APPENDIX 4-7

CRUMHACH WIND FARM 110KV GRID CONSTRUCTION – CONSTRUCTION METHODOLOGY

CONSTRUCTION METHODOLOGY

Crumhach Wind Farm 110kV Grid Connection

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1.0 Introduction

The purpose of this document is to outline and explain the construction techniques and methodologies which will be implemented during the construction of the Crumhach Wind Farm 110kV grid connection to the existing Srananagh 220kV 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 and some elements in forestry access tracks.

The UGC works will consist of the installation of 6 No. ducts in an excavated trench to accommodate 3 No. power ducts, 2 No. fibre communications ducts to allow communications between the Crumhach Wind Farm Substation and the existing Srananagh 220kV substation and 1 No. earth continuity conductor duct.

This document is intended to be used as an aid to understand the methodologies to be employed during construction. 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 proposed development.

The grid connection cabling trench is not included in the planning application for the proposed Crumhach Wind Farm. However, the methodologies and techniques to be implemented in the construction of the grid connection cabling trench are assessed in the Environmental Impact Assessment Report (EIAR).

2.0 Proposed Grid Connection Route

The UGC route is approximately 41.57 km in length and runs in a predominately north westerly direction from the existing Srananagh 220kV substation to the Crumhach Wind Farm substation location utilising public road networks.

The exact location of the UGC within the curtilage of the public local road network may be subject minor modification following confirmatory site investigations, to be undertaken prior to construction of the proposed wind farm development, to confirm the conditions predicted in the EIAR (Environmental Impact Assessment Report). The cable location will take into consideration Sligo County Council and all other relevant stakeholder requirements. Installation of the cable will be carried out in line with the methodologies outlined in this document and all relevant environmental protection measures included in the EIAR.

Figure 1 outlines the proposed UGC grid connection route, with the total length of each road type detailed in Table **1**.

Table 1 – Approximate UGC Route Location of Preliminary Design:		
National Road	**Regional Road**	**Local Road**
22808m	9200m	8700m

Table 1: **Crumhach Wind Farm to Srananagh 220kV Substation – UGC Route Location Summary**

Figure 1: Grid Connection Route Layout Plan

Table 2 below separates the UGC route into a number of 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 Grid Connection Design Route	
Section	**Description**
Section 1 UGC 11675m	**UGC from Srananagh 110kV substation to N59 Road.** The underground cable route initially begins within the site of the existing Srananagh 220kV substation. The UGC then briefly travels south and then west for approx. 665m along the L-52043 until it reaches the L-5204-36. Here the UGC travels in a western direction along the L-5204-36 for approx. 1810m where the UGC then heads northwest along the R-284. After circa. 812m the route will cross beneath Bridge 1 by means of a road-to-road HDD, until it remerges and heads northwest along the regional road for approx. 1336m undercrossing Culvert 1. The route then traverses northwest for approx. 150m undercrossing Culvert 2 and continues northwest for approx. 270m, it should be noted that this watercourse was unviewable from the roadside and would require further assessment. The UGC then crosses beneath Culvert 3 and proceeds northwest for approx. 110m, crossing Bridge 2 via an HDD. Further site assessment for this watercourse will be required to determine the crossing approach. The underground cable route continues for approx. 167m and merges onto the R-290 and follows this regional road southwest for approx. 102m, encountering Bridge 3 along the route. From here the UGC continues along the R-290 for approx. 1036m. undercrossing Culvert 4. The route then proceeds along the R-290 for approx. 908m, where it will cross Bridge 4 via HDD. Further site assessment for this watercourse will be required to determine the crossing approach. The route then travels west for approx. 796m, at this point the UGC enters the town of Collooney and continues along the R-290 for approx. 488m where the route encounters a junction where it heads northeast staying on the R-290. The UGC continues on the regional road for approx. 550m until it encounters Bridge 5 which will be crossed via HDD, further assessment will be required to determine the HDD requirements to cross the watercourse. The cable route will then continue through the town along the regional road for approx. 519m. At this point the UGC will cross under a railway bridge (UBS592) and proceed along the R-290 for approx. 1211m where the route crosses culvert 5. The route continues for approx. 145m, where it crosses Bridge 6. The route then travels northwest along the R-290 for approx. 580m where it reaches a roundabout and proceeds northwest for approx. 20m, and from there the UGC merges onto the N-59. <u>Features</u> Section 1 contains 18 No. joint bays. Joint bays, described in Section 8.8 below, will be located below ground, within the curtilage of the existing road and finished/reinstated to the required roads specification. All joint bays will have associated communication chambers and

	mentioned joint bays will also include earth link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 01 (JB01) will be located approximately 680m southwest of the entrance to Srananagh 110kV Substation. • Joint Bay 02 (JB02) will be located approximately 640m west of JB01 along the L-5204 local road. • Joint Bay 03 (JB03) will be located approximately 630m northwest of JB02 positioning the joint bay within the local secondary road. • Joint Bay 04 (JB04) will be located approximately 640m northwest of JB03 in the regional road (R-284). • Joint Bay 05 (JB05) will be located approximately 620m northwest of JB04 in the regional road. JB05 is located approx. 43m southeast of Bridge 1. • Joint Bay 06 (JB06) will be located approximately 624m northwest of JB05 in the regional road. • Joint Bay 07 (JB07) will be located approximately 635m northwest of JB06 in the regional road. JB07 is located approx. 192m southeast of Culvert 1. • Joint Bay 08 (JB08) will be located approximately 640m southwest of JB07 in the regional road. JB08 is located approx. 10m southeast of Bridge 2. • Joint Bay 09 (JB09) will be located approximately 660m west of JB08 in the regional road (R-290). JB09 is located approx. 383m southwest of Bridge 3. • Joint Bay 10 (JB10) will be located approximately 400m southwest of JB09 in the regional road. • Joint Bay 11 (JB11) will be located approximately 715m southwest of JB10 in the regional road (R-290). JB11 is located approx. 460m northwest of Culvert 4. • Joint Bay 12 (JB12) will be located approximately 680m southwest of JB11 in the regional road. JB12 is located approx. 220m west of Bridge 4. • Joint Bay 13 (JB13) will be located approximately 680m west of JB12 in the regional road. JB13 is located approximately 11m southeast of a 110kV Overhead Line and is located approximately 118m southeast of a 38kV underground cable. • Joint Bay 14 (JB14) will be located approximately 670m northwest of JB13 in the regional road. JB14 is located approximately 230m southeast of Bridge 5. • Joint Bay 15 (JB15) will be located approximately 670m west of JB14 in the regional road. • Joint Bay 16 (JB16) will be located approximately 650m west of JB15 in the regional road. JB16 is located approximately 153m northwest of a railway bridge (UBS592). • Joint Bay 17 (JB17) will be located approximately 670m northwest of JB16 in the regional road. • Joint Bay 18 (JB18) will be located approximately 700m northwest of JB17 in the regional road. JB18 is located approx. 119m northwest of Bridge 6.

