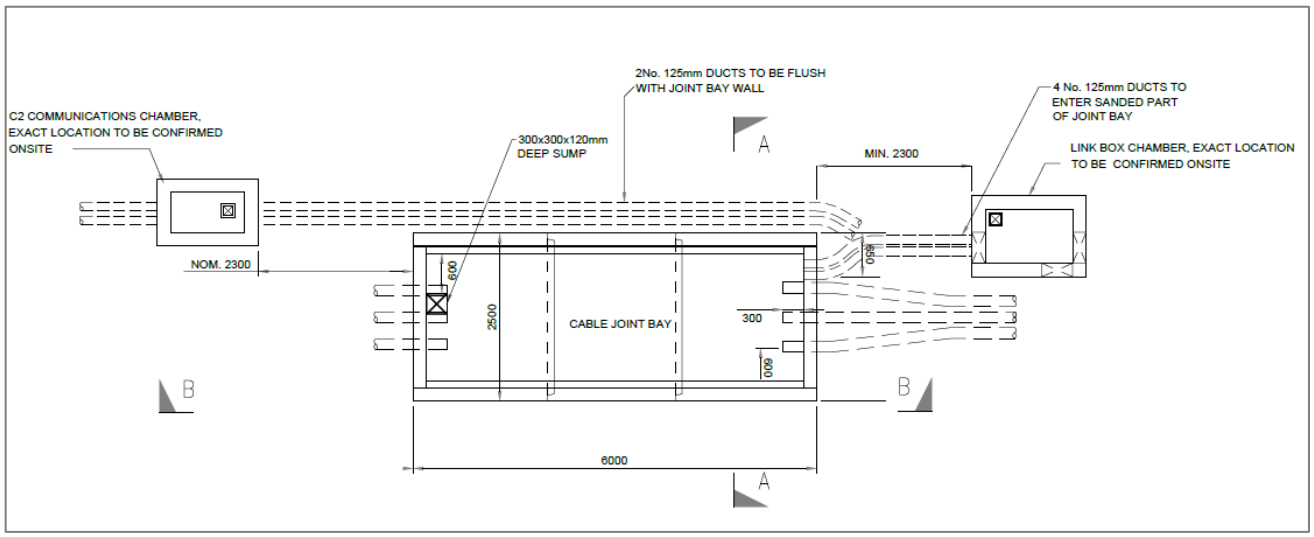

Figure 8.5: Typical Joint Bay and Link Box Plan Layout

8.9 Joint Bay Construction and Cable Installation

Before starting construction, the area around the edge of the joint bay which will be used by heavy vehicles will be surfaced with a geo-composite cover (Terram® or similar) if required and stone aggregate to minimise ground damage. Any roadside drains within the temporary works area will be culverted and check dams made from stone or geo-composite covered sandbags 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 15 m 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 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 bay 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 sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.

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 75 mm depth of blinding concrete (for in situ construction) or 50 mm thick sand (for pre-cast concrete construction) on 200 mm thick Clause 804 granular material.
3. In situ construction. Construct 200 mm thick reinforced concrete floor slab with sump and starter bars placed for walls as detailed on the drawings.
4. In situ construction. Construct 200 mm thick reinforced concrete sidewalls as detailed on the drawings. (Figure 8.6)

Figure 8.6: Typical Joint Bay under Construction (In Situ)

5. In situ construction. Remove formwork and backfill with suitable backfill material in grassed areas or Clause 804 material once ducting has been placed in the bay. Backfill externally with granular material to local authority/TII Specification for Roadworks. (Figure 8.7)

Figure 8.7: Completed Joint Bay prior to Cable Installation (in-situ)

6. Pre-cast concrete construction. Place pre-cast concrete sections on sand bedding. (Figure 8.8)

Figure 8.8: Typical Joint Bay under Construction (Pre-Cast)

7. 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.
8. 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.
9. Later, 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.
10. The cable is supplied in pre-ordered lengths on large cable drums (Figure 8.9). Installing “one section” of cable normally involves pulling three individual conductors into three separate ducts. The cable pulling winch must be set at a predetermined cut off pulling tension as specified by the designer. The cable will be connected to the winch rope using approved suitably sized and rated cable pulling stocking and swivel or the pulling head fitted by the cable manufacturer. A sponge may also be secured to the winch rope to disperse lubricant through the duct. Lubrication is also applied to the cable in the joint bay before it enters the duct.

