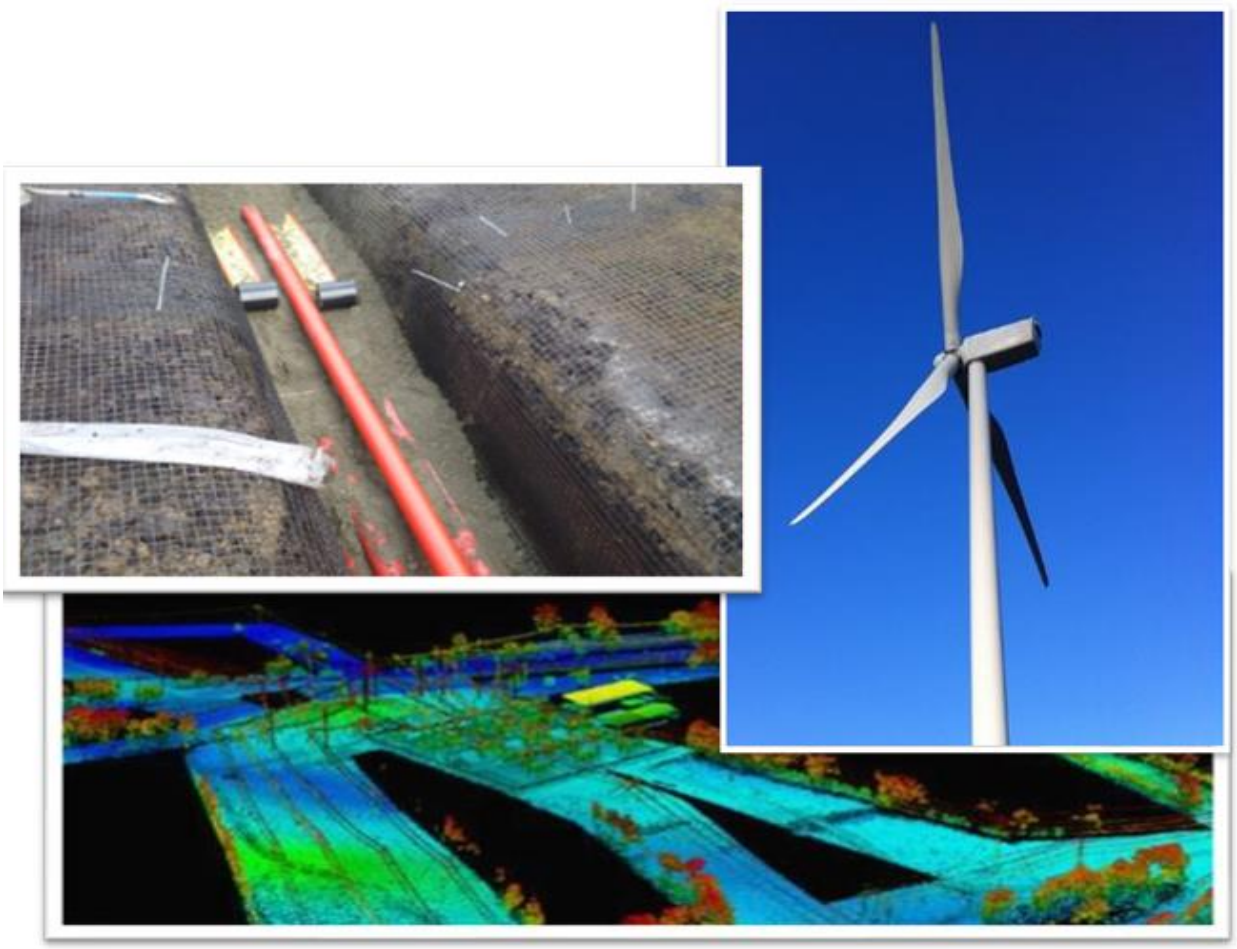
Construction Methodology

Carrownagowan Wind Farm 110kV Underground Cable Connection



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Clients: Futur Energy Ireland C/o Malachy Walsh Partners

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00	DB	SK	04.03.19	*Issued for Client Review*
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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 construction of the proposed Carrownagowan Wind Farm 110kV grid connection to the existing ESB Ardnacrusha 110kV 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, 1 No. fibre communications cable to allow communications between the Carrownagowan Wind Farm Substation and Ardnacrusha 110kV substation 1 No. spare fibre communications cable and 1 No. earth continuity duct.

This document is intended to be used as an aid to understand the methodologies to be employed during construction and should be read in conjunction with all other specialist reports which accompany the planning application. Detailed Method Statements will be prepared in respect of each aspect of the Proposed Development.

2.0 Proposed 110kV Underground Cable Route

The proposed UGC route is approximately 25km in length and runs in a northerly direction from the existing ESB Ardnacrusha 110kV substation to the proposed Carrownagowan Wind Farm substation location utilizing public local road networks, existing access tracks, private forestry access tracks and private lands.

Below (Figure 1) which outlines the proposed UGC route, with each section of the route being formulated in detail within Table 1.

This proposed grid connection option is shown as an Overall Site layout Plan in Drawing No. 05641-200.

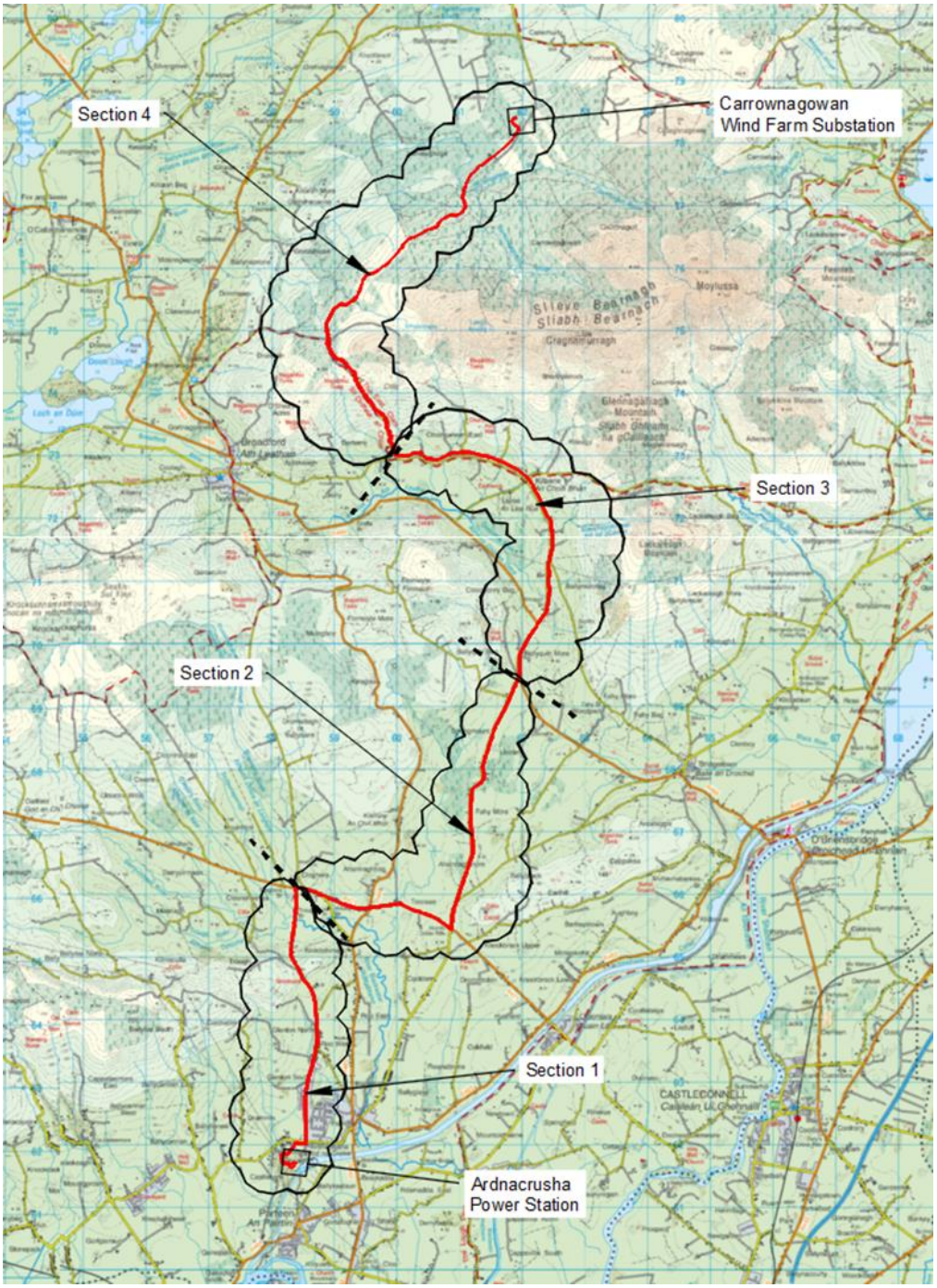

Figure 1 -Grid Connection Route Location

Table 1 of this report summaries the route location features of the underground cable connection and proposed route.

Table 1 – Approximate Route Location of Preliminary Design:			
ESB Access Track (UGC)	**Public Roads (UGC)**	**Wind Farm Site/Forestry Roads (UGC)**	**Private third party lands (UGC)**
695 m	16,953 m	5,126 m	2,330 m

Table 1: Carrownagowan Wind Farm to Ardnacrusha 110kV Substation – UGC Route Location Summary

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 proposed works will be subject to good site organisation and hygiene, particularly during construction activities.