	Section 1 has 6 No. bridge crossings: The UGC route crosses over a variation of bridges in section 1. These include flat slab, shuttered, single and multi-arch bridges. Insufficient clearance exists within a number of the bridge structures across grid connection route. Each of these bridges are described in further detail below in Section 8.5 and as shown indicatively on the drawings included as part of this pack. Section 1 has 5 No. Culvert Crossings. A standard culvert crossing method is shown in drawing no. 051071-DR-195-196.
Section 2 UGC 22,808 m	**UGC from N59 to L6309 Local Road** The UGC merges onto the National Road (N-59) at a roundabout and continues in a northwestern direction following the National Road for approx. 4057m, where the route encounters Bridge 7 which will be crossed via road-to-road HDD. The UGC then continues along the N-59 for approx. 792m where the route crosses beneath Culvert 6 and proceeds for 471m. At this point, the cable route under crosses Culvert 7 continues heading northwest for approx. 992m where it crosses beneath Culvert 8. The route continues northwest for approx. 853m, at this point the UGC will under cross Culvert 9. The route will then traverse northwest for approx. 868m where it under crosses Culvert 10 and proceeds along the N-59 for approx. 2450m undercrossing Culvert 11. The UGC route then continues along the N-59 for approx. 748m where it crosses beneath Culvert 12, from there it proceeds heading northwest for approx. 1189m and under crosses Bridge 8. The route will then traverse northwest for approx. 1913m, at this point the UGC will cross beneath Bridge 9 via Horizontal Directional Drilling. The route then travels west circa 612m where it crosses Bridge 10 and continues for approx. 3081m where the route encounters Bridge 11. After crossing the previous bridge via open trench, the route continues west for approx. 2111m and will under cross Culvert 13 before proceeding northwest circa 2443m to under cross Bridge 12 via road-to-road HDD. The UGC route then continues heading northwest for approx. 278m and then from there the UGC merges on the L-6309. <u>Features</u> Section 2 contains 35 no. joint bays. Joint bays, described in Section 8.8 below, will be located below ground, within the curtilage of the existing road and finished/reinstated to the required roads specification. All joint bays will have associated communication chambers and mentioned joint bays will also include earth link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 19 (JB19) will be located approximately 600m northwest of JB18 in the national road (N-59).

	• Joint Bay 20 (JB20) will be located approximately 630m northwest of JB19 in the national road (N-59). • Joint Bay 21 (JB21) will be located approximately 660m southwest of JB20 in the national road (N-59). • Joint Bay 22 (JB22) will be located approximately 675m southwest of JB21 in the national road (N-59). • Joint Bay 23 (JB23) will be located approximately 675m west of JB22 in the national road (N-59). • Joint Bay 24 (JB24) will be located approximately 650m southwest of JB23 in the national road (N-59). • Joint Bay 25 (JB25) will be located approximately 652m southwest of JB24 in the national road (N-59). JB25 is approx. 81m southwest of Bridge 7. • Joint Bay 26 (JB26) will be located approximately 650m southwest of JB25 in the national road (N-59). JB26 is approx. 62m southeast of Culvert 6. • Joint Bay 27 (JB27) will be located approximately 650m northwest of JB26 in the national road (N-59). JB27 is approx. 119m northwest of Culvert 7. • Joint Bay 28 (JB28) will be located approximately 182m southeast of Culvert 8 in the national road (N-59). • Joint Bay 29 (JB29) will be located approximately 650m northwest of JB28 in the national road. • Joint Bay 30 (JB30) will be located approximately 650m southwest of JB29 in the national road. JB30 is approx. 277m northwest of Culvert 9. • Joint Bay 31 (JB31) will be located approximately 650m northwest of JB30 on the national road. JB31 is located approx. 39m northwest of Culvert 10. • Joint Bay 32 (JB32) will be located approximately 650m northwest of JB31 on the national road. • Joint Bay 33 (JB33) will be located approximately 650m northwest of JB32 on the national road. • Joint Bay 34 (JB34) will be located approximately 650m northwest of JB33 on the national road. • Joint Bay 35 (JB35) will be located approximately 650m northwest of JB34 on the national road. JB35 is approx. 199m northwest of Culvert 11. • Joint Bay 36 (JB36) will be located approximately 650m northwest of JB35 on the national road. JB36 is approx. 105m northwest of Culvert 12. • Joint Bay 37 (JB37) will be located approximately 650m northwest of JB36 on the national road. • Joint Bay 38 (JB38) will be located approximately 650m northwest of JB37 on the national road. JB38 is approx. 212m northwest of Bridge 8. • Joint Bay 39 (JB39) will be located approximately 650m northwest of JB38 on the national road. • Joint Bay 40 (JB40) will be located approximately 650m northwest of JB39 on the national road.