Figure 8.9: HV Cable Pulling Procedure (Typical Drum Setup)

11. Once the two sections of cable (total of 6 conductors) 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. (Figure 8.10)

Figure 8.10: HV Cable Jointing Container

12. Following the completion of jointing and duct sealing works in the joint bay, 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 400 mm depth below finished surface.

Equipment:

- 2-3 General Operatives
- 1 Excavator Operator
- 360° tracked excavator (13-ton normal operations, 22-ton for rock breaking applications)
- 1 no. tracked dumper or tractor and trailer

Materials:

- Sand for pipe bedding
- Blinding Concrete where necessary
- Clause 804 Material
- 160 mm diameter HDPE ducting

- 125 mm diameter HDPE ducting
- 63 mm diameter HDPE ducting
- Precast Chamber Units / Relevant construction materials for chambers
- Earth Sheath Link Box

8.10 Horizontal Directional Drilling

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles such as bridges, railways or watercourses 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 are several bridges and culverts on both UGC route options which will require HDD due to there being insufficient cover and depth in the bridge to cross within the bridge deck.

Detailed site investigation works will be completed at each of the HDD locations to confirm ground conditions at detailed design stage. This information will be obtained by completing boreholes at each location, the results from the borehole data will be used to design the HDD and crossing depths. A bespoke design will be prepared for each HDD crossing by a specialist drilling contractor. Each individual HDD design will be subject to prior EirGrid review and approval. As part of each HDD design, an Outline Frac-Out Mitigation Plan will be prepared by the contractor which will detail the measures which will be implemented to prevent, contain, control and stop any frac-out.

The drilling methodology is as follows:

1. A works area of circa. 40m² will be fenced on both sides of the river crossing,
2. The drilling rig and fluid handling units will be located on one side of the bridge and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
3. Entry and exit pits (1m x 1m x 2m) 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.
4. A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.
5. The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the watercourse.
6. A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
7. The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
8. Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side.
9. Once all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
10. The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
11. The ducts will be cleaned and proven, and their installed location surveyed.
12. The entry and exit pits will be reinstated to the specification of ESB Networks and Waterford City and County Council.
13. A transition coupler or transition chamber will be installed at either side of the obstacles following the horizontal directional drilling as per EirGrid requirements, this will join the HDD ducts to the standard ducts.

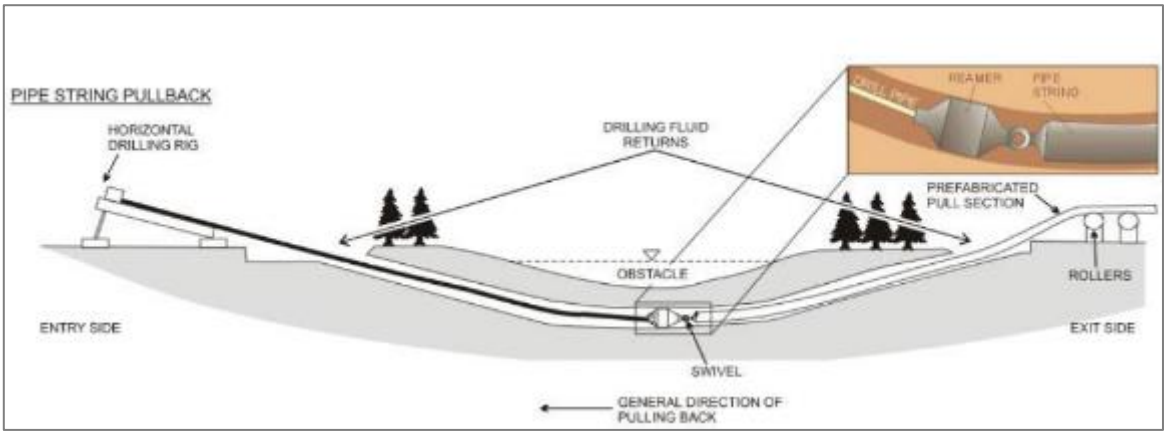

Figure 8.11: Illustration of HDD Installation

8.11 Watercourse Damming and Reinstatement Methodology

If sections of trenching and ducting would involve instream works at culvert crossing locations in order to install cabling. To facilitate the works, these watercourses will be dammed, and the water diverted over or around the works using either a flume pipe or a diversion channel. Following the completion of works at the watercourse, the dam will be removed, and the watercourse reinstated. These works would require pre-planning engagement with Inland Fisheries Ireland to agree environmental controls required.