Table 2 - Summary of Grid Connection Design Route	
Section	**Description**
Section 1	**UGC from Ardnacrusha 110kV substation to R-471 Road *(Chainage 0 m to 5000 m)*** The underground cable route initially begins within the townland of Ballykeelaun, Co. Clare where from the Ardnacrusha 110kV substation GIS compound, the UGC departs the substation on the northwest boundary, converging onto an existing access track within folio No. CE51663. The proposed UGC route then continues mainly north for a further approx. 300m where it converges onto the L-3056, leaving the Ardnacrusha complex. The underground cable route briefly travels along the L3056 for approximately 165m where it then approaches a crossroad junction, the UGC turns north opposite the main entrance of Ardnacrusha Power Station onto L-3054 (Lackyle Heights Road) and continuing along this route for approximately 2.8km. The UGC will predominantly be installed in the carriageway until encountering another road junction (L-7066) at which point the UGC will traverse to continue north bound. The UGC will carry within another section of localised secondary road carriageway (L7066-1), which in turn will inhibit the first proposed bridge crossing. The river Blackwater (Trough Bridge, denoted as Bridge 1) will be crossed using a horizontal directional drill method (HDD) before continuing within the L-7066-1. The mobilisation of an HDD will require temporary construction areas to be facilitated to complete the tranche of works involved in drilling beneath the riverine feature and bridge abutments. After navigating a path across the river Blackwater and the Trough Bridge, the underground cable infrastructure continues north until reaching the regional road, R471. ***Features*** ***Section 1 contains 8 no. joint bays***. Joint bays will be located below ground and finished/reinstated to the required roads specification. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 01 (JB01) will be located adjacent to the entry to Ardnacrusha 110kV Station. *Chainage – 60m* • Joint Bay 02 (JB02) will be located north of JB01. The joint bay will be installed within a secondary access road into Ardnacrusha Power Station. *Chainage – 480m* • Joint Bay 03 (JB03) will be located north of JB02 within the local road network situated within Lackyle Road network. *Chainage – 1125m* • Joint Bay 04 (JB04) will be located north of JB03 positioning the joint bay within the Lackyle Road network. *Chainage – 1760m*

	• Joint Bay 05 (JB05) will be located north of JB04 positioning the joint bay within the local road network. A temporary construction passing bay will be facilitated at this joint bay with consents in place with relevant landowner(s). *Chainage – 2350m* • Joint Bay 06 (JB06) will be located north of JB05 within the local road carriageway. The joint bay will be positioning within the shoulder of the roadway. *Chainage – 3130m* • Joint Bay 07 (JB07) is located northwest of JB06 within the shoulder of a section of public roadway. *Chainage – 3860m* • Joint Bay 08 (JB08) will be located north of JB07 within the shoulder of an unpaved section of public roadway. JB08 is located immediately north of the first proposed Bridge crossing and located outside of the flood zone for the blackwater river. This joint bay will be situated at the proposed receptor area for the first proposed directional drill. *Chainage – 4610m* ***Section 1 has 1 No. watercourse crossings:*** Bridge 1 (Trough Bridge - *Chainage – 4475m*) has been surveyed with the result of insufficient clearance existing within this structure. To cross the Blackwater River, it will be required to utilise a Horizontal Directional Drill within the roadway to cross beneath with a satisfactory clearance to the waterway and bridge structure. The HDD crossing will require a transition chamber to be installed at either side of the drill following the works, the location of these chambers is to be determined by the drilling contractor following site investigation. The launch and receptor pits will reside within the curtilage of the local roadway (L-7066-1). Refer to Drawing 05641-DR-231-P4 for further Bridge 1 details. ***Section 1 will encounter a multitude of service crossings:*** Existing utility infrastructure (inclusive of ESB, Irish Water, Gas and Telecoms) will be encountered, and the crossing schedules will be prepared at detailed design to identify under or over methods to cross these existing buried services. ***Section 1 has 2 No. culvert crossings:*** Refer to ***Appendix A***, appended to the end of this report and also refer to drawings 05641-DR-224-P4 & 05641-DR-259-P4 for crossing details.
Section 2	**UGC within R-471 and L-3046 Carriageway *(Chainage 5000 m to 11850 m)*** The UGC converges upon the regional road (R-471) with the underground cable infrastructure merging and heading east. continuing eastwards, the UGC route passes “Mary Mother of God church” in the townland of Trough before encountering a junction that will require the UGC route to converge but remains on the R-471 regional roadway. Within this section of regional road, a second bridge crossing will be encountered. This bridge (Bridge 2) was surveyed during field investigatory works and found to have insufficient cover. With this information, it is intended to mobilise an HDD to cross beneath the riverine feature whilst maintaining the drill corridor within the curtilage of the public road.

Continuing east bound for an additional 660m, the UGC route will approach a regional crossroads junction, at chainage 6200 m respectively. At this junction the UGC will be required to cross underground services (water, telecoms, etc) which are evident within the surrounding area. These utilities are contained within the existing road curtilages of the R471 and R476 prior to continuing east bound. The UGC route encounters a third bridge crossing, the Glenmora Wood Stream (Bridge 3) which will be crossed again using HDD. Third party consents have been acquired from proprietors (folio No. CE3940 & folio No. CE24089F) if the need to align the UGC route away from the structural makeup of the bridge. The composition of the ground conditions in this vicinity is wet, and predominantly marshy land.

Once the UGC crosses this structure, the route continues for a further 905m before making the approach onto the local road (L-3046) at Carmody's cross, at chainage 7600m. The underground cable will carry north along this route for approximately 4.25km.

Features

Section 2 contains 10 no. joint bays. Joint bays will be located below ground and finished/reinstated to the required roads specification.

Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels.

- Joint Bay 09 (JB09) will be located north of JB08 on the regional road (R-471) within the shoulder of this roadway. *Chainage – 5130m*
- Joint Bay 10 (JB10) will be located within the R-471 roadway, east of JB09. A temporary construction passing bay will be facilitated at this joint bay with consents in place with relevant landowner. *Chainage – 5775m.*
- Joint Bay 11 (JB11) will be located within the R-471 roadway, approx. 640m east of JB10 and circa. 200m after crossing the regional carriageway (R-465). *Chainage – 6410m*
- Joint Bay 12 (JB12) will be located within the R-471 roadway, east of JB11. The Joint Bay will reside within a gated agricultural entrance. *Chainage – 7050m*
- Joint Bay 13 (JB13) will be located within the L-3046 local roadway, northeast of JB12. A temporary construction passing bay will be facilitated at this joint bay with consents in place with relevant landowner(s). *Chainage – 7860m*
- Joint Bay 14 (JB14) will be located within the L-3046 local roadway, north of JB13. *Chainage – 8640m*
- Joint Bay 15 (JB15) will be located within the L-3046 local roadway, north of JB14. *Chainage – 9420m*
- Joint Bay 16 (JB16) will be located within the L-3046 roadway, north of JB15. The Joint Bay will reside within a bell mouth, forestry entrance to Coillte owned lands. *Chainage – 10210m*
- Joint Bay 17 (JB17) will be located within the L-3046 local roadway, north of JB16. *Chainage – 10880m*
- Joint Bay 18 (JB18) will be located within the L-3046 local roadway, north of JB17. *Chainage – 11660m*

	Section 2 has 2 No. watercourse crossings: Bridge 2 (*Chainage – 5580m)* has been surveyed with the result of insufficient clearance existing within this structure. To cross the Knockdonagh River, it will be required to utilise a Horizontal Directional Drill within the roadway (R471) to cross beneath with a satisfactory clearance to the waterway and bridge structure. Refer to Drawing 05641-DR-232-P4 for further Bridge 2 details. Bridge 3 (*Chainage – 6660m)* has been surveyed with the result of insufficient clearance existing within this structure. To cross the Glenmora Wood Stream, it will be required to utilise a Horizontal Directional Drill beneath bridge abutments, satisfactory clearance to the water way to adhere to Inland Fishery Ireland requirements whilst the possible inclusion of executing the drill shot within third party consenting lands. The launch and receptor pits will reside within the curtilage of the roadway (R471). Refer to Drawing 05641-DR-233-P4 for further Bridge 3 details. Both HDD crossings will require a transition chamber to be installed at either side of the drill following the works, the location of these chambers is to be determined by the drilling contractor following site investigation but will be contained within the curtilage of the public road. ***Section 2 will encounter a multitude of service crossings:*** Existing utility infrastructure (incl. ESB, Irish Water, Gas and Telecoms) will be encountered, and the crossing schedules will be prepared at detailed design to identify under or over methods to cross these existing buried services. ***Section 2 has 5 No. culvert crossings:*** Refer to ***Appendix A***, appended to the end of this report and also refer to drawings 05641-DR-224-P4 & 05641-DR-259-P4 for crossing details.
Section 3	**UGC within R466 & L-3022-8 roadways, through Kilbane Village *(Chainage 11850 m to 17500 m)*** Section 3 of the grid connection route converges onto the regional route R-466 and carries within the verge way of this carriageway for approximately 950m. At this point the UGC route converges onto a localise secondary road (L-3022-8). The UGC route carries within this curtilage for circa 470m, before encountering a fourth bridge (Bridge 4, *Chainage – 13300m*). This crossing will be carried out by means of installing the UGC within the bridge deck as it has been found that sufficient cover exists in the structure which spans over the Broadford River. Continuing along the proposed route, a fifth proposed bridge (Bridge 5, *Chainage – 14350m*) crossing over the Cloonconry Beg River which will be crossed using the deployment of an HDD. On navigating a path across this structure, the UGC continues for an additional 900m on approach to a sixth bridge crossing, at *chainage – 15270m.* This bridge is situated within Kilbane village, in which the Kilbane Stream flows through. The demobilisation of the HDD will be carried out entirely within the curtilage of the road and will be enabled with the use of

residual fluid to drill within a rock formed composition which was evident from field investigation works.

Once passed the sixth bridge structure, the UGC exits the Kilbane village and continues toward the windfarm in a north-westerly direction. The UGC route carries through the townland of Upper Kilbane, encountering a seventh bridge crossing over the Kilbane stream (Bridge 7, *Chainage – 15720m*). It is proposed to cross this bridge by means of HDD, given the insufficient cover found within the existing bridge deck.

A further bridge structure is situated circa 440m after the aforementioned bridge which crosses over the Clonagaheen east stream (Bridge 8, *Chainage – 16670m*). It is proposed to cross this bridge using HDD.

The final bridge structure is situated circa 215m subsequent to this bridge which crosses beneath the Clonagaheen west stream (Bridge 9, *Chainage – 16875m*).

Features

Section 3 contains 7 no. joint bays. Joint bays will be located below ground and finished/reinstated to the required roads specification.

Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels.