	• Joint Bay 41 (JB41) will be located approximately 650m northwest of JB40 on the national road. JB41 is approx. 250m west of Bridge 9. • Joint Bay 42 (JB42) will be located approximately 650m northwest of JB41 on the national road. JB42 is approx. 291m northwest of Bridge 10. • Joint Bay 43 (JB43) will be located approximately 650m southwest of JB42 on the national road. • Joint Bay 44 (JB44) will be located approximately 650m southwest of JB43 on the national road. • Joint Bay 45 (JB45) will be located approximately 650m southwest of JB44 on the national road. • Joint Bay 46 (JB46) will be located approximately 650m southwest of JB45 on the national road. • Joint Bay 47 (JB47) will be located approximately 650m southwest of JB46 on the national road. JB47 is approx. 461m west of Bridge 11. • Joint Bay 48 (JB48) will be located approximately 650m northwest of JB47 on the national road N-59. • Joint Bay 49 (JB49) will be located approximately 650m northwest of JB48 on the national road. • Joint Bay 50 (JB50) will be located approximately 635m northwest of JB49 on the national road. JB50 is approx. 285m northwest of Culvert 13. • Joint Bay 51 (JB51) will be located approximately 665m northwest of JB50 on the national road N-59. • Joint Bay 52 (JB52) will be located approximately 650m northwest of JB51 on the national road. • Joint Bay 53 (JB53) will be located approximately 665m northwest of JB52 on the national road. JB53 is approx. 179m southeast of Bridge 12. Section 2 has 6 No. bridge crossings: The UGC route crosses over a variation of bridges in section 2. These include flat slab, shuttered, single and multi-arch bridges. Insufficient clearance exists within a number of the bridge structures across grid connection route Each of these bridges are described in further detail below in Section 8.5 and as shown indicatively on the drawings included as part of this pack. Section 2 has 8 No. Culvert Crossings. A standard culvert crossing method is described in drawing no. 051071-DR-195-196.
Section 3 UGC 6,928 m	**UGC from L6309 to Wind Farm Access Track** The UGC merges onto the Local Road (L-6309) from N59 road junction and proceeds in a southeastern direction for approx. 845m where the route encounters Culvert 14 which will be undercrossed.

	The route continues heading southwest for approx. 320m undercrossing culvert 15 and then proceeds following the local road south for approx. 660m until it reaches Bridge 13. The UGC will then cross Bridge 13 via HDD, further assessment will be required to determine the HDD requirements to cross the watercourse. The route then continues along the L6309 heading south for approx. 437m and under crosses Culvert 16. The route then travels southeast for approx. 610m where the UGC will under cross Culvert 17. The UGC then proceeds southeast for approx. 902m where it will cross Bridge 14 and then continue heading south circa 105m until it reaches a junction and remains on the L6309 local road. The UGC then travels west for approx. 962m where it under crosses Culvert 18 and continues west approx. 571m where it under crosses Bridge 15. The UGC proceeds west circa 617m where it encounters Culvert 19. The UGC will cross beneath this watercourse and continue west for approx. 40m where it will turn southwest and travel through private lands along the proposed access road for approx. 130m before connecting into the Substation.
	Section 3 contains 10 no. joint bays. Joint bays, described in Section 8.8 below, will be located below ground, within the curtilage of the existing road and finished/reinstated to the required roads specification. All joint bays will have associated communication chambers and mentioned joint bays will also include earth link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 54 (JB54) will be located approximately 635m southwest of JB53 in the local road (L-6309). • Joint Bay 55 (JB55) will be located approximately 650m southwest of JB54 in the local road (L-6309). JB55 is approx. 25m north of Culvert 14. • Joint Bay 56 (JB56) will be located approximately 650m southwest of JB55 in the local road (L-6309). JB56 is approx. 304m south of Culvert 15. • Joint Bay 57 (JB57) will be located approximately 650m southwest of JB56 in the local road (L-6309). JB57 is approx. 138m northwest of the Culvert 16. • Joint Bay 58 (JB58) will be located approximately 650m southeast of JB57 in the local road (L-6309). JB58 is approx. 96m northwest of the Culvert 17. • Joint Bay 59 (JB59) will be located approximately 650m southeast of JB58 in the local road (L-6309). JB59 is approx. 348m northeast of the Bridge 14. • Joint Bay 60 (JB60) will be located approximately 650m southeast of JB59 in the local road (L-6309). • Joint Bay 61 (JB61) will be located approximately 650m southeast of JB60 in the local road (L-6309). JB61 is approx. 114m northeast of Culvert 18. • Joint Bay 62 (JB62) will be located approximately 650m southeast of JB61 in the local road (L-6309). JB62 is approx. 36m northeast of Bridge 15

	• Joint Bay 63 (JB63) will be located approximately 640m west of JB62 in the local road (L-6309). JB63 is approx. 12m southwest of Culvert 19. Section 3 has 3 No. bridge crossings: The UGC route crosses over a variation of bridges in section 3. Insufficient clearance exists within a number of the bridge structures across grid connection route. Each of these bridges are shown in further detail in 051071-DR-232-234. Section 3 has 6 No. Culvert Crossings. A standard culvert crossing method is described in drawing no. 051071-DR-195-196.
Note: The precise location of the UGC route within the curtilage of the existing access tracks and public roads may be subject to minor modifications following confirmatory site investigations prior to the construction phase of the proposed wind farm development.	

3.0 Description of Proposed Electrical Infrastructure

The proposed 110kV substation will consist of both EirGrid and IPP Control Room buildings, HV electrical equipment and associated infrastructure including palisade fences and concrete post and rail fences. The installation of HV electrical equipment will include a 110/33kV Transformer (TRAFO) with associated equipment along with:

- Cable Sealing End (CSE);
- Surge Arrestor (SA);
- Earth Disconnect (DT);
- Current /Voltage Transformer (CT/VT);
- House Transformer (HT);
- Circuit Breaker (CB);
- Harmonic Filter (HF);
- Shunt Reactor (SR);
- Lightning Mast (LM);
- 110kV underground cable to Srananagh 110kV Station comprising 3 No Power Ducts, 2 No Telecoms Ducts and 1 No Earth Continuity Duct;
- Diesel Generator;
- Security Fencing and Cameras.