Duration: 1-2 Days per location

Personnel, Machinery & Equipment:

- 2-3 operatives
- Wheeled dumper or track dumper (6 to 8 tons)
- 360° tracked excavator
- Materials:
- Pipe culvert
- Box culvert
- Cable ducting and trenching backfill
- Sandbags
- Water pump
- Geotextile membrane
- Straw bales

8.11.1 Standard Methods- Dam & Flume Work:

1. The flume pipe(s) will be set out on the bed of the existing stream.
2. A dam will be constructed using sandbags and suitable clay material around the flume pipe(s) and across the stream so that all the flows are diverted through the pipe(s).
3. Silt traps, such as geotextile membrane, straw bales etc. will be placed downstream of the in-stream trenching location prior to construction, to minimise silt loss.
4. The ducting installation works will be carried out in the dry stream bed and under/around the flume pipe(s). If required, a temporary sump will be established and used to collect any additional water. This water will be removed by pumping to a percolation area if the soil is not saturated, otherwise a settlement tank will be used to remove any solids from the de-watering.

8.11.2 Standard Methods- Dam & Divert Work

1. A suitable channel for the stream will be excavated adjacent to the original channel. Bedding stone will be placed on the bed of the new channel.
2. A dam will be constructed using sandbags and suitable clay material across the stream so that the flow is diverted down the new channel.
3. Silt traps, such as geotextile membrane, straw bales etc. will be placed downstream of the in-river trenching location prior to construction, to minimise silt loss.
4. The trench will be excavated in the dry stream bed. If required, a temporary sump will be established and used to collect any additional water. This water will be removed by pumping to a percolation area if the soil is not saturated, otherwise a settlement tank will be used to remove any solids from the de-watering.

8.11.3 Standard Methods- Reinstatement of the Watercourse at Dam and Flume Locations

1. Following the completion of works, the stream bed will be reinstated with original or similar material and the spawning gravels replaced under the supervision of an aquatic ecologist.
2. Once the stream bed is appropriately re-instated the dam and the flume pipe(s) will be removed thus restoring the stream to its original condition.

8.11.4 Standard Methods- Reinstatement of the Watercourse at Dam and Divert Locations

1. Following the installation of the cable ducts, the stream bed will be reinstated with original or similar material and the spawning gravels replaced under the supervision of an aquatic ecologist.
2. Once the stream bed is appropriately reinstated, the dam will be removed thus restoring the stream to its original alignment.
3. The temporary channel will then be reinstated with the previously excavated material.

8.12 Replacement of Existing Culverts

Given the length of both route options presented in this report, there is a high likelihood of encountering a significant number of culverts along the route. Of these culverts found during previous surveys, many appear to be either concrete pipe, HDPE twin wall pipe or stone construction, most of which are on the public road. Where there is insufficient cover over the culvert, it will be necessary to trench under the culvert. It should be again noted that the EirGrid preferred method of crossing third party services/culverts is undercrossing. For stone culverts there is a high probability that the culvert would collapse sending stream water into the trench. To avoid this occurring, stone culverts with insufficient cover will be identified and replaced prior to trenching works. The following approach will be taken:

1. Works will be supervised by the ECoW and / or the project aquatic ecologist who will liaise with IFI and National Parks and Wildlife Service (NPWS) prior to works commencing. The ECoW will also monitor surface water quality downstream of the works in accordance with the surface water monitoring programme and will have the authority to cease any works should the monitoring identify unacceptable water quality conditions.
2. Any works within watercourses that are subject to fish habitat (indicated in the EIAR at least of “Medium” sensitivity), will be avoided between Oct 1st and April 30th as per IFI and Loughs Agency guidelines.
3. All plant and equipment will be serviced and cleaned before entry to site to limit risk of oil spillage and for biosecurity.
4. Where temporary fluming or flow diversion are in situ, in a watercourse frequented by salmon or trout, (at least medium sensitivity) all fish within the designated area will be subject to fish rescue and translocation downstream by a fisheries biologist. Fish rescue will be conducted under Section 14 authorisation (DCCAE/ IFI) or Section 69 authorisation (Loughs Agency) where appropriate.
5. Works will be carried out in dry weather with low flows in the streams with forecast for dry weather for the duration of the works – approximately 2 days.

