OUTLINE CONSTRUCTION METHODOLOGY

Cappakeel Solar Farm 110 kV

Grid Connection and Substation

Perigus Energy

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List of Abbreviations

Abbreviation	Definition
BGL	Below Ground Level
ECC	Earth Continuity Conductor
EIA	Environmental Impact Assessment
ESBN	Electricity Supply Board Networks
GNI	Gas Networks Ireland
HDD	Horizontal Directional Drilling
HV	High Voltage
JB	Joint Bay
UGC	Underground Cable
IPP	Independent Power Producer
OHL	Overhead Line

1 Introduction

1.1 Background

TLI Group ("the Consultant") were engaged by Perigus Energy ("the Client") to identify and analyse potential 110kV loop in options available for the Cappakeel Solar Farm Project, which is currently being developed by Perigus Energy ("the Developer") and will connect the Tail-fed Substation into the existing Cushaling – Port Laoise 110kV Overhead line (OHL).

The Consultant was engaged by the Client to identify and analyse potential 110kV grid connection options available for the proposed Cappakeel Solar Farm Substation to the Coolnabacky 110 kV Substation.

Coolnabacky 110 kV is a new substation located to the south-east of Portlaoise at Coolnabacky, designed to accommodate both voltage levels. For the Cappakeel project, this substation will be referred to as Coolnabacky 110 kV Substation.

This project will have an estimated Maximum Export Capacity (MEC) of 170 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 110kV EirGrid standard substation and the loop-in grid connection from the existing Cushaling – Port Laoise 110kV line to the substation, it will also explain the implementation of the Cappakeel Solar Farm grid connection to the Coolnabacky 110 kV Substation.

The 110kV loop-in grid connection will consist of constructing two masts and a new standard EirGrid loop in substation. The Cappakeel Substation will be connected via 2 no. 110kV UGC circuits to the 2 no. mast structures that will intersect with the existing Cushaling – Port Laoise 110kV line. The OHL works will consist of the installation of 2 no. masts and terminating the existing phase conductors on those masts.

The Underground Cable (UGC) grid connection will consist of a single 110kV UGC circuit, which will be installed predominantly within the public road network. The UGC works will consist of the installation of 6 no. ducts in an excavated trench to accommodate 3 no. power cables, 2 no. fibre communications cables and 1 no. earth continuity conductor (ECC). The fibre communications cable will allow communications between the proposed Cappakeel Solar Farm 110kV Substation and the Coolnabacky 110 kV Substation access road.

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.

For the purposes of the planning application, this document should be read in conjunction with the Planning and Environmental Report (Chapters Dev. Description / Policy etc, Environmental Impact Assessment (EIA), Traffic and Transport, Noise and Hydrology), Construction and Environmental Management Plan (CEMP), Natura Impact Statement (NIS), Archaeology Report, Landscape and Visual Impact Assessment (LVIA), Glint and Glare and Flood Riak Assessment Report (FRA).

2 Proposed Grid Connection Route Summary

2.1 Loop-in grid connection route summary

The loop-in grid connection route is approximately 348 m in length, as described in Table 1 and showing in Figure 1 below:

Ref	Section Description	Route Length (approx.)
Section 1 Tower 156A – Substation	Installation of one 110 kV Steel Line Cable Interface Mast Type 1493ET with shield wire to be connected as UGC to the Cappakeel Substation.	195 m
Section 2 Tower 157A – Substation	Installation of one 110 kV Steel Line Cable Interface Mast Type 1493ET with shield wire to be connected as UGC to the Cappakeel Substation.	153 m
Total		**348 m**

