



Construction Methodology

Ballincor Wind Farm 110 kV Grid Connection

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1 Introduction

1.1 Background

TLI Group (“the Consultant”) were engaged by Tobin Consulting Engineers (“the Client”) to identify and analyse potential 110 kV grid connection options available for the Ballincor Wind Farm Project, which is currently being developed by RWE Renewables (“the Developer”) and will connect to the grid at ESB’s Dallow 110 kV Substation. This project will have an estimated Maximum Export Capacity (MEC) of 77 MW.

1.2 Purpose of this Document

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

The UGC works will consist of the installation of 6 no. ducts in an excavated trench to accommodate 3 no. power cables, 2 no. fibre communications cables and 1 no. earth continuity conductor (ECC) where required. The fibre communications cable will allow communications between the proposed Ballincor Wind Farm 110 kV Substation and ESB Dallow 110 kV Substation.

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

2 Proposed Grid Connection Route Summary

2.1 Grid connection route Overall Location

The Grid connection route is approximately 12.23 km in length and will travel in a northerly direction from the proposed Ballincor Wind Farm 110 kV Substation to the existing ESB Dallow 110 kV Substation with most of the Grid connection route situated in the public road network. The first 8.57 km of the Grid connection route will be in County Tipperary, with the final 3.66 km of the Grid connection route being in County Offaly.

The Grid connection route begins by exiting the Ballincor 110 kV Substation, located approximately 5 km southwest from the outskirts of Birr Town. The UGC exits under the northwest boundary of the wind farm substation, travelling northwest for a short distance through private land before reaching the L-1071 public road.

The Grid connection route turns in a north-easterly direction from the townland of Cronekill along the L-1071 road for approximately 4.7 km before merging onto the N-52 national secondary road around Riverstown Village heading towards Birr Town. At this location, the Grid connection route is required to avoid a NIAH protected bridge (Bridge 1) (TN-N52-088-00) which was built to cross over the disused Parsonstown (Birr) to Portumna Bridge railway line.

Prior to arriving at the bridge, it is proposed that the Grid connection route will be routed into private land on the east side of the bridge and southeast side of the road. From this private land the Grid connection route will be installed parallel to the road by means of horizontal directional drilling (HDD). Once the Grid connection route exits the HDD section it will merge onto the N-52 via standard open trenching method. The route continues northeast through Riverstown Village along the N-52 for approximately 160 m before turning northwest onto the R-489 regional road.

The route continues northwest on the R-489 regional road for approximately 1.2 km before turning north on to the L-5045 local road where it passes Killeen National School. The route continues northward along the L-5045 for 1.65 km before turning east at the T-junction with the L-1077 Croghan Road heading toward Birr Town.

The Grid connection route will travel east along this road for approximately 1.08 km. 150 m from the T-junction there is a Cattle Pass that crosses perpendicular under the L-1077 Croghan Road. Due to insufficient cover in the road over the Cattle Pass the Grid connection route will pass under it by using road-to-road horizontal directional drilling (HDD). Further along the L-1077 (approximately 0.53 km east of the Cattle Pass) the Grid connection route must cross the Little Brosna River. To do this the Grid connection route will cross from the public road into the private lands on the north side of the road crossing Croghan Bridge over the river. The river will be crossed within the private land on both sides of the river by HDD. On the east side of the river the Grid connection route will transition back onto the L-1077 approximately 300 m east of the T-junction which joins the L-1077 with the R-439 Eden Road / Banagher Road.

At this junction, the Grid connection route turns north along Eden Road (R-439). Eden Road (R-439) is located wholly within Birr Town and becomes Cappaneale Upper/ Banagher Road (R-439) after approximately 125 m. The Grid connection route follows the R-439 north for approximately 2.44 km.

Just south the R-439 regional road junction with the L-70152 local road the Grid connection route will turn eastward transition from the regional road to private land on the south side of the junction where the R-439 regional road meets the local road approaching ESB Dallow 110 kV substation. It is proposed to install parallel with the local road due to the presence of existing services in the local road. Once in the private land the Grid connection route will run parallel with the local road inside the ditch line two adjoining fields. The fields are separated by a farm track which runs perpendicular to the local road. The Grid connection route will run within the private land and parallel to the local road for approximately 580 m until crossing across the same local road and up to the gate at the entrance to ESB Dallow Substation.

The overall location of the grid connection route, the Ballincor Wind Farm boundary and ESB Dallow 110 kV Substation are shown in Figure 2.1 below.