6. Machinery used will stay on the public road; machinery will not be permitted to enter the stream channel.
7. The road edge adjacent to the watercourse will be lined with sandbags and silt fences (multiple fences recommended) as appropriate to prevent runoff from the trenching works reaching the stream. The design of these multiple features shall also allow for the safe removal of accumulated silt away from the channel, particularly through staged removal of the most contaminated upper fence before the lower ones, and the removal of the final fence only when it is clear of any silt.
8. Clean sandbags will be used to dam flows on the upstream side of the culvert. Sandbags will be placed by hand at a suitable location to take advantage of any natural pool but set back from the works to permit unhindered excavation of the existing culvert.
9. A second sandbag dam will be placed on the downstream side of the culvert to prevent backflow into the works and contain any groundwater seepage that is likely to be turbid.
10. Sandbagging requires careful attention to detail if it is to be effective. All bags must be laid neck uppermost and seams aligned. Bags must not be overfilled, or they will not tamp together or will burst with ease. Additional bags will be filled ready to raise freeboard of dams.
11. Flume placement for temporary flow diversion or permanent replacement of culverts will follow guidelines issued by IFI and CIRIA to ensure that fish passage is not impeded.
12. If topography permits, the water will be piped over the road by gravity flow, otherwise, it will be pumped. Discharge will be via break tank or similar approved storage onto a splash-plate or riprap (gabion basket) to dissipate energy and avoid scour or erosion of the stream bend or banks. The pump will be filled with a screen, so fish aren't drawn into the pump intake.
13. The use of pump sumps will be considered within the dammed area. These will be lined to prevent scouring. The intention is to intercept clean groundwater ingress and pump it out rather than allowing it to get silted in the works area by segregating off areas.
14. Any spoil generated will be removed to designated safe area clear of the flood plain. Some of this spoil will be saturated and will require bunding and sheeting over.
15. If bank material needs to be removed, it will be stored separately and reinstated according.
16. The ducting will be advanced passed the culvert and the existing culvert will be excavated 'in the dry' and a new culvert, sized for a 100-year rainstorm event, will be installed with appropriate gradient, headworks, and outfall. A precast concrete culvert, concrete pipe or HPDE pipe will be used. Culverts will be embedded to at least 300mm below the existing stream bed to ensure backwatering. Culverts will avoid a significant change in gradient (i.e., >3%). After embedding, replacement culverts will be filled with clean washed gravels and cobbles to replace lost habitat and facilitate fish movement.
17. Dry stone headworks will be placed at the culvert intake and discharge and the stream bed adjacent to the works will be reinstated at the direction of the project aquatic ecologist.
18. The ECoW will determine the quality of any water trapped between the two dams – visual inspection and turbidity meter. If this water is clean, it will be left in situ. If it is not clean, it will be removed from the works area prior to removal of the dams. If required, dewatering of the works area prior to dam removal will be undertaken by pumping from the stream bed to either a) the cable trench for percolation or b) taken back to the wind farm site for treatment at an existing settlement pond or c) treatment using a mobile water treatment system such as Siltbuster® or similar. The most efficient method will depend on the volume of water present and the available percolation.
19. The upstream dam will then be removed to permit flow though the new culvert. This will be done in phases, so a large volume of water isn't released at once. The downstream dam will be removed in a similar manner.

9 Design and Construction & Environmental Management

Prior to commencement of construction works the contractor will draw up detailed Method Statements which will be informed by this Outline Construction Methodology, measures proposed within the CEMP, and the guidance documents and measures listed below. These 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 proposed 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 proposed 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 wind farm sites 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 taken into account when planning construction activities to minimise risk of run off from site;
- Provision of 50 m 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 proposed 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, and the Contractor is required to prepare a contingency plan for before and after such events;
- The contractor will carry out visual examinations of local watercourses from the proposed 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 solar farm sites; 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 waste water 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 50 m hydrological buffer at all times.

10 Relocation of Existing Services

In order 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 with in order 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 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, with the underground cables will then be re-energised.

10.2 Gas Networks

Consultation with Gas Networks Ireland (GNI) must take place before starting works where gas pipes are present. Gas Networks Ireland will advise on the safety measures required and will arrange for the exact location of the gas pipe to be marked out on site. The works will be carried out in accordance with the safety working practices and utility standards to be outlined by GNI.

No gas network pipework is indicated in the project area.

10.3 Water Mains

The water supply will be turned off by the utility so work can commence on diverting the service. The section of 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.