- Joint Bay 19 (JB19) will be located northeast of JB18 on the regional road R-466. *Chainage – 12420m*
- Joint Bay 20 (JB20) will be located within a paved local roadway (L-3022-8), northeast of JB19. *Chainage – 13180m*
- Joint Bay 21 (JB21) will be located within the L-3022-8 roadway, north of JB20. A temporary construction passing bay will be facilitated at this joint bay with consents in place with relevant landowner(s). *Chainage – 13975m.*
- Joint Bay 22 (JB22) will also be located within the L-3022-8 roadway, north of JB21. *Chainage – 14750m*
- Joint Bay 23 (JB23) will also be located within the L-3022-8 roadway, northwest of JB22. JB23 is located approx. 265m northwest of Kilbane village. *Chainage – 15570m*
- Joint Bay 24 (JB24) will also be located within the L-3022-8 roadway, west of JB23. The Joint bay will reside within a shouldered road junction within this paved carriageway. *Chainage – 16320m*
- Joint Bay 25 (JB25) will also be located within the L-3022-8 roadway, west of JB24. *Chainage – 17050m*

Section 3 has 6 No. watercourse crossings:

- The first bridge crossing within this section is Bridge 4, *Chainage – 13300m* which spans over the Broadford River. This crossing will be carried out by means of installing the UGC ducting within the bridge deck as it has been found that sufficient cover exists in the structure. Refer to Drawing 05641-DR-234-P4 for further Bridge 4 details.
- The second bridge in this section is Bridge 5 *Chainage – 14350m* where the bridge crosses over the Cloonconry Beg River. Insufficient clearance exists within the bridge structure, and it is proposed to cross this bridge adopting the HDD method. Refer to Drawing 05641-DR-235-P4 for further Bridge 5 details.
- The third bridge crossing within this section is Bridge 6, *Chainage – 15250m*, where the proposed route crosses over the Kilbane Stream within the village of Kilbane. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method before proceeding. Refer to Drawing 05641-DR-236-P4 for further Bridge 6 details.
- The fourth bridge crossing within the section is Bridge 7, *Chainage – 15720m* where the UGC route crosses over the Kilbane stream. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method before proceeding. Refer to Drawing 05641-DR-237-P4 for further Bridge 7 details.
- The fifth bridge crossing within this section is Bridge 8, *Chainage – 16700m*, where the roadway crosses over the Clonagaheen east stream. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method before proceeding. Refer to Drawing 05641-DR-238-P4 for further Bridge 8 details.
- The sixth bridge crossing within this section is Bridge 9, *Chainage – 16900m*, this structure is the crossing point over Clonagaheen west stream. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method before proceeding towards the Windfarm site. Refer to Drawing 05641-DR-239-P4 for further Bridge 9 details.

All HDD crossings will require a transition chamber to be installed at either side of the drill following the works, the location of these chambers will be within the HDD launch and receptor pit which will be determined by the drilling contractor following site investigation.

Section 3 will encounter a multitude of service crossings:

Existing utility infrastructure (incl. ESB, Irish Water, Gas and Telecoms) will be encountered, and the crossing schedules will be prepared at detailed design to identify under or over methods to cross these existing buried services.

Section 3 has 3 No. culvert crossings:

Refer to ***Appendix A***, appended to the end of this report and also refer to drawings 05641-DR-224-P4 & 05641-DR-259-P4 for crossing details.

Section 4	**UGC within Consenting 3rd party folios to Windfarm *(Chainage 17500 m to 25000 m)*** The UGC route will avail of third-party land (folio No. CE13253F) to carry northwards traversing grassland parcel, for approximately 325m with the latter running adjacent to the existing local tertiary roadway on a upward terrain. Another grassland parcel will be traversed, folio No CE26625 before re-entering the local road networks at chainage 18300m. After carrying within the road curtilage for a minor portion, the UGC route re-enters into another third party with consents. Folio No CE759F will also allow for the UGC route to run adjacent to the existing tertiary roadway along the L-3022-8 local roadway subsequent to Joint Bay 25 for an additional 512m in a westerly direction until reaching a local roadway on the right-hand side, where it continues north uphill for approximately 1.74km before the road becomes unpaved. From this point on, the unpaved roadway forms along an existing forestry access road continuing in a north-eastern direction. On this route, the cable accesses the permitted Carrownagowan Wind Farm site boundary, carrying on the use of these existing forestry access roads and some permitted new wind farm internal roads for approximately 5km until reaching the permitted location of the wind farm substation. ***Features*** ***Section 4 contains 10 no. joint bays***. Joint bays will be located below ground and finished/reinstated to the required roads specification and as per Forestry Road Manual (Guidelines for the design, construction and management of forest road) Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 26 (JB26) will be located adjacent to the local tertiary road, heading in a north westerly direction. *Chainage – 17760m* • Joint Bay 27 (JB27) will be located adjacent to the local tertiary road, northwest of JB26. *Chainage – 18460m* • Joint Bay 28 (JB28) will be located within the local tertiary road, northwest of JB27. *Chainage – 19150m* • Joint Bay 29 (JB29) will be located northwest of JB28, the joint bay will be located on access to the existing forestry access roads, Figure 2. *Chainage – 19860m* • Joint Bay 30 (JB30) will be located within existing forestry access roads within the Coillte-owned forestry. Its location will exist at Chainage 20460m. • Joint Bay 31 (JB31) will be located within existing forestry access roads within the Coillte-owned forestry. Its location will exist at Chainage 21200m. • Joint Bay 32 (JB32) will be located within the Coillte-owned forestry access tracks and located will exist at Chainage 21880m. • Joint Bay 33 (JB33) will be located within the Coillte-owned forestry access tracks. It's location will exist at Chainage 22660m • Joint Bay 34 (JB34) will be located within permitted haul road routes for the wind farm development, located at Chainage 23450m. • Joint Bay 35 (JB35) will be located within permitted haul road routes for the wind farm development, located at Chainage 24250m.

Section 4 will encounter a multitude of service crossings:

Existing utility infrastructure (incl. ESB, Irish Water, Gas and Telecoms) will be encountered, and the crossing schedules will be prepared at detailed design to identify under or over methods to cross these existing buried services.

Section 4 has 15 No. culvert crossings:

Refer to ***Appendix A***, appended to the end of this report and also refer to drawings 05641-DR-224-P4 & 05641-DR-259-P4 for crossing details.

Figure 2 - Location of Joint Bay 29, converging onto Coillte owned forestry road.

Refer to Figure 1 and to the planning drawings submitted for location details.

3.0 Access Routes to Work Area

The majority of the Proposed Development will be installed within the public road network and therefore will be accessed via the existing road network. Where the cable route is located on private lands, such as the Ardnacrusha complex, third party agricultural lands and permitted wind farm roads, the contractor(s) will be required to access these from the local public road network in the vicinity of the work area and from there, traverse the consenting and permitted, predominantly within the permitted wind farm site.

A detailed Traffic Management Plan (TMP) accompanies this planning application. In the event that planning consent is granted for the Proposed Development, the TMP will be updated prior to commencement of development to address the requirements of any relevant planning conditions, including any additional mitigation measures, which are conditioned and will be submitted to the planning authority for written approval.

Careful and considered local consultation has been 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.

4.0 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with Clare County Council. All work on public roads will be subject to the approval of a road opening license application. The contractor will prepare detailed traffic management plans 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 100m 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 within the works area so as not to cause additional obstruction or inconvenience to road users or residents. The traffic signals will be in place prior to the works commencing and will remain in place until after the works are completed. The public road will be checked regularly and maintained free of mud and debris. Road sweeping will be carried out as appropriate to ensure construction traffic does not adversely affect the local road condition.

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

All traffic management measures will comply with those outlined in the accompanying Chapter 12 Materials assets chapter of the EIAR, which includes an assessment of traffic and transport. and in the event that planning consent is granted for the Proposed Development, the TMP will be updated prior to commencement of development to address the requirements of any relevant planning conditions, including any additional mitigation measures, which are conditioned and will be submitted to the planning authority for written approval.

5.0 Road Opening Licence

The proposed underground grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from Clare County Council. In the event that planning consent is granted for the Proposed Development, the TMP will be updated prior to commencement of development to address the requirements of any relevant planning conditions, including any additional mitigation measures, which are conditioned and will be submitted to the planning authority for written approval.

The TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with Clare County Council in advance of the preparation of the TMP.

6.0 Construction Hours

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

7.0 UGC Construction Methodology

The UGC will consist of 3 No. 160mm diameter HDPE power cable ducts, 2 No. 125mm diameter HDPE communications duct and 1 no. 63mm diameter earth continuity duct to be installed in an excavated trench, the maximum being 825mm wide and a depth of 1,315mm, with slight variations that need to be in line with Eirgrid specifications on this design to adapt to bridge crossings, service crossings and watercourse crossings, etc. Please refer to sections If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation methods and to schedule a suitable time to carry out works.

Relevant information will also be provided to the local authority and the employed crews to mitigate against any conflicts with existing buried services. It is an obligation of the developer/licence holder to install underground cable infrastructure in line with EirGrid functional specifications, for safety, constructability, and maintenance reasons. The new infrastructure shall be designed / installed as per these standards, to ascertain a separation from any existing 3rd party services (i.e. Water, Telecom, etc) and inclusive from any High Voltage /Medium Voltage or Low Voltage cables that may also be present. This minimum clearance requirement is incorporated into the H.S.A. Code of Practice on "Avoiding Danger from Buried Services". Electricity cables/ducts must not be laid above other existing services except at crossing positions.

Service Culvert Crossings & 10.0 Bridge Crossings of this report which alludes to the crossing procedures experienced by the grid infrastructure.

The power cable ducts will accommodate 1 No. power cables per duct. The communications duct will accommodate a fibre cable to allow communications between the Carrownagowan Wind Farm substation and Ardnacrusha 110kV substation. The inclusion 1 No. earth continuity conductor duct will also be required.

The ducts will be installed, the trench reinstated in accordance with with the local road's authority within Clare County Council where installed on public roads, with the Forestry Road Manual (Guidelines for the design, construction and management of forest road) where installed with in forestry roads and reinstated in accordance with the landowner's and with EirGrid functional specifications, where installed on private lands

Once all are satisfied, then the electrical cabling/fibre cable is pulled through the installed ducts in approximately 700/850m sections at the joint bays. Construction method statements will be implemented to ensure that the UGC is installed in accordance with the correct requirements, materials, and specifications of ESBN and EirGrid functional specification[1].