4.0 Access Routes to Work Area

The proposed grid route will consist entirely of UGC. Where the proposed underground cable will be installed predominantly within the existing roads network, it will be accessed via the existing road network. 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 tracks, where appropriate. Prior to the commencement of development, precise access arrangements will be agreed with the respective landowners.

A detailed Traffic Management Plan will be prepared and agreed with Sligo County Council, prior to the commencement of construction.

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 proposed 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.

5.0 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 Sligo County Council. All work on public roads will be subject to the approval of a road opening license application by Sligo 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 150m sections, and no more than 100m 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 appropriately within the works area so as not to cause additional obstruction or inconvenience to road users or local 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. Access for local residents can be accommodated, although traffic flows during works may have to minimised.

All traffic management measures will comply with those outlined in the EIAR and will be incorporated into a detailed Traffic Management Plan (TMP) to be prepared, in consultation with Sligo County Council, prior to the commencement of UGC construction.

6.0 Road Opening Licence

The proposed UGC works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from County Council. A Traffic Management Plan (TMP) will be agreed with County Council prior to the commencement of the development. This 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 Sligo County Council in advance of the preparation of the TMP.

7.0 UGC Construction Methodology

The UGC trench will consist of 3 no. 160mm diameter HDPE power cable ducts, 2 no. 125mm diameter HDPE communications ducts and 1 no. 125mm diameter earth continuity conductor 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. The power cable ducts will accommodate 1 No. power cable per duct. The communications duct will accommodate a fibre cable to allow communications between the Crumhach Wind Farm substation and Srananagh 220kV substation.

The ducts will be installed and the trench reinstated in accordance with the specifications of the Roads Section within County Council where installed in public roads and reinstated in accordance with the landowner's requirements where installed in private lands. The installation of the electrical cabling/fibre cable will be pulled through in one section in approximately 620 to 680m section lengths. Construction methodologies to be implemented and materials to be used will ensure that the UGC is installed in accordance with the requirements of the Council and private landowners.

7.1 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 within the EIAR where relevant;
- All existing underground services along the UGC route shall be identified on site prior to the commencement of construction works;
- Traffic management measures will be implemented in accordance with those included in Section 5.0 of the EIAR, and a detailed Traffic Management Plan will be prepared and agreed with County Council;
- The excavated trench will be approximately 825mm in width and approximately 1315mm deep both within the public road network and within private lands;
- The 160mm diameter HDPE cable ducting will be placed into the prepared trench, inspected and backfilled as per Figure 3 & Figure 4.
- 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 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Project Environmental Clerk of Works (ECoW);
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported to one of the proposed on-site borrow pits;
- 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. (Please refer to Section 9.0)
- 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 100 metres 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 cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;
- Works will only be conducted in normal working hours of Monday to Friday 07:00 to 19:00 and Saturday 07:00 to 13:00, with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency;
- Following the installation of ducting, pulling the cable will take approximately 1 no. days between each joint bay, with the jointing of cables taking approximately 1 week per joint bay location.

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 diameter HDPE ducting;
- 125mm diameter HDPE ducting;
- 125mm diameter HDPE duct;
- Temporary Surface Reinstatement Materials.

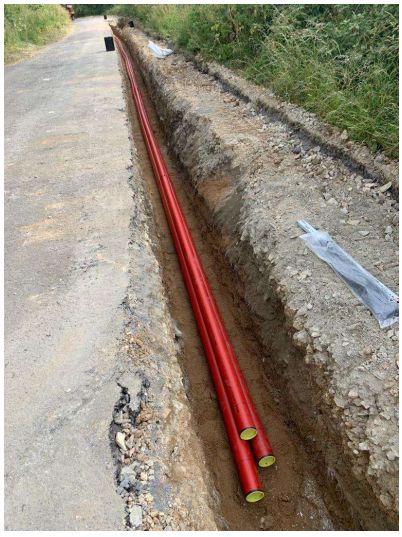

Figure 2: Typical 110kV Underground Duct Installation

7.2 Ducting Installation Methodology

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

- Grade, smooth and trim trench floor when the required 1315mm depth and 825mm width have been obtained.

- 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.
- 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.
- Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
- Place cable protection strips on compacted CBGM B directly over the ducts.
- 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.
- Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.
- Place red cable protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.
- 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.
- 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 landowners, unless otherwise agreed with local authority *(*Figure 3*).*
- 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 4*).*
- 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 at a later date. All the works should be witnessed by ESBN Clerk of Works (CoW) as required.