Table 1: Loop-in Grid Connection Route Section Summary

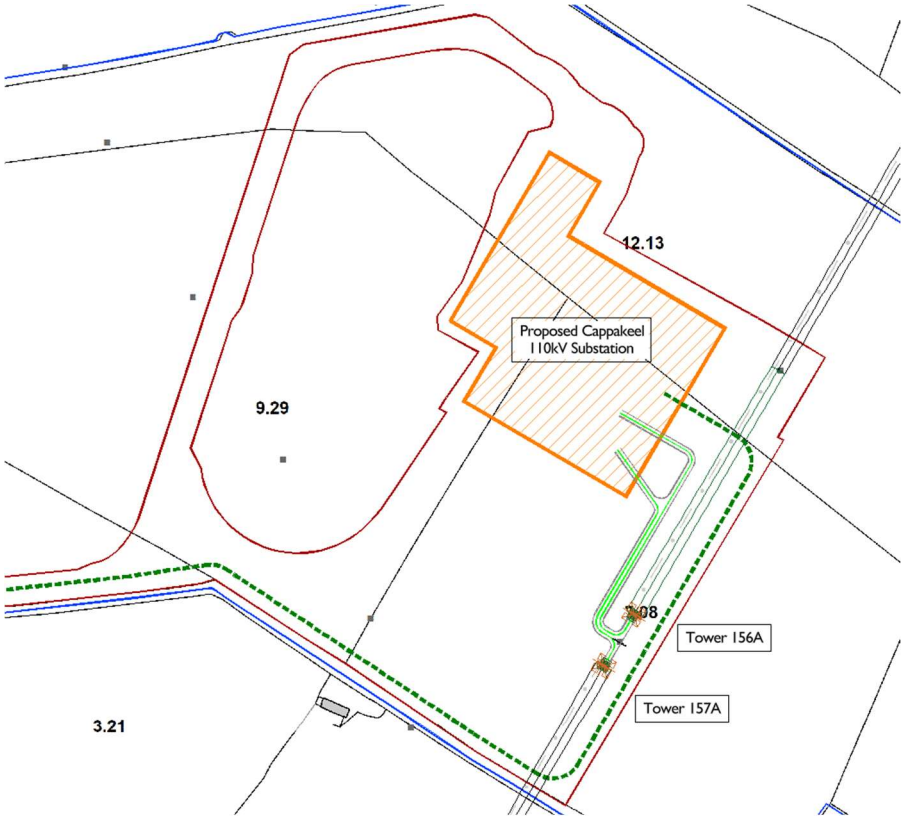


Figure 1: Loop-in Grid Connection Route

2.2 Overall UGC Grid Connection Route

The Grid connection route is approximately 13.7km in length and will travel in a southerly direction from the proposed Cappakeel Solar Farm 110 kV Substation to the Coolnabacky 110 kV Substation access road with most of the Grid connection route situated in the public road network.

The Grid connection route begins by exiting the Cappakeel Solar Farm 110 kV Substation, which is located in Morett, County Laois. The UGC exits through the western boundary of the Cappakeel Solar Farm, travelling northwest for a short distance of 1.2 km through private access track before reaching the L-7815 public road.

The Grid connection route turns south along the L-7815 for approximately 930 m before merging onto the L-3813 local road heading towards the Rock of Dunamase. The cable will traverse approximately 4.3 km onto L-3813 to reach at the at the T-junction with the local road L-7830. Along this section, the UGC route will cross one bridge, two culverts (C1 & C2), two cattle grids, and navigate narrow road sections while running parallel with Uisce Éireann assets. It should be noted that at this point of the route, the UGC passes through a proposed Natural Heritage Area (pNHA).

Continuing along the L-7830 local road for approximately 60 m, it diverts towards the access road located between the Rock of Dunamase and Trinity Holy Church to connect with the L-6831 local road. The UGC will continue along the L-6831 for approximately 1 km until it reaches the junction with the National Road N-80. Here the UGC route under crosses a medium-pressure gas pipeline and Uisce Éireann.

The UGC route then crosses the N-80 national road junction before merging onto the L-6772 then progresses southwest for approximately 2.59 km, until it joins the L-7832 local road and traverses southwest for 480m before joining the R-426 regional road traveling southeast. Along this section the UGC will run parallel with Uisce Éireann follows with narrow road widths, and sharp bends.