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 included within the planning application and accompanying reports and as required by planning conditions where relevant;
- All existing underground services shall be identified on site prior to the commencement of construction works;

[1] https://www.eirgridgroup.com/site-files/library/EirGrid/110kV-Underground-Cable-Functional-Specification-General-Requirements.pdf

- At watercourse crossings, the contractor will be required to adhere to the environmental control measures outlined within the planning application and accompanying reports, the detailed Construction Environmental Management Plan (CEMP),
- 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 ESB and Irish Water specifications;
- In the event that that small localised existing drainage crossings in the form of pre-cast concrete pipes or plastic pipes require removal for ducting installation, it is proposed that a suitable method of damming the water source and pumping the water around the work area would be set out in a method statement and agreed with the relevant stakeholders. Once the ducts are installed the culvert will be reinstated to match existing levels and dimensions. If works of this nature are required, the contractor will liaise with Inland Fisheries Ireland in advance of works;
- Traffic management measures will be implemented in accordance with those included in the Materials Assets chapter (which includes an assessment on traffic and transport) and detailed Traffic Management Plan
- 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 Ecological Clerk of Works (ECoW);
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed at a fully authorised soil recovery site, identified in chapter X of the EIAR;
- 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 100m section of trench will be opened at any one time. The second 100m will only be excavated once the majority of reinstatement has been completed on the first;
- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section;
- Where the 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 1 no. day between each joint bay, with the jointing of cables taking approximately 1 week per joint bay location.

Figure 3 - 110kV Underground Duct Installation

7.2 Ducting Installation Methodology

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

1. Grade, smooth and trim trench floor when the required 1315mm depth and 825mm width have been obtained.
2. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with the specification and compact it so that the compacted thickness is as per the drawings.
3. Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing. Fit a secure cap / bung to the end of each duct run to prevent the ingress of dirt or water.
4. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
5. Place 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 4).
11. 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.

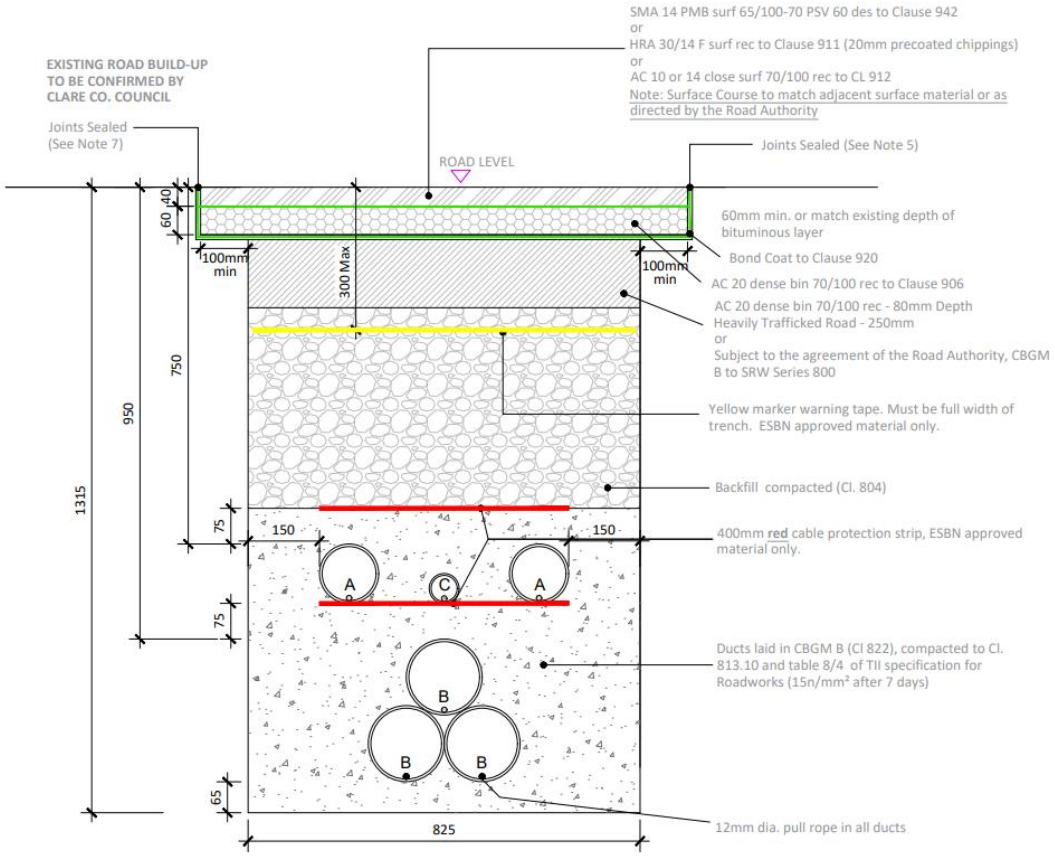

Figure 4 - Standard Trench in Roadway

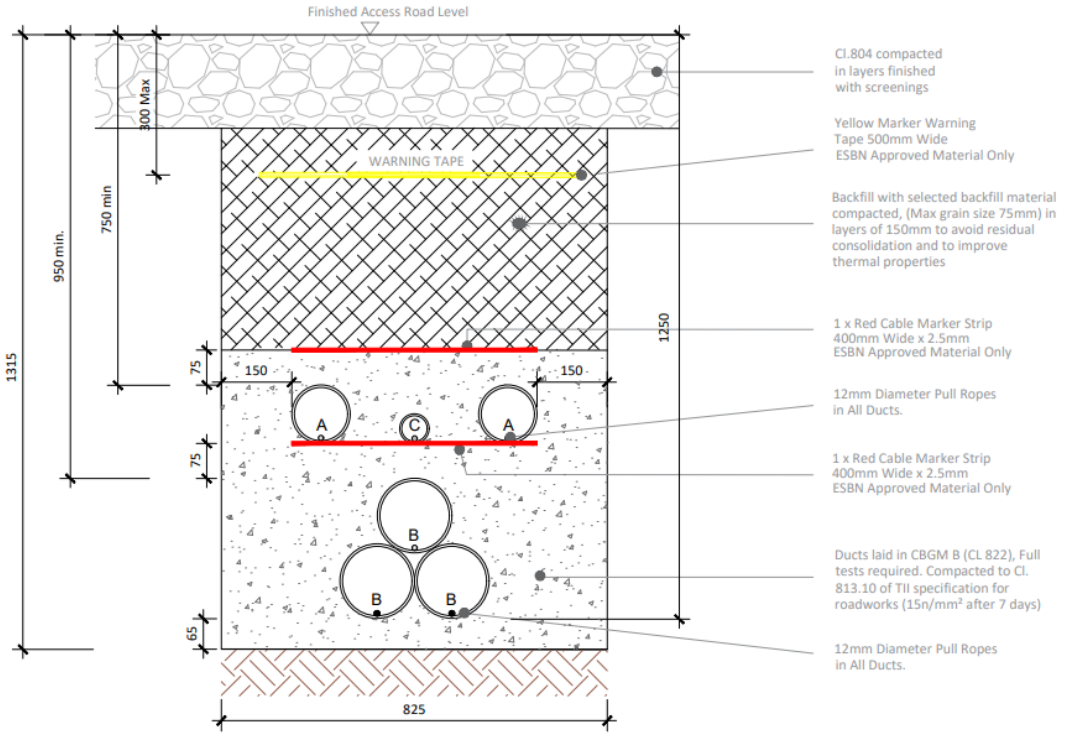

Figure 5 - Standard Trench through Forestry Access Road

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;
- 160mm diameter HDPE ducting;
- 125mm diameter HDPE ducting;
- 63mm diameter HDPE ducting;
- Temporary Surface Reinstatement Materials

7.2.1 On Private Tracks (Chainage 0m – 650m)

Where the cable is installed in private tracks, predominantly within the Ardnacrusha complex, the location where the cable is laid will depend on several factors, width of track, bends along the track and crossings. Where the track needs to be widened stone will be brought in to build up the area to the same level of the track.

7.2.2 On Public Road (Chainage 650m – 17500m)

The majority of the 110kV UGC route is located within public road carriages and the trench will be in the non-trafficked strip between the wheel marks on the road, presence of exiting utilities and depending on the nature of the road and the adjoining terrain. It is preferable to excavate a trench within the middle of the lane, or the middle of the roadway to reduce load on the cable.

7.2.3 Through agricultural lands and permitted wind farm access tracks (Chainages 17500m – 19650m & 20700m – 20800m)

A minimum 3m paved and gated service road designed for heavy traffic will be installed to provide safe access for inspection, maintenance, and fault repair along the entire cable route. The service road which accompanies the UG cable route will be suitably designed for allow for uninterrupted access to service chambers and joint bays. 7.2.4 Through Internal Forestry Access roads (Chainage 19650m – 25000m)

Forest roads are necessary to provide access to the forestry for general management, maintenance, timber extraction and recreation. These roads have been constructed in line with the Coford Forestry roads manual[2]. The UG cable route will be required to traverse sections of existing forestry roads on approach to the permitted wind farm substation. The trench will be in the non-trafficked strip, within the middle of the existing forestry road, cognizant of any future haulage frequenting the plantation. Any excess material deposited from the open trenching from the road will be reused for surface reinstatement or spread locally.