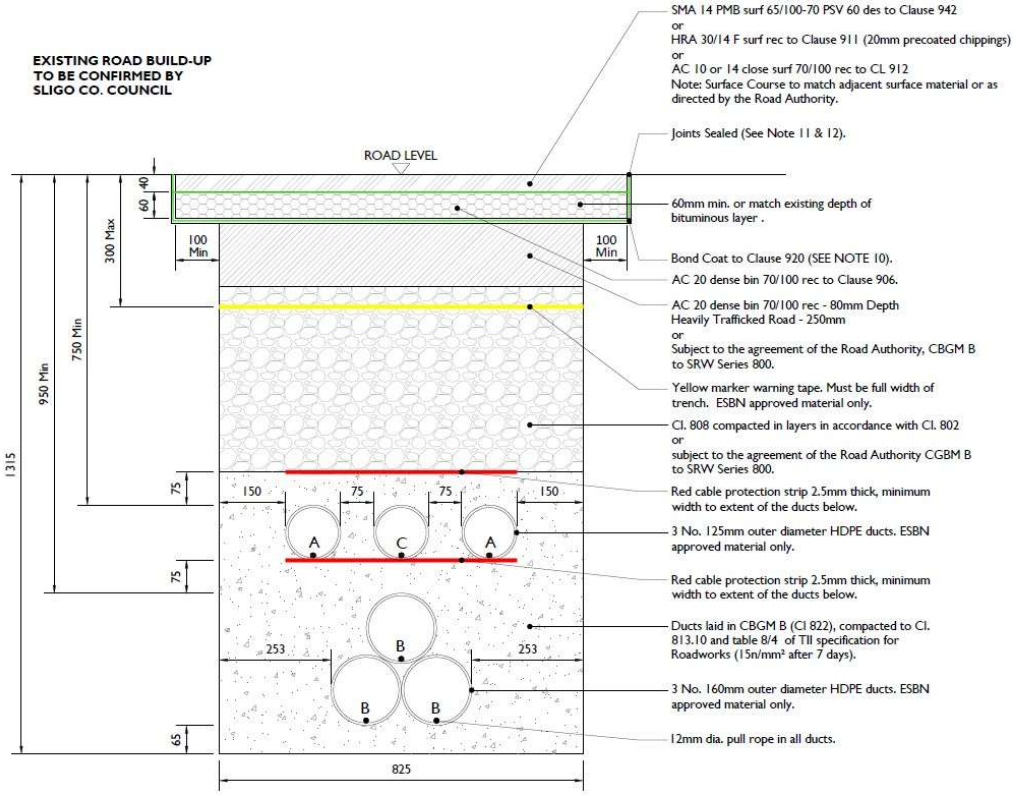

Figure 3: Typical Trench in Road Section

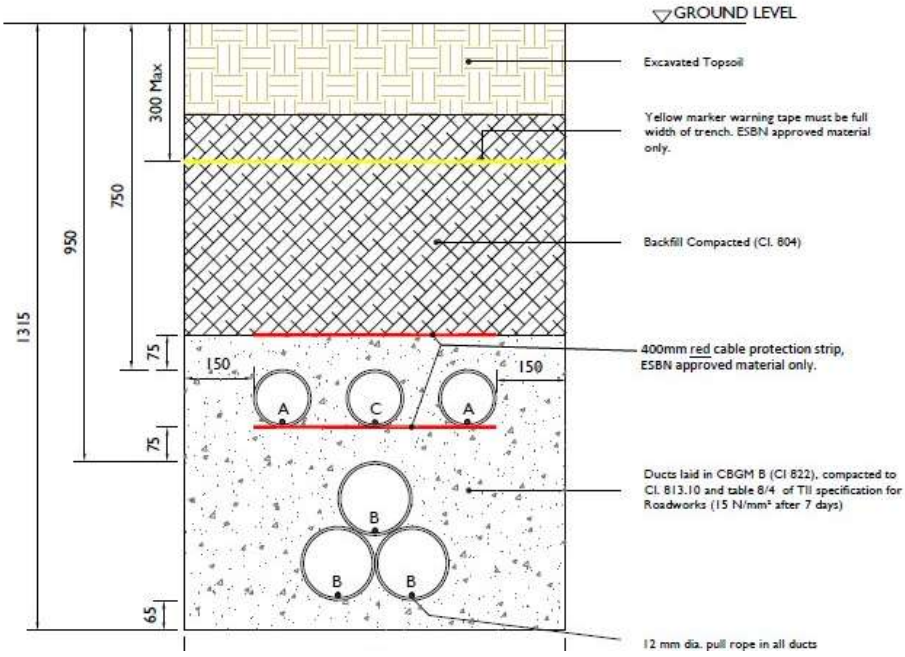

Figure 4: Typical Trench in Off-Road Section

7.3 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.

7.4 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 ESB standards.

Marker posts will be used on non-roadway routes where applicable to delineate the duct route and joint bay positions. Corrosion proof aluminium triangular danger signs, with a 700mm base, and with centred lightning symbol, on fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker posts shall also be placed in the event that burial depth is not to standard. The precise siting of marker posts will be dictated by ESBN as part of the detailed design process.

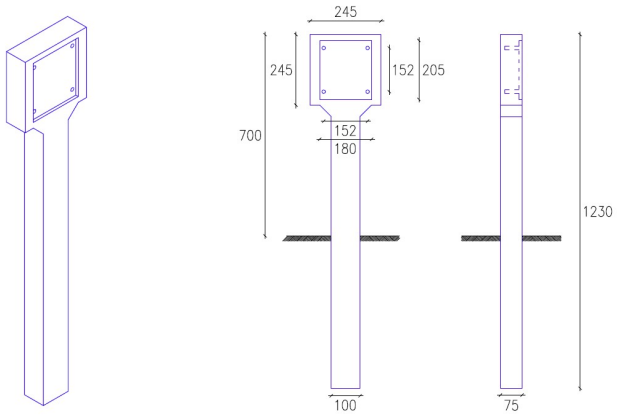

Figure 5: ESB Marker Posts

7.5 Major Watercourse Crossings

The cable route will involve 15 No. bridge crossings including 15 No. HDD crossings. 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. The cable will be located within the bridge deck where there is sufficient depth and width available on the bridge, where there is insufficient depth and width available horizontal directional drilling (HDD) may be employed as an alternative.

The underground cable will encounter 19 no. culverts along the route. 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.

Existing culverts will be crossed using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. A visual site survey of all culverts viewable from the roadside has been completed as part of this phase of the project prior to planning to identify the crossing methods. The proposed standard culvert crossing methods are detailed in Figure 6 and Figure 7 and can be found in drawing 051071-DR-195-196.