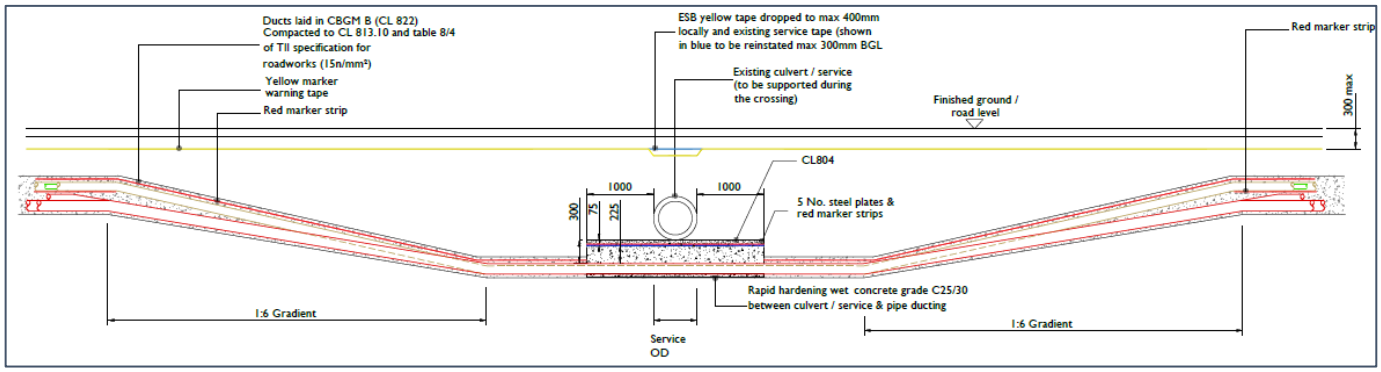

Figure 10.1: 110 kV UGC Culvert/Service Undercrossing

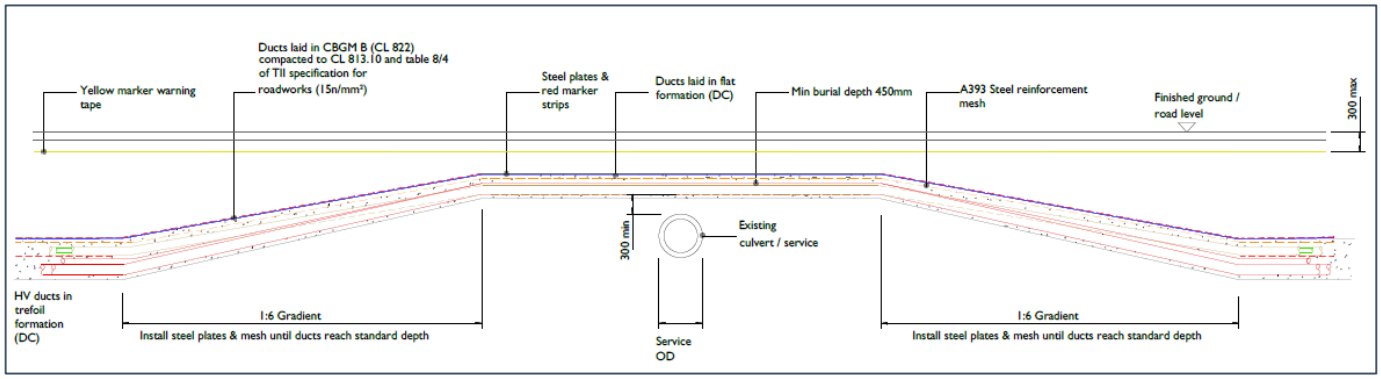

Figure 10.2: 110 kV UGC Culvert/Service Overcrossing

11 Reinstatement of Private Lands

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

12 Emergency Response Plan

All site personnel will be inducted in the provisions of the Emergency Response Plan. The following outlines some of the information, on the types of emergencies, which must be communicated to site staff (list not exhaustive);

- Release of hazardous substance - Fuel or oil spill
- Concrete spill or release of concrete
- Flood event – extreme rainfall event
- Environmental buffers and exclusion zones breach
- Housekeeping of materials and waste storage areas breach
- Stop Works order due to environmental issue or concern

The Emergency Response Plan must be completed by the appointed contractor before the project begins.

13 Invasive Species Best Practice 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 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.

14 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 prior to the commencement of construction. All waste material will be disposed of at a fully licensed facility.

15 Archaeology

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

- 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.

16 Provisional 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 16 - 18 months.

Estimated Construction Duration	
Development Element	**Estimated Construction Duration**
Scart Mountain Wind Farm 110 kV Cable Route Commissioning	14 - 16 months 6 weeks
Total	16 - 18 months

Table 16.1: Estimated Construction Duration