[2] http://www.coford.ie/media/coford/content/publications/projectreports/ForestRoadManual.pdf

7.3 Marker posts

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

Marker posts will be used on non-roadway routes to delineate the cable route and joint bay positions. Corrosion proof aluminium triangular danger sign, with 700mm base, and with centred lightning symbol, on engineering grade fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker post shall also be placed in the event that burial depth is not to standard. Siting of marker posts to be dictated by ESBN as part of the detailed design process. (Figure 6) below

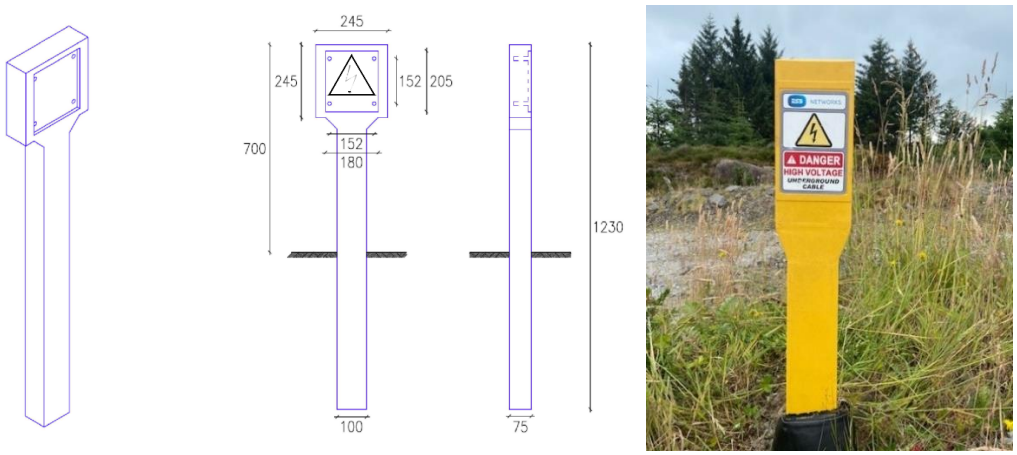

Figure 6 - Typical ESB Marker Posts Example

7.4 Horizontal Direction Drilling

Horizontal Direction 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 several 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 proposed 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 ESB Networks and Clare County Council.
13. A transition chamber will be installed at either side of the bridge/ following the horizontal directional drilling as per ESB/EirGrid requirements, this will join the HDD ducts to the standard ducts.

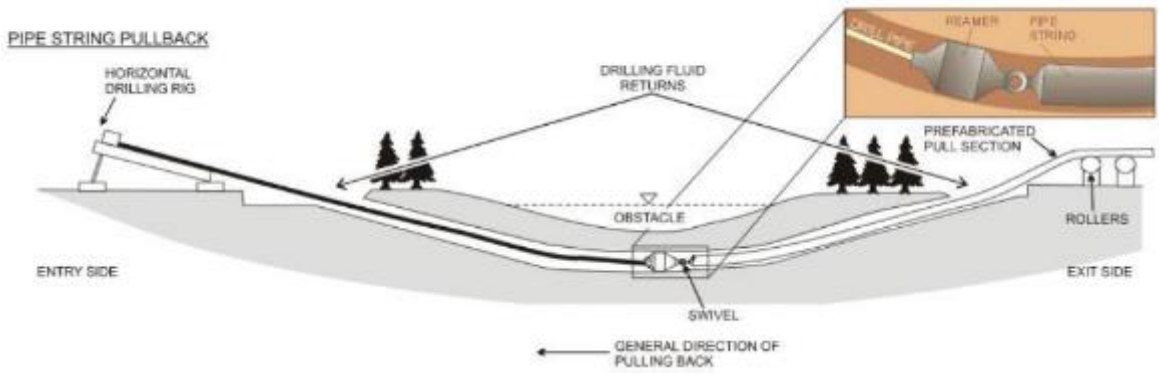

Figure 7 - Typical HDD Installation

7.5 Joint Bays and Associated Chambers

Joints Bays are to be installed as shown on drawings accompanying the planning application and approximately every 700m - 850m along the UGC route to facilitate the jointing of 2 No. lengths of UGC. Joint Bays are typically 6m x 2.5m x 2.05m pre-cast concrete structures installed below finished ground level. Joint Bays will be located in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this may not always be possible. In the event of a joint bay and associated chambers being installed within narrow road profiles, there may be a requirement for a temporary road closure to facilitate the works or construction measures such as passing bays to allow safe passage for commuting traffic.

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between the Carrownagowan Wind Farm substation and the existing 110kV substation at Ardnacrusha. 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. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions.

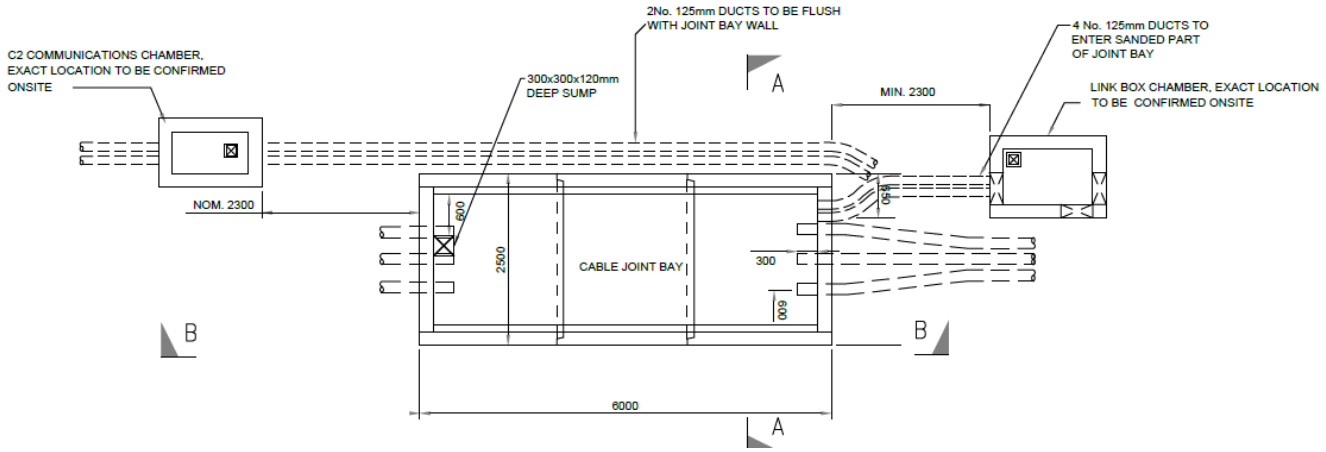

Figure 8 - 110kV Joint Bay Plan Layout

7.6 Joint Bay Construction and Cable Installation

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

Any subsoils in third party agricultural lands that isn't removed off-site to a licenced facility will be temporarily stored near the excavations and reused for reinstatement works. Any soil required for reinstatement that will be temporarily stockpiled on site will be placed at least 15m back from the nearest watercourse on level ground and will be ringed at the base by silt fencing and be regularly monitored by a designated competent person for signs of solids escape. In which case an additional line of silt fencing with straw bales will be added in line with the relevant environmental control measures.

If the joint bay 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 50 mm thick sand (for pre-cast concrete construction) on 200 mm thick Clause 804 granular material.

3. Pre-cast concrete construction. Place pre-cast concrete sections on sand bedding. (Figure 9)

Figure 9 - Joint bay under construction (pre-cast)

4. Where joint bays are located under the road surface the joint bay will be backfilled with compacted layers of Clause 804 and the road surface temporarily reinstated as specified by the local authority.
5. Precast concrete covers may be used as temporary reinstatement of joint bays at off road locations. These covers are placed over the constructed joint bay and are then removed at the cable installation stage of the project.
6. At a later date to facilitate cable installation and jointing, reinstate traffic management signage, secure individual sites, re-excavate three consecutive joint bays and store excavated material for reuse.
7. The cable is supplied in pre-ordered lengths on large cable drums (Figure 10). 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 10 - HV cable pulling procedure (Typical drum set-up)

8. 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 11)

Figure 11 - HV cable jointing container

9. 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 normally, 22 ton for rock breaker)
- 1 no. tracked dumper or tractor and trailer.

Materials:

- Sand for pipe bedding
- Blinding Concrete where necessary
- Clause 804 Material
- 160mm diameter HDPE ducting
- 125mm diameter HDPE ducting
- 63mm diameter HDPE ducting
- Precast Chamber Units / Relevant construction materials for chambers
- Earth Sheath Link Box

8.0 Identification of Existing Services

In order to facilitate the installation of the proposed underground cable, it may be necessary to excavate close to existing underground services such as water mains, gas networks, telecommunications, or existing cables.

Prior to work commencement of any excavation works, it is the responsibility of the developer to locate all existing services by undertaking detailed surveys and scans of the proposed route to confirm the presence or otherwise of any services and to safeguard same during construction. If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation methods and to schedule a suitable time to carry out works.

Relevant information will also be provided to the local authority and the employed crews to mitigate against any conflicts with existing buried services. It is an obligation of the developer/licence holder to install underground cable infrastructure in line with EirGrid functional specifications, for safety, constructability, and maintenance reasons. The new infrastructure shall be designed / installed as per these standards, to ascertain a separation from any existing 3rd party services (i.e. Water, Telecom, etc) and inclusive from any High Voltage /Medium Voltage or Low Voltage cables that may also be present. This minimum clearance requirement is incorporated into the H.S.A. Code of Practice on “Avoiding Danger from Buried Services”. Electricity cables/ducts must not be laid above other existing services except at crossing positions.

9.0 Service Culvert Crossings

Numerous other minor watercourses crossing locations have been noted along the proposed cable route i.e. culverts, pipe drains. The majority of these minor watercourses have been identified as part of the survey works and a proposed crossing schedule has been included as part of this report, see ***Appendix A***.

Crossing existing culverts will be implemented using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. The cable route will involve 3 No. culvert crossings

locations. The culvert crossing methods are detailed in *Figures 13* and *14* below, and more detailed culvert crossing drawings are available. Ref Drawings 05641-DR-224-P4 & 05641-DR-259-P4.