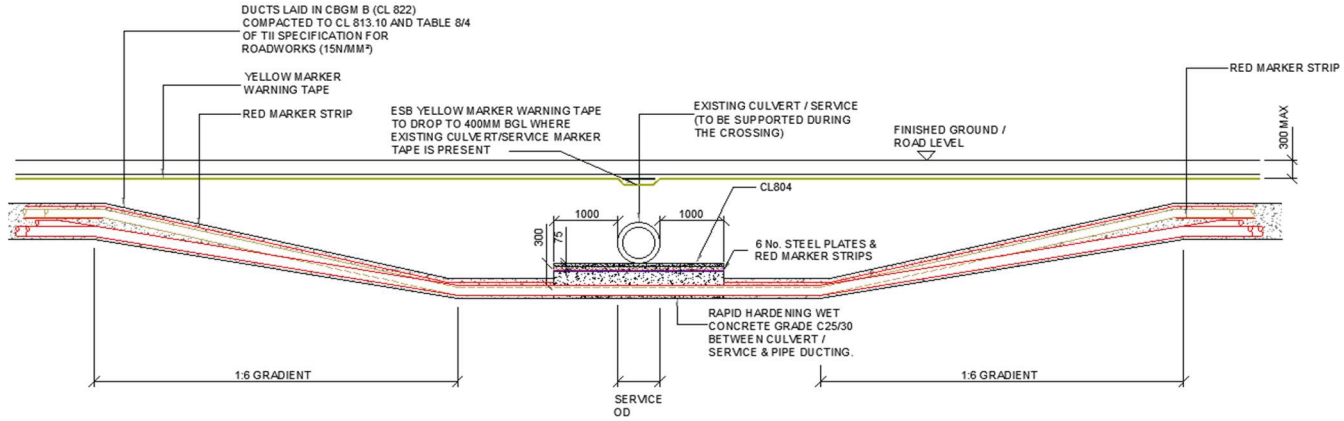

Figure 6: 110kV UGC Culvert/Service Undercrossing

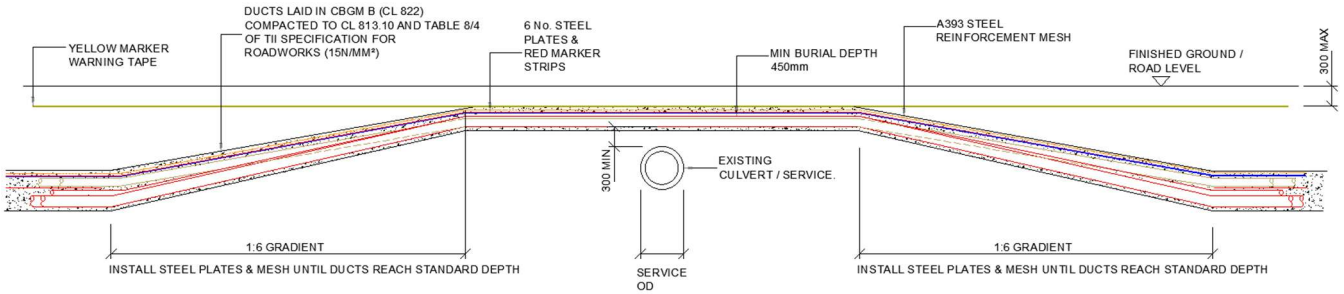

Figure 7: 110kV UGC Culvert/Service Overcrossing

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.

7.5.1 Bridge 1 – Horizontal Directional Drilling

ITM Coordinates: 572362.0188, 825624.3349

Bridge 1 is located on a regional road approx. 43m northwest of JB05 crossing over the 'Ballygrania' Stream (EPA Name). The Bridge has insufficient room to install the cable to ESBN and EirGrid specifications (450mm cover to top of ducts) therefore the suitability of the bridge is inadequate to accommodate the works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. This required depth may increase if advised by Inland Fisheries Ireland. Drilling will take place from the road carriageway**.** The methodology for HDD is outlined in Section 9 below. See Drawing 051071-DR-220 details

Figure 8: Bridge 1 - Wall View

Figure 9: Bridge 1 - Road View

7.5.2 Bridge 2 – Horizontal Directional Drilling

ITM Coordinates: 570973.5526, 826786.9583

Bridge 2 is located on a regional road approx. 10m northwest of JB08 crossing over the 'Carrigeenboy' Stream (EPA Name). The Bridge has sufficient room to install the cable to ESBN and EirGrid specifications (450mm cover to top of ducts) therefore the suitability of the bridge is adequate to accommodate the works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.** The methodology for HDD is outlined in Section 8.6 below.

See Drawing 051071-DR-221 for further details.

Figure 10: Bridge 2 - Road View

Figure 11: Bridge 2 - Wall View

7.5.3 Bridge 3 – Horizontal Directional Drilling

ITM Coordinates: 570805.0805, 826877.8486

Bridge 3 is located on a regional road approx. 385m southeast of JB09 crossing over the 'Carrigeenboy' stream (EPA Name). The Bridge has insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the scope of works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations.

See Drawing 051071-DR-222 for further details.

Figure 12: Bridge 3 - Over Wall View

Figure 13: Bridge 3 - Google Street View ©2025 Google

7.5.4 Bridge 4 – Horizontal Directional Drilling

ITM Coordinates: 569430.8294, 825947.3784

Bridge 4 is located on a bend on the regional road (R290) approx. 230m east of JB12 crossing over the 'Unshin 35' stream (EPA Name). The Bridge may have insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge may be inadequate to accommodate the scope of works.

Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Due to the acute angle of the bridge to the road entering and exiting the bridge, drilling may not be feasible to take place from the road carriageway. Therefore, further assessment will be required on site to determine a feasible crossing location in line with the accompanying EIAR assessment. It should be noted due to the location and visibility from the roadside; it was deemed unsafe to assess and would require access to private lands to conduct a visual survey.

See Drawing 051071-DR-223 for further details.

Figure 14: Bridge 4 - Approach from Road Bend

7.5.5 Bridge 5 – Horizontal Directional Drilling

ITM Coordinates: 567924.0326, 826548.1926

Bridge 5 is located on the R290 regional road approx. 64m northwest of JB14 crossing the Owenmore River. Bridge 5 has insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.**

See Drawing 051071-DR-224 for further details.