The route then continues onto the R-426 for an additional 3.1 km, traversing the R-427 regional road and Uisce Éireann at the junction until it reaches at the start of access road turning towards the Coolnabacky 110 kV substation.

The overall location of the grid connection route, the Cappakeel Solar Farm boundary and Coolnabacky 110 kV Substation location is shown in Figure 2 below.



Figure 2: Map Indicating overall location of Cappakeel Solar Farm and Grid Connection Route

2.3 Grid connection route summary

Table 2 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	0.06 km
Regional Roads	3.1 km
Local Primary Roads	4.3 km
Local Secondary Roads	5.1 km
Total Road Network	**12.56 km**
Private Lands[1] (Access Track)	1.2 km
Total Off Road Network	**1.2 km**
Total Route Length	**13.7 km**

Table 2: Grid Connection Route Summary

2.4 Section-by-section summary

As an aid to understanding, the grid connection route has been broken into four shorter sections as shown in Table 3 below. Each of these route sections is described in further detail in Sections 2.4.1-2.4.4 below. Across all sections of the UGC route, there is 20 no. of 110 kV joint bays required to accommodate the 13.7 km circuit.

Ref	Section Description	Route Length
Section 1	The T-junction of R-426 near Coolnabacky 110 kV Substation access road to the junction of R-426 merging to L-7832.	3.1 km
Section 2	The junction of R-426 with L-7832 to the junction of L-7830 with L-3813.	4.2 km
Section 3	The junction of L-7830 with L-3813 near Rock of Dunamase to the junction of L-3813 with L-7815	4.3 km
Section 4	The junction of L-3813 with L-7815 towards the proposed Cappakeel SF 110 kV Substation	2.1 km
Total		**13.7 km**

Table 3: Grid Connection Route Section Summary

2.4.1 Route Section 1 Summary (Approximate length 3.1 km)

The grid connection route begins following the regional road R-426 for approximately 3.1 km, crossing the R-427 regional road at the junction until it merges onto the L-7832 heading northeast. This section of the route is relatively flat with relatively slow long bends.

Features:

- Joint Bay 1 (JB-01) will be located approximately 25 m from the Coolnabacky 110 kV substation access road. It is proposed that this Joint Bay will be installed within the R-426 regional road.
- Joint Bay 2 (JB-02) will be located approximately 750 m from Joint Bay 1. It is proposed that this Joint Bay will be installed within the R-426 regional road.
- Joint Bay 3 (JB-03) will be located approximately 770 m from Joint Bay 2. It is proposed that this Joint Bay will be installed within the R-426 regional road.
- Joint Bay 4 (JB-04) will be located approximately 760 m from Joint Bay 3. It is proposed that this Joint Bay will be installed within the R-426 regional road.
- Joint Bay 5 (JB-05) will be located approximately 750 m from Joint Bay 4. It is proposed that this Joint Bay will be installed within the R-426 regional road.

[1] Access track within the Cappakeel Solar Farm boundary.

2.4.2 Route Section 2 Summary (Approximate length 4.2 km)

Section 2 for the grid connection route continues along the L-7832 local road and traverses northeast for 480m before joining L-6772 local road. Along this section the UGC will run parallel with Uisce Éireann follows with narrow road widths, and couple of sharp bends until it reaches at the junction with R-426 regional road.

The UGC route then progresses northwest for approximately 2.59 km, until the route crosses the N-80 national road joining the L-6831 local road. Here the UGC route under crosses a medium-pressure gas pipeline and Uisce Éireann services.

The UGC will continue along the L-6831 heading northeast for approximately 1 km until it reaches the Trinity Holy Church, it should be noted that this section of road is narrow. The route then continues north through an access road located between the Rock of Dunamase and Trinity Holy Church for approximately 115 m. The UGC then joins the L-7830 heading northeast for approximately 60m, where it merges onto the L-3813 local road.