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

2.2 Grid connection route Summary

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

Description	Route Length
National Roads	0.16 km
Regional Roads	3.64 km
*Local Primary Roads	4.78 km
Local Secondary Roads	1.65 km
Total Road Network	10.23 km
*Private Lands (Including ESBN Dallow Substation Site)	2.10 km
Total Off Road Network	2.10 km
Total Route Length	12.23 km

Table 2.1: Grid Connection Route Summary

*Length depends on HDD on road or off-road option taken.

2.3 Section-by-Section Summary

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

Ref	Section Description	Route Length
Section 1	Wind Farm Substation joining to L-1071 from Cronekill to the junction with N-52	4.745 km
Section 2	The junction of L-1071 with N-52 to the junction of R-489 with L-5045 Killeen	1.43 km
Section 3	The junction of the R-489 with L-5045 Killeen to the Bridge 6 over on the L-1077 Croghan Road	2.43 km
Section 4	Birr Town inside the 50 km/h zone	1.045 km
Section 5	R- 439 Cappaneale Upper to just before the junction of the L-70152	1.7 km
Section 6	Just before the junction of the L-70152 to Dallow 110 kV Substation	0.88 km
Total		12.23 km

Table 2.2: Grid Connection Route Section Summary

2.3.1 Route Section 1 Summary (4.745 km)

The grid connection route begins within the proposed Ballincor Wind Farm 110 kV Substation and travels approximately 0.83 km within private land before joining the L-1071 local road. The grid connection route follows the L-1071 local road northeast from the townlands of Castletown Hoctor until it reaches the junction with the N52 around the townlands of Ballyloughnane North.

Features:

There is one watercourse (W1) encountered on this section, and will be undercrossed by means of horizontal directional drilling (HDD) in the road and under the culverted stream. The watercourse is approximately located 4.175 km along the cable route.

1. Joint Bay 01 (JB-01) will be located approximately at chainage mark 535 m on this section. It is proposed that this Joint Bay will be installed within the wind farm/substations access road.

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2. Joint Bay 02 (JB-02) will be located approximately 546 m north of joint bay 1. It is proposed that this Joint Bay will be installed within the L-1071 local road.
3. Joint Bay 03 (JB-03) will be located approximately 545 m north of joint bay 2. It is proposed that this Joint Bay will be installed within the L-1071 local road.
4. Joint Bay 04 (JB-04) will be located approximately 705 m from joint bay 3. It is proposed that this Joint Bay will be installed within the L-1071 local road.
5. Joint Bay 05 (JB-05) will be located approximately 688 m from joint bay 4. It is proposed that this Joint Bay will be installed within the L-1071 local road.
6. Joint Bay 06 (JB-06) will be located approximately 725 m from joint bay 5. It is proposed that this Joint Bay will be installed within the L-1071 local road.
7. Joint Bay 07 (JB-07) will be located approximately 722 m from joint bay 6. It is proposed that this Joint Bay will be installed within the L-1071 local road.

2.3.2 Route Section 2 Summary (1.43 km)

This section of the grid connection route starts by avoiding a NIAH protected bridge (Bridge 1) (Reg. No. 22400514) (TN-N52-088-00) located on the N-52 national road which as previously mentioned was built to cross over the now disused Parsonstown (Birr) to Portumna Bridge railway line. The grid route will avoid the bridge by using off-road horizontal directional drilling (HDD). The HDD will be located in the private land on the southeast side of the bridge. The grid route will transition from the private land on the southeastern side of the N-52 by using standard trenching techniques. The grid connection route will remain in the N-52 national road for approximately 160 m before turning northwest onto the R-489 regional road. The grid connection route remains in the R-489 regional road for approximately 1.2 km until it reaches the junction of the L-5045 Killeen local road where it turns north.

Features:

There is one watercourse/culvert (W2) encountered on this section of the grid connection route 175 m northwest of joint bay 08 on the R-489 regional road. The crossing method for this watercourse/culvert is proposed to be an overcrossing in flat formation.

- Joint Bay 008 (JB-08) will be located approximately 766 m from joint bay 7. It is proposed that this Joint Bay will be installed within the northwest bound carriageway of the R-489 regional road.
- Joint Bay 09 (JB-09) will be located approximately 767 m from joint bay 8. It is proposed that this Joint Bay will be installed within the northwest bound carriageway of the R-489 regional road.
- The route crosses through the zone of notification for National Monuments Service (NMS) Sites and Monument Record (SMR) TN005-021.

2.3.3 Route Section 3 Summary (2.43 km)

Section 3 for the grid connection route start at the T-junction where the L-5045 local road meets the R-489 regional road. This junction is wide and within the 60 km/h speed limit of Riverstown village. Killeen National School is located on the northwest side of the T-junction at approximate 170 m northwest of joint bay 9. From here the route progresses north along the L-5045 for its entire length (approximately 1.650 m) until it reaches the T-junction with the L-1077 Croghan Road. The L-5045 has no road markings. The speed limit on the L-5045 is 60 km/h. At the T-junction where the L-5045 and the L-1077 Croghan Road meet the grid route turns east and heads towards the Croghan Bridge which passes over the Little Brosna River on the outskirts of Birr Town.