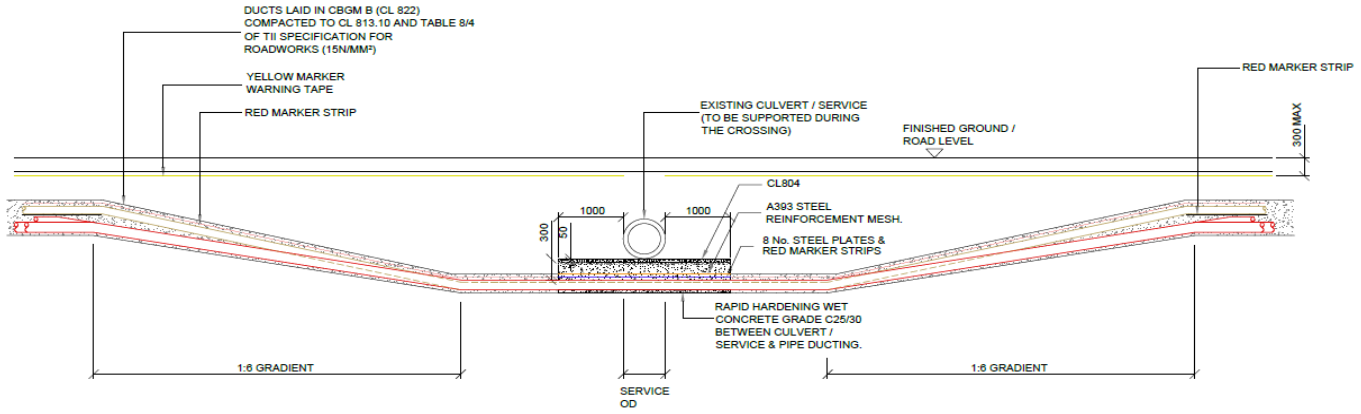

Figure 12 – 110kV UGC Culvert Undercrossing

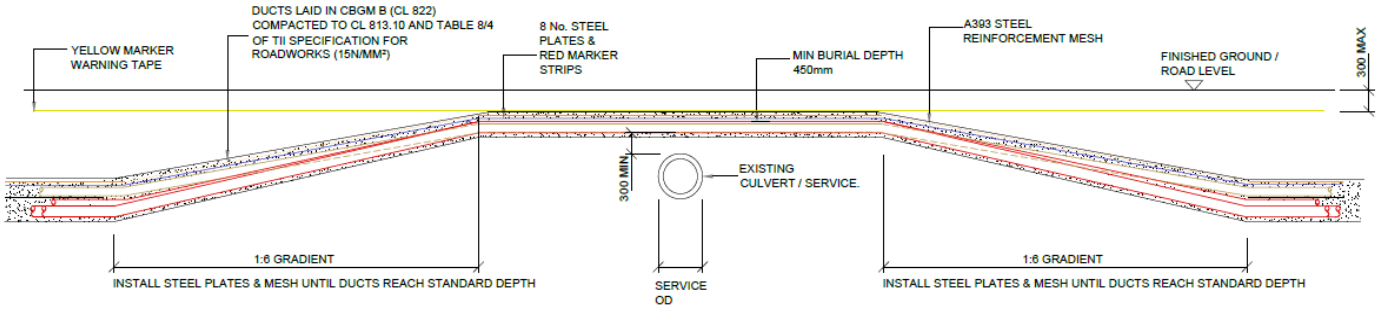

Figure 13 - 110kV UGC Culvert Overcrossing

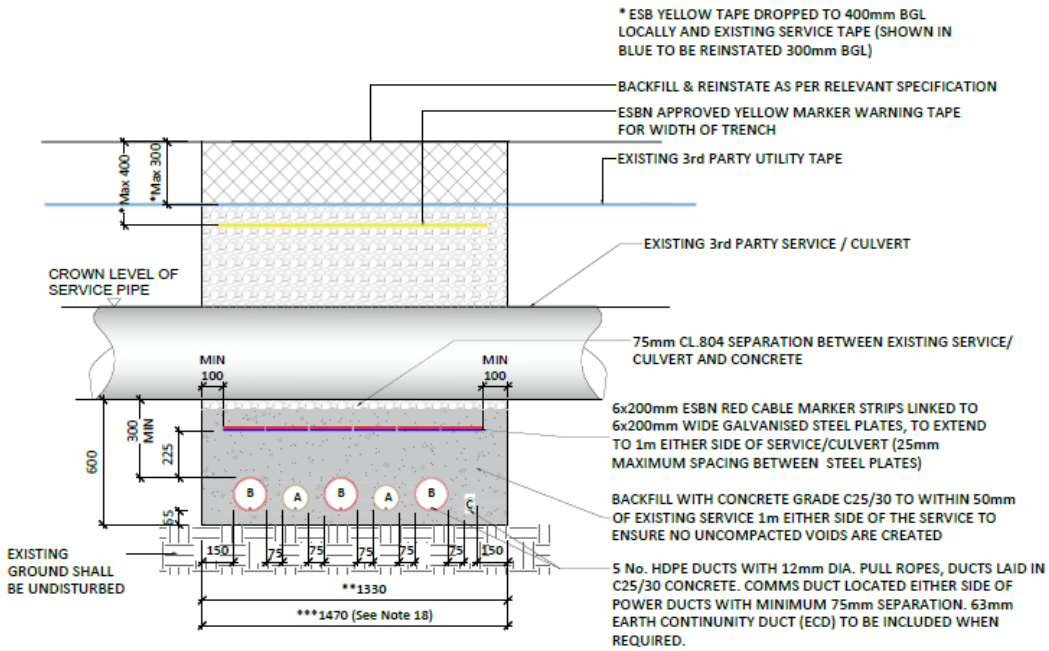

Figure 14 - Service undercrossing sectional view

10.0 Bridge Crossings

The Proposed Development will involve 9 No. bridge crossings including 8 No. HDD crossings and 1 No. crossings in the road on the bridge. 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 HDD is proposed.

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

9.1 Bridge 1 - Horizontal Directional Drilling

ITM Coordinates: 558345.19, 665647.18

Bridge 1 has insufficient room to install the cable to ESB/EirGrid specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to HDD 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 05641-231-P4 for further details.

Figure 15 - Bridge 1

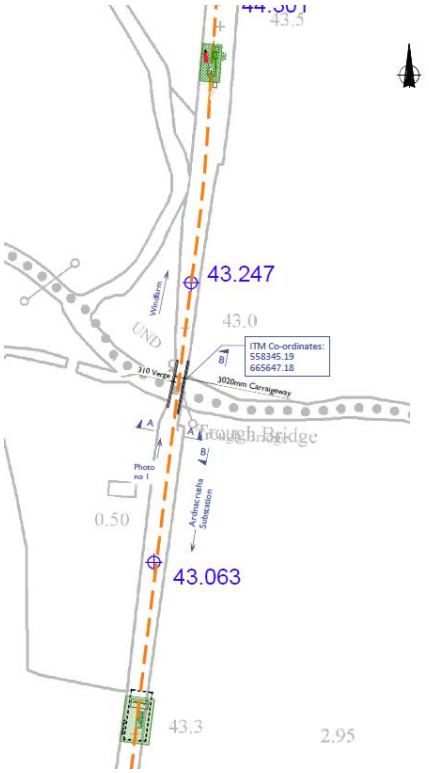

Figure 16 - Bridge 1 on OSI Background

9.2 Bridge 2 - Horizontal Directional Drilling

ITM Coordinates: 558923.04, 665964.19

Bridge 2 has insufficient room to install the cable to ESB/EirGrid specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to HDD 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 05641-232-P4 for further details.

Figure 17 - Bridge 2

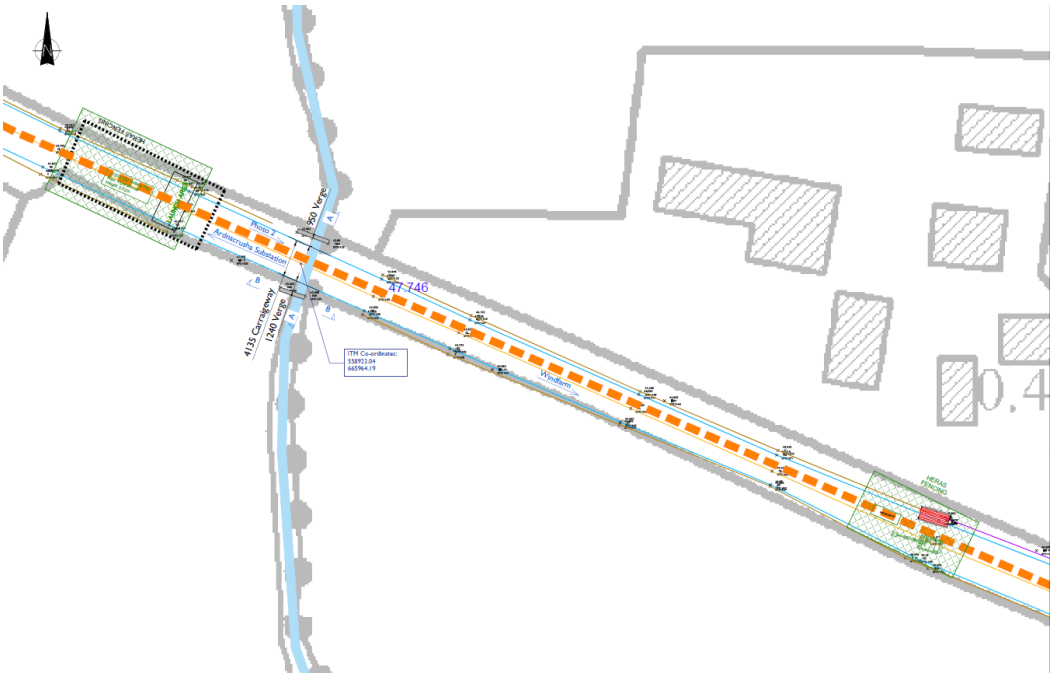

Figure 18 - Bridge 2 within R471 on OSI Background

9.3 Bridge 3 - Horizontal Directional Drilling

ITM Coordinates: 559988.32, 665884.64

Bridge 3 has insufficient room to install the cable to ESB/EirGrid specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to HDD approximately 1500mm beneath the waterway and away from bridge abutments. 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 05641-233-P4 for further details.