Features:

There is 2 no. medium pressure GNI crossings and Uisce Éireann services crossings perpendicularly to the UGC at the N-80 National Road junction. These two-medium pressure GNI pipelines and Uisce Éireann services will be undercrossed within the N-80 National Road. The Uisce Éireann services running parallel for this whole section alongside the grid connection route and the grid route will also under cross Uisce Éireann services at multiple locations on this section. There is one LV UGC on this section of the grid connection route approximately 60 m southeast of the joint bay 6 which will be undercrossed. The grid connection route will cross under this cable as per EirGrid/ESB safety requirements.

- Joint Bay 6 (JB-06) will be located approximately 746 m from joint bay 5. It is proposed that this Joint Bay will be installed within the L-6772 local road.
- Joint Bay 7 (JB-07) will be located approximately 725 m from joint bay 6. It is proposed that this Joint Bay will be installed within the L-6772 local road.
- Joint Bay 8 (JB-08) will be located approximately 717 m from joint bay 7. It is proposed that this Joint Bay will be installed within the L-6772 local road.
- Joint Bay 9 (JB-09) will be located approximately 727 m from joint bay 8. It is proposed that this Joint Bay will be installed within the L-6772 local road.
- Joint Bay 10 (JB-10) will be located approximately 699 m from joint bay 9. It is proposed that this Joint Bay will be installed within the L-6831 local road.
- Joint Bay 11 (JB-11) will be located approximately 688 m from joint bay 10. It is proposed that this Joint Bay will be installed within the L-7830 local road.

2.4.3 Route Section 3 Summary (Approximate length 4.3 km)

This section of the grid connection route follows L-3813 local road. The grid route will be installed within the public road in parallel with other services in the road. The grid connection route will cross 2 Cattle Grids and 2 culverts, and 1 bridge continuing for approximately 4.3 km on the L-3813 until it reaches the T-junction merging onto the L-7815.

Features:

There are 2 culverts (C1, & C2) and 1 bridge encountered on this section of the grid connection route on the L-3813 local road. The crossing method for these culverts is proposed to be an undercrossing in flat formation, and the crossing method for the bridge is proposed to be an open trench. The grid connection route will under cross Uisce Éireann services at multiple locations on this section. The grid connection route will pass through the approximately 150 m stretch of pNHA.

- Joint Bay 12 (JB-12) will be located approximately 705 m from joint bay 11. It is proposed that this Joint Bay will be installed within the L-3813 local road.

- Joint Bay 13 (JB-13) will be located approximately 705 m from joint bay 12. It is proposed that this Joint Bay will be installed within the L-3813 local road.
- Joint Bay 14 (JB-14) will be located approximately 222 m from joint bay 13. It is proposed that this Joint Bay will be installed within the L-3813 local road.
- Joint Bay 15 (JB-15) will be located approximately 720 m from joint bay 14. It is proposed that this Joint Bay will be installed within the L-3813 local road.
- Joint Bay 16 (JB-16) will be located approximately 741 m from joint bay 15. It is proposed that this Joint Bay will be installed within the L-3813 local road.
- Joint Bay 17 (JB-17) will be located approximately 740 m from joint bay 16. It is proposed that this Joint Bay will be installed within the L-3813 local road.

2.4.4 Route Section 4 Summary (Approximate length 2.1 km)

The grid connection route continues along the L-7815 local road heading northeast for approximately 930m where the route will merge onto the access track within the proposed Cappakeel Solar Farm and travels for approximately 1.2 km where it will connect into the proposed Cappakeel 110 kV Substation.

Features:

- Joint Bay 18 (JB-18) will be located approximately 698 m from joint bay 17. It is proposed that this Joint Bay will be installed within the L-7815 local road.
- Joint Bay 19 (JB-19) will be located approximately 680 m from joint bay 18. It is proposed that this Joint Bay will be installed within the L-7815 local road.
- Joint Bay 20 (JB-20) will be located approximately 680 m south of joint bay 19. It is proposed that this Joint Bay will be installed within the Cappakeel 110 kV Substation access road.