Features:

There is a cattle pass crossing perpendicularly under the L-1077 Croghan Road located at approximately 150 m east of the junction with the L-5045 local road. The Cattle Pass will be undercrossed by using a road-to-road HDD.

- Joint Bay 10 (JB-10) will be located on the L-5045 local secondary road approximately 728 m from joint bay 9.

- Joint Bay 11 (JB-11) will be located on the L-5045 local secondary road approximately 700 m from joint bay 10.
- Joint Bay 12 (JB-12) will be located on the L-1077 Croghan Road approximately 729 m from joint bay 11.

There is one NIAH protected bridge (Croghan Bridge) (Reg. No. 22400527), (Bridge 2 (W3)) on this section of the grid connection route at approximately 378 m from joint bay 11 (to the centre of the bridge). The bridge will be avoided by crossing the Little Brosna River by using an off-road HDD in the private lands on the north side of the bridge.

There is one stormwater outfall pipe (W4) (525 mm Ø ID) which run in the private land on the east side of the Little Brosna River and parallel to the L-1077 Croghan Road. This pipe has been avoided and taken into consideration with the initial design of the off-road HDD crossing of the Little Brosna River.

2.3.4 Route Section 4 Summary (1.045 km)

This section of the grid connection route starts inside the 50 km/h speed limit zone on the western side of Birr town. The route continues eastward along the L-1077 Croghan Road until it reaches a T-junction with the R-439 (Eden Road) at approximately 280 m from the centre of joint bay 13. From the T-junction the grid connection route turns northward and this section of the route finishes on the northwestern outskirts of Birr Town at the 80 km/h speed limit sign.

Features:

- Joint Bay 13 (JB-13) will be located on the L-1077 Croghan Road approximately 478 m from joint bay 12.
- Joint Bay 14 (JB-14) will be located on the R-439 Cappaneale Upper approximately 451 m from joint bay 13.
- Joint Bay 15 (JB-15) will be located on the R-439 Cappaneale Upper approximately 463 m from joint bay 14.

There is a stormwater pipe, and a culvert crossing (W5 and W6) encountered on this section of the grid connection route. The first is the same stormwater outfall pipe encountered (W4) in Section 3 above. This pipe runs in parallel with and across the grid connection route from the east bank of the little Brosna River until the T-junction where the L-1077 Croghan Road meets the R-439 regional road in Birr Town. This pipe must be crossed once more approximately 68 m from the centre of joint bay 13. The second crossing is a culvert (W6) which is located approximately 40 m north from the centre of joint bay 15. This culvert is be buried diagonally under the R-439 regional road for some distanced.

2.3.5 Route Section 5 Summary (1.7 km)

Section 5 of the grid connection route will be installed in the R-439 regional road heading north away from Birr Town. This section of the route is relatively flat with three relatively slow long bends. The grid connection route travels north until just before the turning for the L-70152 local road heading west towards ESB Dallow Substation. This junction is approximately 195 m north from the centre of joint bay 17. At this point, the route will turn in an easterly direction before entering private land on the southern side of the local road on the approach to the ESB Dallow 110 kV Substation.

Features:

- Joint Bay 16 (JB-16) will be located on the R-439 Cappaneale Upper approximately 812 m from joint bay 15.
- Joint Bay 17 (JB-17) will be located on the R-439 Cappaneale Upper approximately 769 m from joint bay 16.

There are two watercourse/culverts (W7 and W8) on this section of the grid connection route. The intention is to cross over Culvert 7 and cross under Culvert 8. Both crossings will be completed using flat formation duct/trench configurations.

2.3.6 Route Section 6 Summary (0.88 km)

The final section of the grid connection route will mainly run in the private farmland to the east side of the L-70152 local road that leads to ESB Dallow 110 kV Substation. The grid connection route will travel through three fields and

parallel to the L-70152 local road. At approximately 575 m from where the grid connection route turned into the private land from the R-439 regional road the route will turn in a northerly direction before crossing the L-70152 local road perpendicularly as it arrives at the ESB Dallow substation gate. As there has not been a cable bay or route allocated at this time by ESNB the proposed grid connection route follows the substation road and finishes at the centre of the substation. The final section of the grid connection route inside the ESB Dallow Substation will require further consideration by ESNB and the grid connection route designer during the detailed design phase of the project.