Figure 15: Bridge 5 - Elevation View

7.5.6 Bridge 6 – Horizontal Directional Drilling

ITM Coordinates: 567130.5487, 828605.1573

Bridge 6 is located on the R290 approx. 120m southeast of JB18 in the vicinity of the 'Knoxspark' stream (EPA Name). Bridge 6 has insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.**

See Drawing 051071-DR-225 for further details.

Figure 16: Bridge 6 - Google Streetview ©2025 Google

7.5.7 Bridge 7 – Horizontal Directional Drilling

ITM Coordinates: 562970.9231, 828384.7733

Bridge 7 is located on the N59 approx. 81m northeast of JB25 crossing over the 'Stonehall or Carrownageeragh' Stream (EPA Name). Bridge 7 has insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.**

See Drawing 051071-DR-226 for further details.

Figure 17: Bridge 7 - Elevation View

7.5.8 Bridge 8 – Horizontal Directional Drilling

ITM Coordinates: 556058.0622, 832265.3511

Bridge 8 is located on the N59 national road approx. 215m southeast of JB38. Bridge 8 has insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations.

See Drawing 05795-DR-227 for further details.

Figure 18: Bridge 8 - Over Bridge wall View

Figure 19: Bridge 8 - Google Street map Road View ©2025 Google

7.5.9 Bridge 9 – Horizontal Directional Drilling

ITM Coordinates: 554297.0648, 832993.9115

Bridge 9 is located on the N59 national road approx. 250m east of JB41 crossing over the 'Dunmoran' Stream (EPA Name). Bridge 9 is a flat concrete slab which has insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.**

See Drawing 051071-DR-228 for further details.

Figure 20: Bridge 9 - Road View

Figure 21: Bridge 9 - Over Rail View

7.5.10 Bridge 10 – Horizontal Directional Drilling

ITM Coordinates: 553712.9144, 833115.2175

Bridge 10 is located on a National Road (N59) approx. 291m southeast of JB42 crossing over the 'Dunmoran Trib West' stream (EPA Name). Bridge 10 is also a flat concrete slab which has insufficient room to install the cable to ESBN and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway.

See Drawing 051071-DR-229 for further details.

Figure 22: Bridge 10 - Google Street map View ©2025 Google

Figure 23: Bridge 10 - Bridge wall View

7.5.11 Bridge 11 – Horizontal Directional Drilling

ITM Coordinates: 550777.6985, 832498.0597

Bridge 11 is located on a National Road (N59) approx. 200m southwest of JB46 crossing over the 'Doonflin' stream (EPA Name). Bridge 11 is a stone-arch which has sufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is adequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.**

See Drawing 051071-DR-230 for further details.

Figure 24: Bridge 11 - Road View

Figure 25: Bridge 11 - Elevation View

7.5.12 Bridge 12 – Horizontal Directional Drilling

ITM Coordinates: 546322.2279, 833113.1113

Bridge 12 is located on a National Road (N59) approx. 180m southwest of JB53 crossing over the 'Lugdoon' stream (EPA Name). Bridge 12 is a stone-arch which has insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.**

See Drawing 051071-DR-231 for further details.

Figure 26: Bridge 12 - Roadside Wall View

Figure 27: Bridge 12 - Google Maps Streetview ©2025 Google

7.5.13 Bridge 13 – Horizontal Directional Drilling

ITM Coordinates: 545698.1762, 831529.1528

Bridge 13 is located on a Local Road (L6309 Dunowla) approx. 352m northeast of JB56. The feature is presumed to be a stone-arch bridge (to be determined with private land access) which may have insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge may be inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations.

See Drawing 051071-DR-232 for further details.

Figure 28: Bridge 13 - Google Streetview of Dunowla River ©2025 Google

7.5.14 Bridge 14 – Horizontal Directional Drilling

ITM Coordinates: 550777.6985, 832498.0597

Bridge 14 is located on a Local Road (L6309 Dunowla) approx. 350m southwest of JB59 crossing over the 'Doonbeakin 35' stream (EPA Name). Bridge 14 is a stone-arch which has insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations.

See Drawing 051071-DR-233 for further details.

Figure 29: Bridge 14 - Wall View

Figure 30: Bridge 14 - Road View

7.5.15 Bridge 15 – Horizontal Directional Drilling

ITM Coordinates: 550777.6985, 832498.0597

Bridge 15 is located on a Local Road (L6309) approx. 36m southwest of JB62 crossing over the 'Doonflin' stream (EPA Name). Bridge 15 is precast which has insufficient room to install the cable to ESBN and EirGrid specifications (650mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations.

See Drawing 051071-DR-234 for further details.

Figure 31: Bridge 15 - Elevation View

Figure 32: Bridge 15 - Road View

7.6 Horizontal Directional Drilling

Horizontal Directional Drilling (HDD) is a method of drilling under obstacles such as bridges, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. There are a number of bridges on this UGC route which will require HDD due to there being insufficient cover and depth in the bridge to cross within the bridge deck. The drilling methodology is as follows:

1. A works area of circa. 40m^2 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 ESBN, EirGrid and Sligo County Council.
13. A transition coupler will be installed at either side of the bridge/ following the horizontal directional drilling as per ESBN and EirGrid requirements, this will join the HDD ducts to the standard ducts.