Figure 19 - Bridge 3

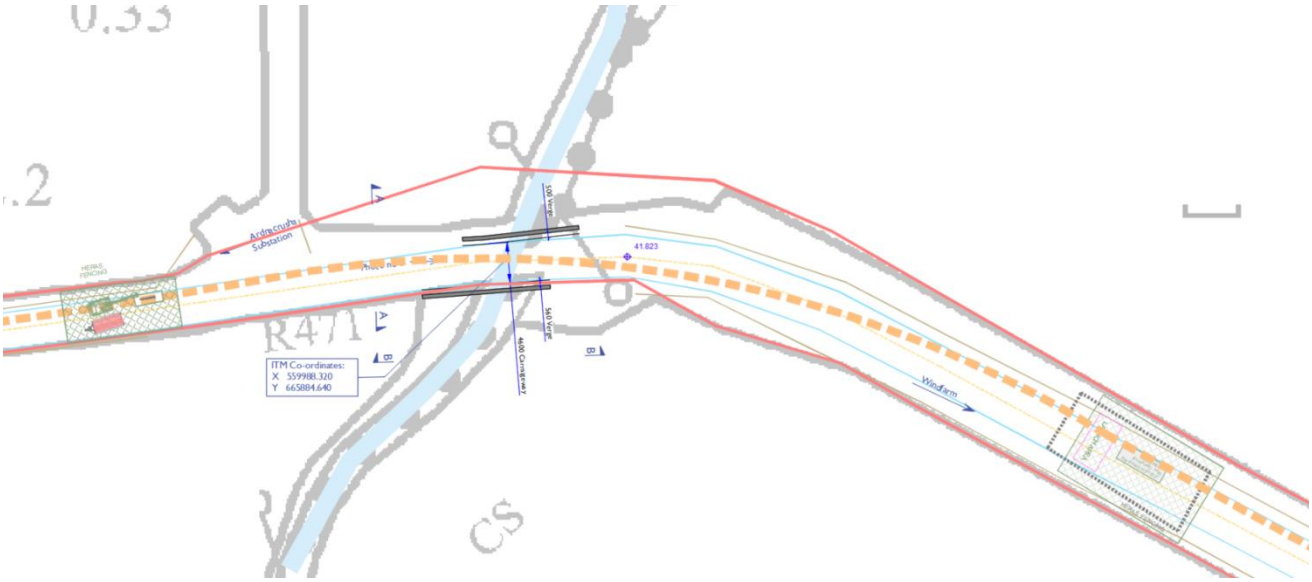

Figure 20 - Bridge 3 within L-3022-8 on OSI Background

9.4 Bridge 4 – Instatement within Road deck

ITM Coordinates: 562355.61, 670800.83

Bridge 4 has been found to have sufficient deck cover within the structure to accommodate UGC to comply with ESB/EirGrid specifications. The installation can be carried out within a Trefoil arrangement with a depth of 1315mm. This permanent reinstatement of a local route can be seen as per Drawing No. 05641-222-P4 with reinstatement of the bridge deck to be carried and will be completed to the specification of the Local Authority.

See Drawing 05641-234-P4 for further details.

Figure 21 - Bridge 4

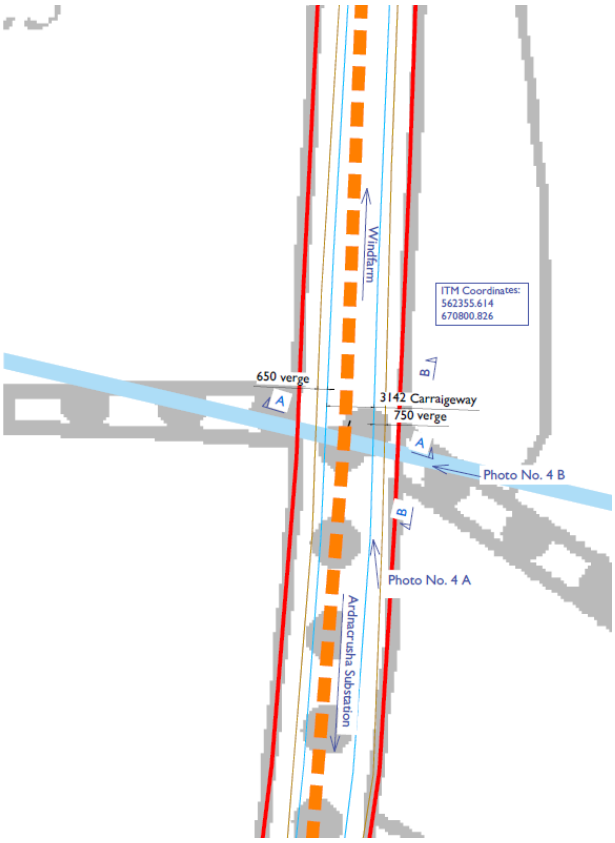

Figure 22 - Bridge 4 within L-3022-8 on OSI Background

9.5 Bridge 5 - Horizontal Directional Drilling

ITM Coordinates: 562388.62, 671852.72

Bridge 5 has insufficient room to install the cable to ESB specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to HDD 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 05641-235-P4 for further details.

Figure 23 - Bridge 5

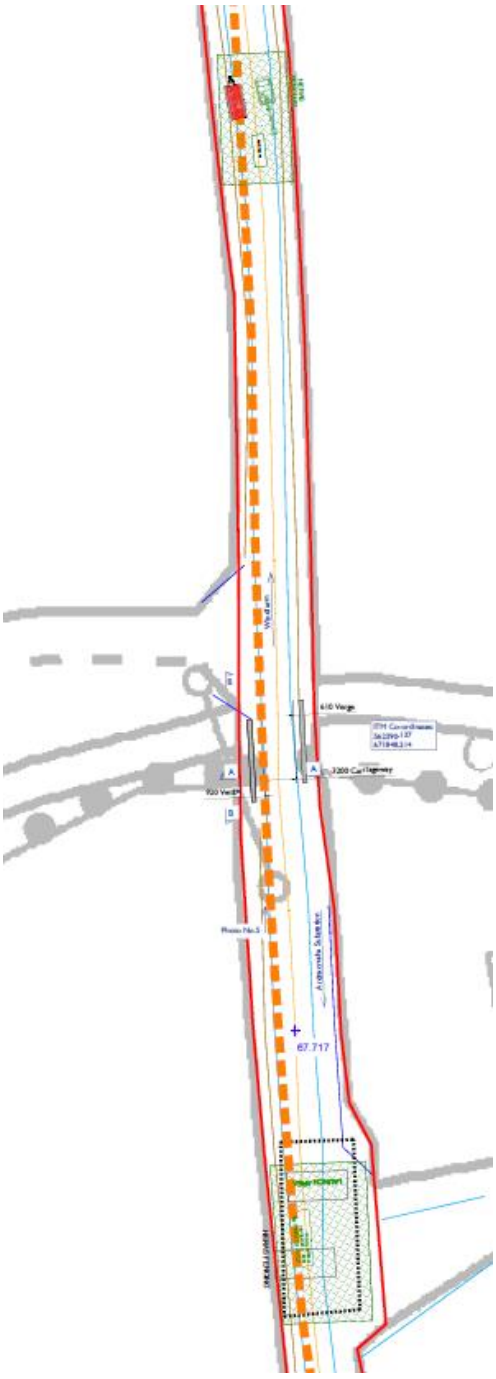

Figure 24 - Bridge 5 within L-3022-8 on OSI Background

9.6 Bridge 6 - Horizontal Directional Drilling

ITM Coordinates: 561986.58, 672643.56

Bridge 6 has insufficient room to install the cable to ESB/EirGrid specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to HDD approximately 1500mm beneath the waterway and away from bridge abutments. 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 05641-236-P4 for further details.

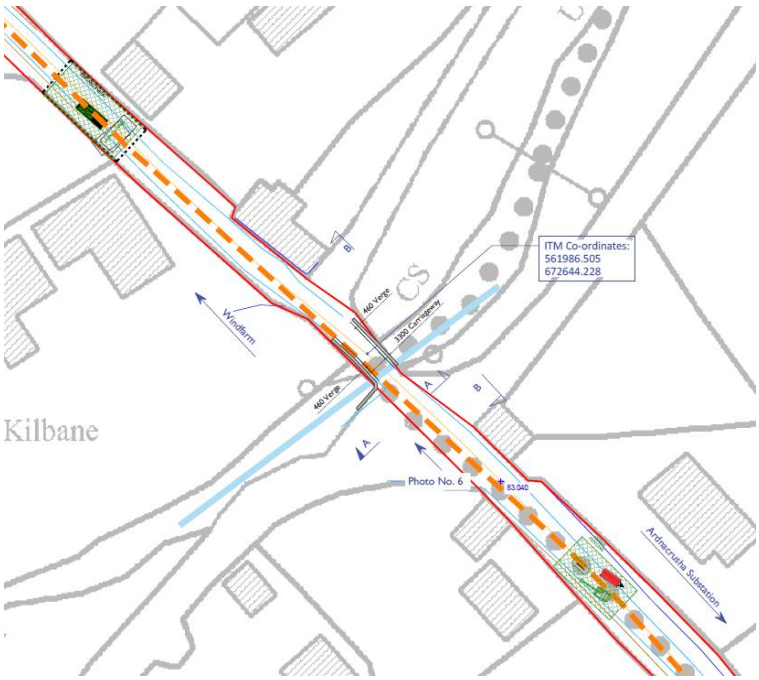

Figure 25 - Bridge 6 within L-3022-8 on OSI Background

Figure 26 - Side view of Bridge 6 facing southeast.

9.7 Bridge 7 – Horizontal Directional Drilling

ITM Coordinates: 561617.17, 672877.71

Bridge 7 has insufficient room to install the cable to ESB/EirGrid specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to HDD 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 05641-237-P4 for further details.