Features:

There is one culvert (W9) on this section of the grid connection route. The intention is to cross under Culvert 9. This crossing will be completed using flat formation duct/trench configurations.

There is one joint bay (JB-18) on this section of the route which is currently located at the start of the ESNB roadway into Dallow 110 kV Substation at approximate 792 m from joint bay 17

There is one 38 kV underground cable crossing on this section of the grid connection route. The grid connection route will cross under this cable as per EirGrid/ESB safety requirements at a location still to be determined in the area around the substation gate.

3 Preliminary Site Investigations

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

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

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

Traffic Management: No known traffic management requirements.

Mechanical Equipment:

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

4 Access Routes to Work Area

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

A Traffic Management Plan (TMP) will be prepared and agreed with the various stakeholders who have a wayleave agreement along the affected construction area, prior to the commencement of construction. Some work areas will require a road closure where it is not possible to safely implement a Stop/Go system. Where road closures are necessary, a suitable diversion will be implemented using appropriate signage, following consultation with

Tipperary/Offaly County Council. While potential diversion routes need to be agreed with Tipperary/Offaly county councils, suggested routes are included in Appendix 2-2 TMP.

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

5 Traffic Management

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

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

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

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

All traffic management measures will comply with those outlined within the accompanying EIAR and will be incorporated into a detailed Traffic Management Plan to be prepared, in consultation with Tipperary/Offaly County Council prior to the commencement of UGC construction.

6 Road Opening Licence

The UG grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-15 from both Tipperary/Offaly County Council. A Traffic Management Plan (TMP) will be agreed with Tipperary/Offaly County Council prior to the commencement of the development. The TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with Tipperary/Offaly County Council in advance of the preparation of the TMP.

7 Construction Hours

Standard working hours for construction will be 7:00 - 19:00 Monday to Friday, and 7:00 - 14:00 on Saturday (if required), with no works on Sundays or bank holidays except in exceptional circumstances or in the event of an emergency.

8 UGC Construction Methodology

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

8.1 Trenching Methodology

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

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures included within the EIAR and as required by planning conditions where relevant.
- All existing underground services along the Grid connection route shall be confirmed prior to the commencement of construction works.
- At watercourse crossings, the contractor will be required to adhere to the environmental control measures outlined within the EIAR, the detailed Construction Environmental Management Plan (CEMP) and best practice construction methodologies.
- Where the cable route intersects with culverts, the culvert will remain in place (where possible) and the ducting will be installed either above or below the culvert to provide minimum separation distances in accordance with ESBN and Uisce Éireann specifications.
- If culverts require removal for ducting installation, a suitable method of damming the water source and pumping the water around the work area will be set out in a method statement and agreed with the relevant stakeholders. Once the ducts are installed the culvert will be reinstated to match existing levels and dimensions. If works of this nature are required, the contractor will liaise with Inland Fisheries Ireland (IFI) in advance of works.
- Traffic management measures will be implemented in accordance with those included in Section 14.1 of the EIAR, and a detailed Traffic Management Plan will be prepared and agreed with the local authority.
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2 m in height. Stockpiles will be located a minimum of 50 m from surface water features and all stockpiling locations will be subject to approval by the site manager and project Ecological Clerk of Works (ECoW).
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be managed in accordance with the waste management act as amended.
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature.
- Where required, grass will be reinstated by either seeding or by replacing with grass turves.
- No more than a 100-metre section of trench will be opened at any one time. The second 100-metre section will only be excavated once most of the reinstatement has been completed on the first section.

- The excavation, installation and reinstatement process will take on average of two days to complete a 100-metre section.
- Where the cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together.
- Following the installation of ducting, pulling the cable will take approximately one day between each joint bay. The jointing of cables will take approximately 1 week per joint bay location.



Figure 8.1: Typical 110 kV Underground Duct Installation

8.2 Ducting Installation Methodology

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

1. Road will be marked out and surface removed to the required depth
2. Grade, smooth and trim trench floor when the required 1315 mm depth and 825 mm width have been obtained.
3. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material and compact it so that the compacted thickness is as per the drawings.
4. Lay the bottom row of ducts as detailed on the design drawings. Use spacers/templates 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.
5. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
6. Place cable protection strips on compacted CBGM B directly over the ducts.
7. 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.
8. Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.
9. Place red cable protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.
10. 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.
11. For concrete and asphalt/bitmac road sections, carry out immediate permanent reinstatement in accordance with the TII specification and to the approval of the local authority and/or private landowners, unless otherwise agreed with local authorities (Figure 8.2).