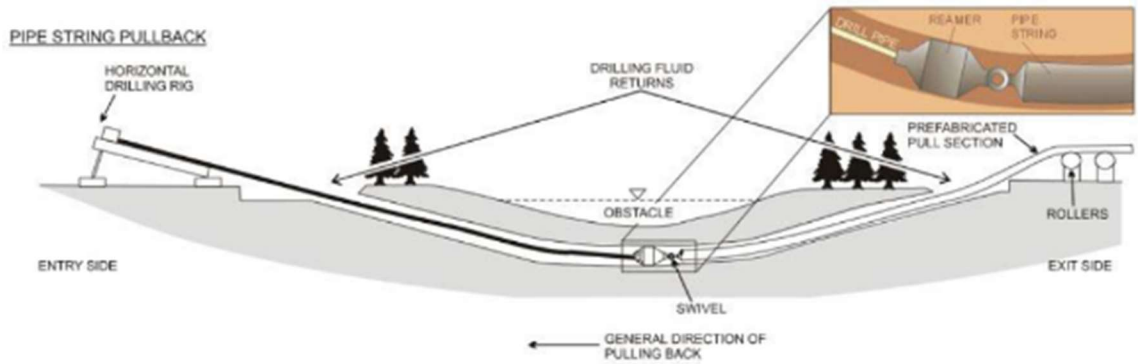

Figure 33: Typical HDD Installation

7.7 Storage of Plant 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 proposed Crumhach Wind Farm site. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds.

7.8 Joint Bays and Associated Chambers

Joints Bays are to be provided approximately every 620m to 680m along the UGC routes to facilitate the jointing of 2 no. lengths of UGC. 110kV Joint Bays are typically 2.5m x 6m 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 are required at every joint bay location to facilitate communication links between Wind Farm and the existing Substation. Earth sheath links are used for earthing and bonding cable sheaths of underground power cables, installed in a trefoil formation so that the circulating currents and induced voltages are eliminated or reduced. Earth sheath link chambers and communication chambers are located close to joint bays. Earth sheath link chambers and communication chambers will typically be pre-cast concrete structures with an access cover at the finished surface level.

The precise siting of all joint bays, earth sheath link chambers, and communication chambers is subject to approval by 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 750mm 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.

The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers, within the curtilage of the public road, is subject to approval by ESBN and EirGrid.

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

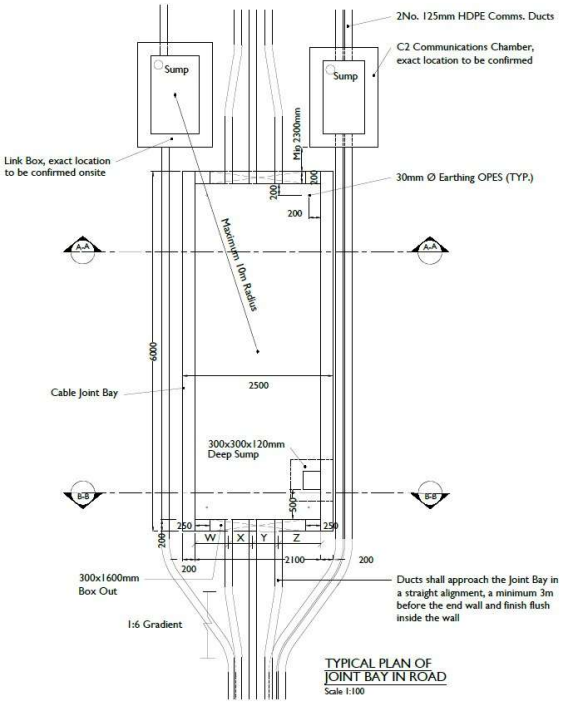

Figure 34: 110kV Joint Bay Plan Layout

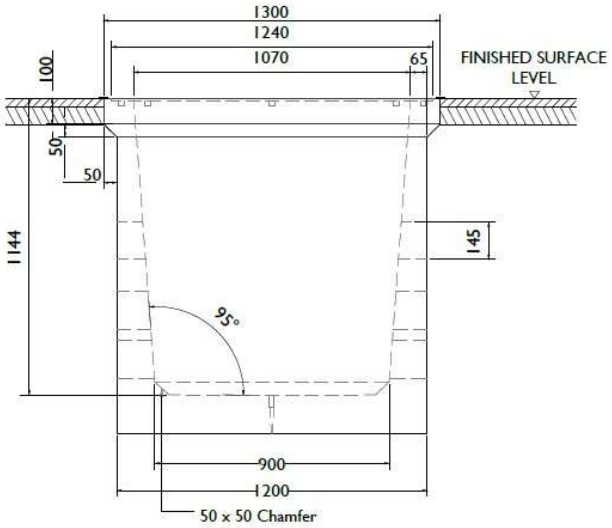

Figure 35: Typical Communications Chamber

Figure 36: Typical Communications Chamber

8.0 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 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 pocketbook*. (C762) 4th edition. CIRIA;
- CIRIA *Environmental Good Practice on Site (fourth edition) (C741) 2015*.

The grid connection 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 compounds within the proposed Crumhach Wind Farm 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 taken into account 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 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 spill kits 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 Wind 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 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.

9.0 Existing Third-Party Services

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. Where required, ducting may be installed using either an under-crossing or over-crossing arrangement, as illustrated in Figure 6 and Figure 7.

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.

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. Any proposed diversion will be undertaken in consultation with the relevant service provider to confirm feasibility and to ensure that all works comply with the applicable codes of practice and design standards.

9.1 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, with the underground cables will then be re-energised.

9.2 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.

9.3 Water Mains

Uisce Éireann will need to be consulted and advised on details of the project and associated technical information with as much available information as possible. Early engagement between Uisce Éireann and the developer will be carried out on the project regarding any infrastructure which may be located near their assets with the intention of identifying as early as possible, to determine if bespoke design measures or diversions are necessary.

10.0 Programme

Estimates for the indicative duration of the construction works are included in the table below. Please note that some of the elements are likely to happen concurrently, and elements such as the cable route will likely require multiple crews at construction should the grid connection be brought forward for planning based on the route outlined in Table 2. Therefore, the overall start-to-finish duration is estimated to be 22 months.

Table 3 - Estimated Construction Duration

Development Element	Estimated Construction Duration
Crumhach Windfarm 110 kV Substation	22 months
Cable route (not including HDD)	12 months
HDD	4 months
Commissioning	6 weeks
Total	22 months