Figure 27 - Bridge 7

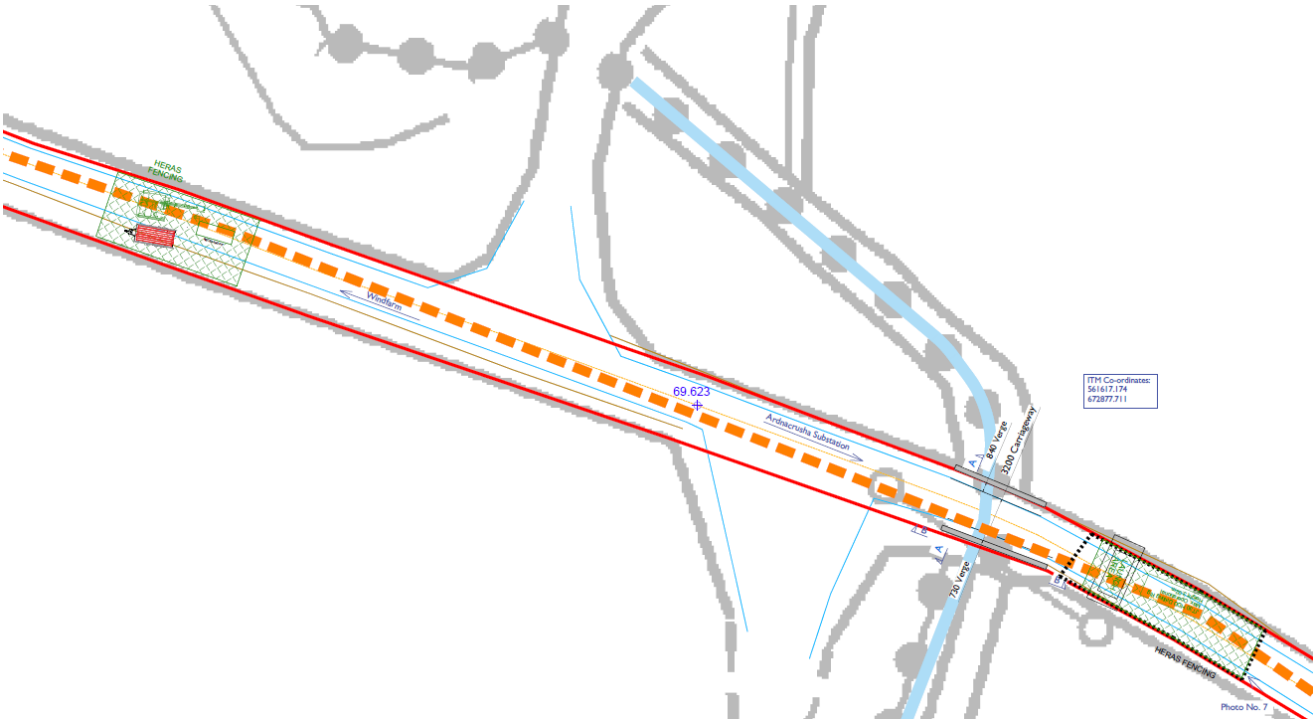

Figure 28 - Bridge 7 within L-3022-8 on OSI Background

9.8 Bridge 8 - Horizontal Directional Drilling

ITM Coordinates: 560685.3, 672949.2

Bridge 8 has insufficient room to install the cable to ESB/EirGrid specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to HDD 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 05641-238-P4 for further details.

Figure - Bridge 8

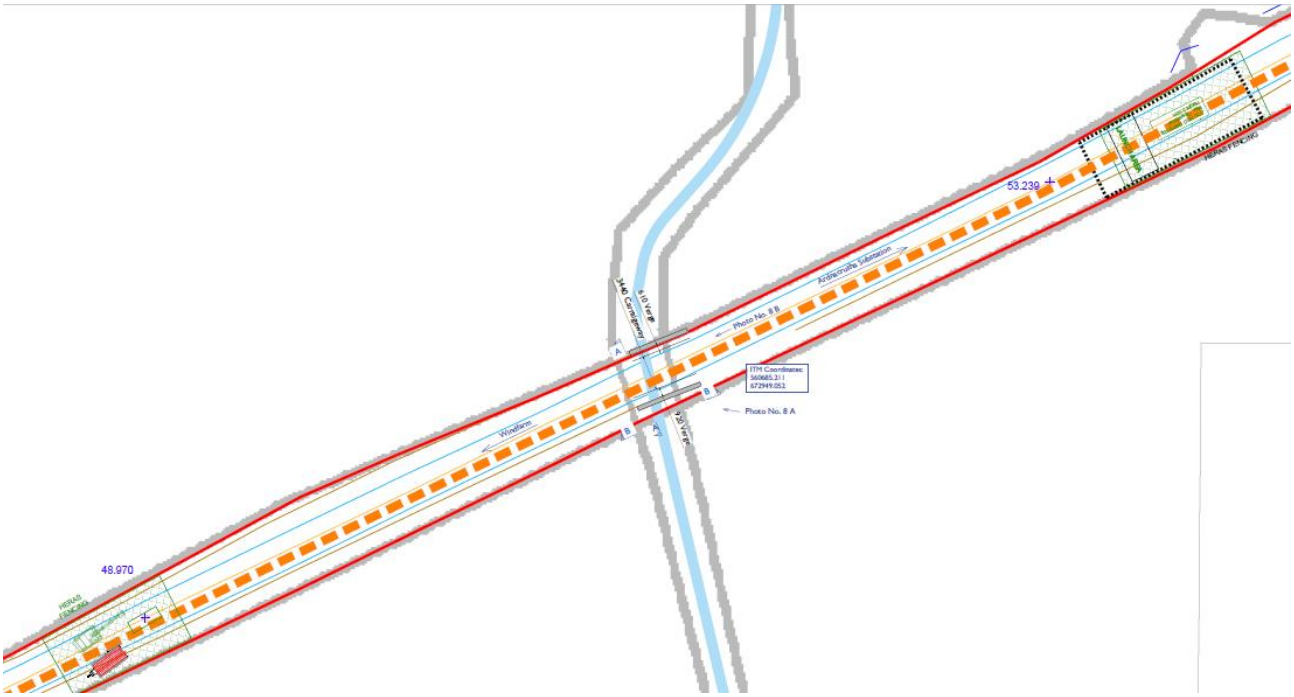

Figure 29 - Bridge 8 within L-3022-8 on OSI Background

9.9 Bridge 9 - Horizontal Directional Drilling

ITM Coordinates: 560488.76, 672919.67

Bridge 9 has insufficient room to install the cable to ESB/EirGrid specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to HDD 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 05641-239-P4 for further details.

Figure 30 - Bridge 9

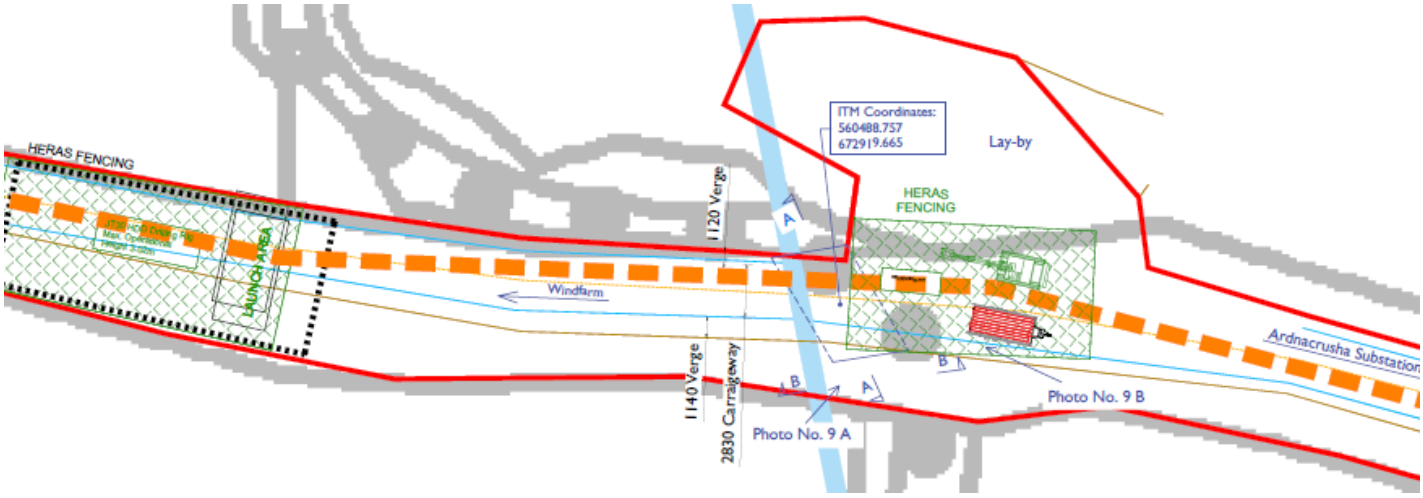

Figure 31 - Bridge 9 within L-3022-8 on OSI Background

10.0 Reinstatement of Private Land

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

11.0 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, environmental protection measures included within the planning application, measures proposed within the CEMP, and the guidance documents and best practice measures listed below. This method statement will be adhered to by the contractors and will be overseen by the Project Manager, Environmental Manager where relevant.

The following documents will contribute to the preparation of the method statements in addition to those measures proposed in Sections 12 to 15 below~~.~~ 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 set out in the EIAR and AASR.

12.0 Invasive Species Best Practice Measures

Please refer the Biodiversity Chapter (Chapter 6) of the EIAR for details and the Invasive Species Management Plan (ISMP) in Appendix 6-3, Volume III.

13.0 Waste Management

Please refer the Material Assets Chapter (Chapter 12) of the EIAR for details.

14.0 Implementation of Environmental Protection Measures

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

Appendix A – Culvert Crossings

Culvert Crossing Schedule					
Culvert No.	Dimensions (mm)	Material	Approx. Cover (mm)	Proposed Crossing Methodology	Photo
1.	350 Ø	Concrete	900	UNDERCROSSING	
2.	300 Ø	HDPE	200	UNDERCROSSING	
3.	2x600 Ø	Concrete	1800	OVERCROSSING	
4.	600 wide x 800 deep	Stone	1000	UNDERCROSSING	
5.	600 Ø	HDPE	200	UNDERCROSSING	
6.	250 Ø	Concrete	500	UNDERCROSSING	
7.	600 Ø	Concrete	700	UNDERCROSSING	
8.	400 wide x 500 deep	Stone	900	UNDERCROSSING	
9.	600 wide x 500 deep	Stone	900	UNDERCROSSING	

Culvert Crossing Schedule					
Culvert No.	Dimensions (mm)	Material	Approx. Cover (mm)	Proposed Crossing Methodology	Photo
10.	600 Ø	HDPE	500	UNDERCROSSING	
11.	300 Ø	HDPE	600	UNDERCROSSING	
12.	2x750 Ø	HDPE	2000	OVERCROSSING	
15.	300 Ø 375 Ø	HDPE HDPE	600 700	UNDERCROSSING	
16.	375 Ø	HDPE	700	UNDERCROSSING	
17.	375 Ø	HDPE	650	UNDERCROSSING	
18.	375 Ø	HDPE	350	UNDERCROSSING	
19.	600 Ø	HDPE	800	UNDERCROSSING