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

8.4 Cable Pulling

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

8.5 Marker Posts

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

Marker posts will be used on non-roadway routes to delineate the cable route and joint bay positions. Corrosion proof aluminium triangular danger sign, with 700 mm base, and with centred lightning symbol, on engineering grade fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker post shall also be placed in the event that burial depth is not to standard. Siting of marker posts to be dictated by ESBN as part of the detailed design process (Figure 8.4).

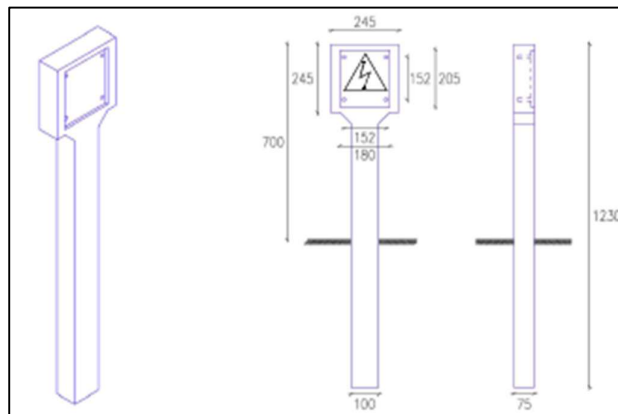


Figure 8.4: Typical ESB Marker Post Example

8.6 Managing Excess Material from Trench

All excavated material will be temporarily stored adjacent to the trench prior to re-use in the trench reinstatement (where applicable). Stockpiles will be restricted to less than 2 m in height. Where excess material exists, it may be managed in accordance with waste management act 1996 as amended. Excavated tar from the public road network will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility.

8.7 Storage of Plant and Machinery

All plant, machinery and equipment will be stored on site within the UGC works area or within the temporary construction compound to be located nearby to the proposed wind farm substation. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds.

8.8 Joint Bays and Associated Chambers

Joints bays are to be installed with various separation distances approximately between every 450 m – 850 m along the grid connection route to facilitate the jointing of two lengths of underground cables. Joint bays are typically 2.6 m x 6 m x 1.75 m pre-cast concrete structures installed below finished ground level (Figure 8.5). Where possible joint bays will be in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this will not always be possible.

In association with joint bays, communication chambers are required at every joint bay location to facilitate communication links between the proposed 110 kV wind farm substation and the existing 110 kV node at Dallow 110 kV Substation. Earth sheath link chambers are also required at every joint bay along the cable route. Earth sheath links are used for earthing and bonding cable sheaths of underground power cables, so that the circulating currents and induced voltages are eliminated or reduced. Earth sheath link chambers and communication chambers are located in proximity to joint bays. Earth sheath link chambers and communication chambers will typically be pre-cast concrete structures with an access cover at finished surface level.

The precise siting of all joint bays, earth sheath link chambers, and communication chambers is subject to approval by ESBN/EirGrid. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions. The marker posts will consist of a corrosion-proof aluminium triangular danger sign, with a 750 mm base, and with a centred lightning symbol, on engineering grade fluorescent yellow background. They will be installed inadequately sized concrete foundations and will also be placed where the cable has not been buried to the standard depth, due to existing road conditions. Drawings of the joint bays and communication chambers are included within this planning package.

Equipment:

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

Materials:

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

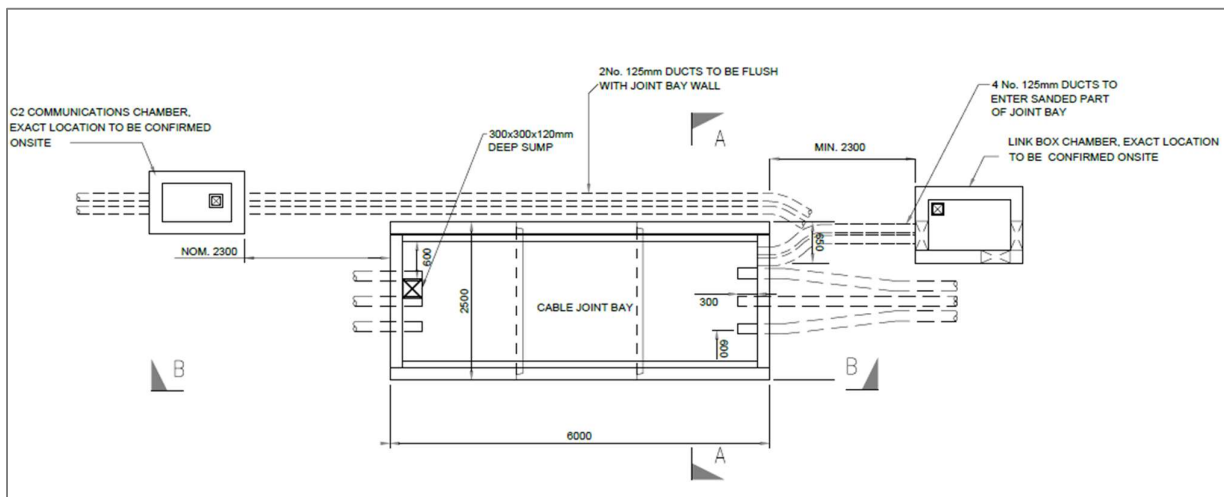


Figure 8.5: Typical Joint Bay and Link Box Plan Layout

8.9 Joint Bay Construction and Cable Installation

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

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

If the joint bay needs to be dewatered, this will be pumped to a 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 sandbags and geotextile sheeting or silt fencing to contain any solids in run-off.

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

1. The contractor will excavate a pit for joint bay construction, including for a sump in one corner.
2. Grade and smooth floor; then lay a 75 mm depth of blinding concrete (for in situ construction) or 50 mm thick sand (for pre-cast concrete construction) on 200 mm thick Clause 804 granular material.
3. In situ construction. Construct 200 mm thick reinforced concrete floor slab with sump and starter bars placed for walls as detailed on the drawings.
4. In situ construction. Construct 200 mm thick reinforced concrete sidewalls as detailed on the drawings. (Figure 8.6)



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

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



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

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



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

7. Where joint bays are located under the road surface the joint bay will be backfilled with compacted layers of Clause 804 and the road surface temporarily reinstated as specified by the local authority.
8. Precast concrete covers may be used as temporary reinstatement of joint bays at off road locations. These covers are placed over the constructed joint bay and are then removed at the cable installation stage of the project.
9. Later, to facilitate cable installation and jointing, reinstate traffic management signage, secure individual sites, re-excavate three consecutive joint bays and store excavated material for reuse.
10. The cable is supplied in pre-ordered lengths on large cable drums (Figure 8.9). Installing “one section” of cable normally involves pulling three individual conductors into three separate ducts. The cable pulling winch must be set at a predetermined cut off pulling tension as specified by the designer. The cable will be connected to the winch rope using approved suitably sized and rated cable pulling stocking and swivel or the pulling head fitted by the cable manufacturer. A sponge may also be secured to the winch rope to disperse lubricant through the duct. Lubrication is also applied to the cable in the joint bay before it enters the duct.



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

11. Once the two sections of cable (total of 6 conductors) are pulled into the joint bay, a jointing container is positioned over the joint bay and the cable jointing procedure is carried out in this controlled environment. (Figure 8.10)



Figure 8.10: HV Cable Jointing Container

12. Following the completion of jointing and duct sealing works in the joint bay, place and thoroughly compact cement-bound sand in approximately 200 mm layers to the level of the cable joint base to provide vertical support. Install additional layers of cement-bound sand and compact each layer until the cement-bound sand is level with the top of the joint. Install an additional 100 mm cement-bound sand layer. Install cable protection strip. Backfill with cement-bound sand to a depth of 250 mm below surface and carry out permanent reinstatement including placement of warning tape at 400 mm depth below finished surface.

Equipment:

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

Materials:

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

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

8.10 Horizontal Directional Drilling

Horizontal Directional Drilling (HDD) is a method of drilling under obstacles such as bridges, railways or watercourses in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. There are several bridges, a cattle pass and culverts located along the grid connected underground cable route which will require HDD due to there being insufficient cover and depth in the bridge to cross within the bridge deck.

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

The drilling methodology is as follows:

1. A works area of circa. 40m² (to be confirmed by a specialist drilling contractor) will be fenced on both sides of the obstacle, bridge or culvert to be crossed under.
2. The drilling rig and fluid handling units will be located on one side of the obstacle, bridge or culvert 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 (approximately 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 obstacle, bridge or culvert.
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 EirGrid/ESB Networks and Tipperary/Offlay County Council.
13. A transition coupler or transition chamber will be installed at either side of the obstacle, bridge or culvert following the horizontal directional drilling as per EirGrid requirements, this will join the HDD ducts to the standard ducts.