3 Preliminary Site Investigation

A Site Investigation (SI) was carried out at the location of the proposed 110 kV substation and loop-in towers. The SI works consisted of trial pits and percolation testing. These investigations were undertaken to establish the ground and groundwater conditions to a depth of approximately 3.0 m BGL, assess the suitability of the site for the disposal of stormwater runoff via soakaways as part of the substation drainage strategy, and provide information for the design of the foundations for the loop-in towers.

A total of 13 No. trial pits and 4 No. percolation tests were completed within the footprint of the proposed substation. The intrusive SI works were conducted on 15 and 16 December 2025.

The Cappakeel Site Investigation Factual Report (300100925-CS-R-10-00) should be read in conjunction with this OCM to support a full understanding of the SI findings.

4 Access Routes to Work Area

Access tracks, combined towers laydown and crane hardstand area (80x30m), and combined pole laydown and crane hardstand area (28x20m) will be utilised for the structure installation and erection on the consented land (if required due to ground conditions and/or landowner requirements) will consist of crushed rock on a geotextile. Upon completion of the works, all access tracks will remain in place for future access to the substation and solar farm grounds. Access routes will be carefully selected to avoid any damage to land. Local consultation will be carried out with the relevant landowners to ensure that any potential disturbance will be minimised. Prior to the commencement of construction, the contractor will assess all access routes and determine specific requirements for each area. Any such requirements will be incorporated into the relevant method statement.



Figure 3: Crushed Rock Roadway build-up with Geotextile



Figure 4: Crane Pad and Laydown Areas

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 Laois County Council.

Careful and considered local consultation will be carried out, to minimise the amount of disturbance caused during works. Prior to the commencement of construction, the contractor will assess all access routes and determine any

additional access requirements which will be incorporated as part of the method statement. All plant and equipment employed during the works (e.g., diggers, tracked machines, footwear etc.) will be inspected prior to arrival on site and on leaving site and cleaned where necessary to prevent the spread of invasive aquatic / riparian species.

5 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with Laois County Council. All work on public roads will be subject to the approval of a road opening license application by Laois 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 metres 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 planning and environmental report will be incorporated into a detailed Traffic Management Plan to be prepared, in consultation with Laois 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 Laois County Council. A Traffic Management Plan (TMP) will be agreed with Laois 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 Laois County Council in advance of the preparation of the TMP.

7 Construction Hours

Standard working hours for construction will be 8:00 - 19:00 Monday to Friday, and 8:00 - 18:00 on Saturday (if required), with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency. If required, all local residents will be notified.

8 Loop-in Masts Construction Methodology

8.1 Existing 110 kV OHL

The proposed Cappakeel Solar Farm 110kV loop-in station will connect into the existing Cushaling – Port Laoise 110kV line. The 2 no. new end masts will be placed either side of existing pole set No.157. Pole set 157 is to be removed

after the installation of the 2 no. new cable interface masts (proposed masts No. 156A and 157A). Pole set No. 156 is to be replaced with larger poles. Presently pole set 156 consists of 2 no. 16m poles. These will need to be replaced with 2 no. 21m poles.

The proposed design for the 110kV Loop-In from the existing OHL will require two new 15m 1493ET mast structures, which will be constructed under the existing Cushaling – Port Laoise 110kV line. The existing OHL conductor will be terminated at these towers connecting to the substation via UGC.

The duration of works for the overhead line construction is expected to be approximately 12 weeks. Construction of foundations for masts circa. 7 days each with time allowing for curing of the concrete, erection of the masts circa 5 days each, weather dependant. Stringing of conductor will be a 2-week process and final connection to the existing grid will be carried out by ESBN and at that point in time commissioning of the substation can start.