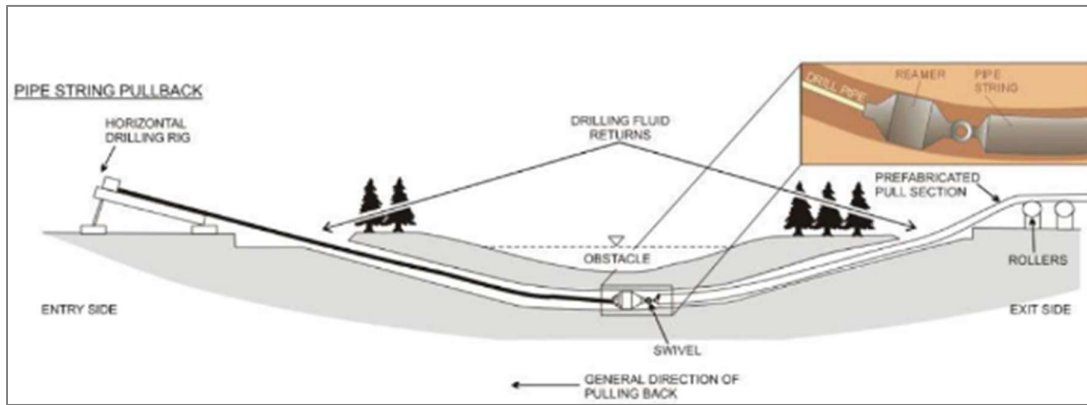


Figure 8.11: Illustration of HDD Installation

8.11 Watercourse Damming and Reinstatement Methodology

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

Duration: 1-2 Days per location

Personnel, Machinery & Equipment:

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

8.11.1 Standard Methods- Dam & Flume Work:

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

8.11.2 Standard Methods- Dam & Divert Work

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

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

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

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

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

8.12 Replacement of Existing Culverts

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

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

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

9 Design and Construction & Environmental Management

Prior to commencement of construction works the contractor will draw up detailed Method Statements which will be informed by this Outline Construction Methodology, measures proposed within the CEMP, and the guidance documents and measures listed below. These method statement will be adhered to by the contractors and will be overseen by the Project Manager, Environmental Manager and ECoW where relevant.

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

- Inland Fisheries Ireland (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters. Inland Fisheries Ireland, Dublin;
- National Roads Authority (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority, Dublin;
- E. Murnane, A. Heap and A. Swain. (2006) Control of water pollution from linear construction projects. Technical guidance (C648). CIRIA;
- E. Murnane et al., (2006) Control of water pollution from linear construction projects. Site guide (C649). CIRIA.
- Murphy, D. (2004) Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin;
- H. Masters-Williams et al (2001) Control of water pollution from construction sites. Guidance for consultants and contractors (C532);
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines;
- Law, C. and D'Aleo, S. (2016) Environmental good practice on site pocket book. (C762) 4th edition. CIRIA;
- CIRIA Environmental Good Practice on Site (fourth edition) (C741) 2015.
- The proposed works will be carried out by employing accepted good work practices during construction, and environmental management measures such as those discussed below. Please note that the following measures will be supplemented by further specific environmental protection measures that will be included in method statements prepared for specific tasks during the works and will form part of the detailed CEMP.
- All materials shall be stored at the temporary compound within the wind farm sites and transported to the works zone immediately prior to construction;
- Where drains and watercourses are crossed with underground cables, the release of sediment will be prevented through the implementation of best practice construction methodologies.
- Weather conditions will be considered when planning construction activities to minimise risk of run off from site;
- Provision of 10 m exclusion zones and barriers (silt fences) between any excavated material and any surface water features to prevent sediment washing into the receiving water environment;
- If dewatering is required as part of the proposed works e.g. in trenches for underground cabling or in wet areas, water must be treated prior to discharge;
- The contractor shall ensure that silt fences are regularly inspected and maintained during the construction phase;
- If very wet ground must be accessed during the construction process bog mats/aluminium panel tracks will be used to enable access to these areas by machinery. However, works will be scheduled to minimise access requirements during winter months;
- The contractor shall ensure that all personnel working on site are trained in pollution incident control response. A regular review of weather forecasts of heavy rainfall is required, and the Contractor is required to prepare a contingency plan for before and after such events;
- The contractor will carry out visual examinations of local watercourses from the proposed works during the construction phase to ensure that sediment is not above baseline conditions. In the unlikely event of water quality concerns, the Environmental Manager and ECoW will be consulted;
- Excavations will be left open for minimal periods to avoid acting as a conduit for surface water flows.
- Only emergency breakdown maintenance will be carried out on site. Emergency procedures and spillage kits will be available and construction staff will be familiar with emergency procedures.

- Appropriate containment facilities will be provided to ensure that any spills from vehicles are contained and removed off site. Adequate stocks of absorbent materials, such as sand or commercially available spill kits shall be available;
- Concrete or potential concrete contaminated water run-off will not be allowed to enter any watercourses. Any pouring of concrete (delivered to site ready mixed) will only be carried out in dry weather. Washout of concrete trucks shall be strictly confined to a designated and controlled wash-out area within the solar farm sites; remote from watercourses, drainage channels and other surface water features;
- Entry by plant equipment, machinery, vehicles and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or 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 50 m hydrological buffer at all times.

10 Relocation of Existing Services

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

10.1 Underground Cables

If existing underground cables are found 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.

10.2 Gas Networks

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

10.3 Water Mains

Uisce Eireann will need to be consulted and advised on details of the project and associated technical information largely comprising drawings and schedules with details of proposed crossings etc. with as much available information as possible. Early engagement between Uisce Eireann 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.

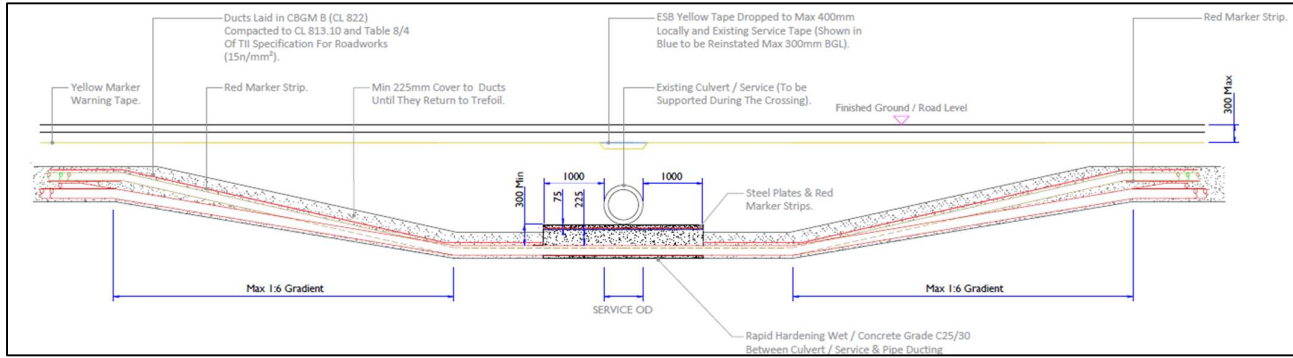


Figure 10.1: 110 kV UGC Culvert/Service Undercrossing

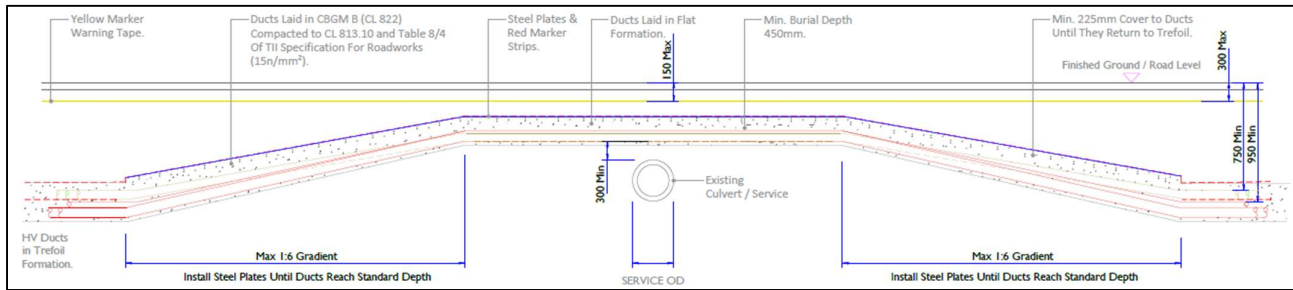


Figure 10.2: 110 kV UGC Culvert/Service Overcrossing

11 Reinstatement of Private Lands

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

12 Emergency Response Plan

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

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

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

13 Invasive Species Best Practice Measures

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

- The contractor will prepare an Invasive Species Action Plan to be implemented during construction, and all personnel will be made aware of the requirements contained within;

- Plant and machinery will be inspected upon arrival and departure from site and cleaned/washed as necessary to prevent the spread of invasive aquatic/ riparian species such as Japanese knotweed Fallopija japonica and Himalayan Balsam Impatiens glandulifera. A sign off sheet will be maintained by the contractor to confirm the implementation of measures:
- Site hygiene signage will be erected in relation to the management of non-native invasive material.

14 Waste Management

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

15 Archaeology

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

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

16 Provisional Grid Route Programme

Estimates for the duration of the construction works are included in the table below. Please note that some of the elements are likely to happen concurrently, therefore the overall start-to-finish duration is estimated to be 6 - 9 months.

Estimated Construction Duration	
Development Element	Estimated Construction Duration
Ballincor Wind Farm 110 kV Cable Route	6 - 8 months
Cable Testing and Commissioning	6 weeks
<u>Total</u>	6 - 9 months

Table 16.1: Estimated Construction Duration