8.2 Steel Mast Structures

The proposed mast structure locations have been selected based on ground surveys, ground profiles, sight lines and ruling span checks.

The proposed construction scope will require the relevant personnel, machinery and materials which is as follows:

Equipment	**Materials**
• 5 operatives • 4x4 vehicle • Winch • Tractor and trailer • Crane • Teleporter • Chains / small tools • Tracked Excavator • Tracked Dumper • Sheet Piling Rig	• 2 Cable Interface Masts • Insulators • Electrical connections • Concrete (foundation) • Aggregate

Table 4: Steel Mast Equipment and Materials

The following section outlines the methodology to be followed during construction works of the new mast structures.

1. Mast sites are scanned for underground services such as cables, water pipes etc. Consultation with the landowners will help to identify hazards and ensure there are no unidentified services in the area.
2. For each leg of the 2 No. masts (8 legs in total) a foundation circa. 4.3m x 4.3m x 3m deep is required. To allow for safe construction, the excavation will be stepped back which requires additional area to be excavated, or shutter piles used if ground material is not suitable for benching. The formation levels (depths) will be checked by the onsite engineer. The excavated material will be temporarily stored close to the excavation and excess material will be used as berms along the site access tracks.
3. To aid construction, a concrete pipe is placed into each excavation to allow operatives level the mast at the bottom of the excavation. The frame of the reinforcing bars will be prepared and strapped to a concrete pipe with spacers as required. The reinforcing bars will be lifted into each excavated foundation using the excavator and chains/slings. The base and body section of each mast will then be assembled next to the excavation.
4. Concrete trucks will pour concrete directly into each excavation in distinct stages.
5. A final pour for the mast is the encasing of the mast leg which will be finished 300mm over finished ground level. The leg of the mast is required to be shuttered with metal panels to form the required shape.

6. Once the concrete is set after five days the shuttering is removed and if used sheet piles removed.



Figure 5: Typical 110kV mast foundation excavation

7. The Mast foundations will be backfilled one leg at a time with the material already excavated at the location. The backfill will be placed and compacted in layers. All dimensions will be checked following the backfilling process. All surplus excavated material will be removed from the mast locations and stored in berms for reuse across the construction site.



Figure 6: Base of mast structure backfilled

8. Once the base is in place the line will be de-energised by ESB so the remainder of the tower cab be built during the approved outage.
9. An earth mat consisting of copper or aluminium wire will be laid circa 400mm below ground around the mast. This earth mat is a requirement for the electrical connection of the equipment on the mast structure.
10. Once the base section of each mast is completed and the concrete sufficiently cured, it is ready to receive the mast body.
11. A hardstand area for the crane will be created by laying geogrid material on the ground surface and overlaying this geogrid with a suitable grade of aggregate.
12. A physical barrier (Heras Fence Site Boundary) will be put in place to restrict plant from coming too close to the OHL.
13. The mast will be constructed lying flat on the ground beside the recently installed mast base.
14. The conductor will be moved off centre using a stay wire and weights to anchor the stay wire to ground.
15. The mast section will be lifted into place using the crane and guide ropes.
16. The body sections will be bolted into position.
17. The conductor will be centred over the masts and held in place. Once the conductor is secured at both ends it is then cut and attached onto each mast. The section of conductor in between the two masts will be removed and utilised as connector wire for the new masts.
18. Down dropper conductors (for electrical connections, insulators, surge arrestors), shackles and all associated accessories required for transition from line to cable will be installed on the interface masts.
19. The circuit will be tested in both directions before the line is re-energised.





Figure 7: Cable End Mast

9 Proposed Substation Build Construction Methodology

The Cappakeel Solar Farm 110kV Substation will be constructed to loop-in the existing Cushaling – Port Laoise 110kV line. The substation will be made up of a control building, transformer compound, electrical equipment and a shunt filter. The control building works will consist of foundation works, block work, roofing, low voltage electrical fit out, cladding and building finishing works. The transformer, cable chair and structural steelwork will be installed in the transformer compound. Substation electrical equipment will be installed once the control building and compound is complete. Palisade fencing will be erected around the compound for security/protection and a concrete post and rail fence to mark the substation boundary.

9.1 110 kV Loop-in and Tail-Fed Substation

The proposed construction scope will require the relevant personnel, machinery and materials which is as follows:

Equipment	**Materials**
• Up to 10 Electrical/Civil Crews • Tracked Excavators • 360˚tracked excavators (13 ton normally, 22 ton for rock breaker) • Tracked dumpers / tractors and trailers • Crane • Hoist • Power Tools • Generator • Scaffolding	• Stone • Geotextile • Lighting • Paving. • Fencing • Steel Uprights • Concrete • Timber • Cladding • Doors

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

1. This new substation will consist of a costumer compound (IPP side) of circa 4,270m^2 and an EirGrid compound of circa 13,480 m^2 surrounded by a 2.6m high palisade fence.
2. A level compound area will be created using cut and fill methods.
3. The substation compound and drainage will be marked out by a qualified engineer.
4. A drainage system will be excavated and installed around the compound area.
5. Topsoil and subsoil will be removed from the footprint of the compound using an excavator. The excavated material will be stored separately and temporarily on adjacent berms for later use during reinstatement works.
6. A layer of geotextile material will be laid over the footprint of the compound.
7. Using an excavator, a base layer of Clause 804 material will be laid followed by a 6F2 capping layer which will provide the finished surface.
8. Each layer will be compacted using a vibrating roller.
9. Earthing cable will be laid underground around the substation for connection to the various electrical components during the electrical fit out phase.
10. The construction of a substation compound circa 17,750m², comprising of approx. 437.5m² single storey 110kV substation control building, a 403.5m² IPP building and associated outdoor electrical equipment, including 1 no. 110kV transformer, associated internal access track, 2.6m high station perimeter fencing and concrete post and rail property boundary fence will be built.

11. Adequate lighting will be installed around the compound on the lighting masts.
12. Lightning protection masts of approximate height 18m will be installed to protect the station from direct lightning strikes.
13. The electrical installation is expected to take 16 weeks and includes the following:
    - Delivery and installation of 33/110kV transformer. The deliveries will be managed in accordance with regulations governing the movement of large loads.
    - Delivery and installation of all other HV equipment.
    - Wiring and cabling of HV/LV equipment, protection, and control cabinets.
    - Commissioning of all newly installed equipment.



Figure 8: Typical 110kV Electrical Infrastructure



Figure 9: Typical 110kV Transformer Connection

10 UGC Construction Methodology

The UGC for the loop-in connection will consist of 2 No. trenches with a minimum of 2.3m separation distance between each circuit. Each circuit will consist of 3 no. 160 mm diameter HDPE power cable ducts, 2 no. 125 mm diameter HDPE communications duct and 1 no. 125 mm Earth Continuity Conductor duct to be installed in an excavated trench between the proposed solar farm substation and existing Cushaling – Port Laoise 110kV line.

The UGC grid to Coolnabacky 110 kV Substation 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 solar farm substation and the Coolnabacky 110 kV Substation access road.

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 Laois County Council specifications. Once all are satisfied, then the electrical cabling/fibre cable is pulled through the installed ducts in up to approximately 220 to 780 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 EirGrid.

10.1 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 and environmental report 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 planning and environmental report, 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 EirGrid 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 the planning and environmental report, and a detailed Traffic Management Plan will be prepared and agreed with the local authority.
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2 m in height. Stockpiles will be located a minimum of 50 m from surface water features and all stockpiling locations will be subject to approval by the site manager and project Ecological Clerk of Works (ECoW).
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported to the on-site borrow pit.
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement.
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature.
- Where required, grass will be reinstated by either seeding or by replacing with grass turves.
- No more than a 100-metre section of trench will be opened at any one time. The second 100-metre section will only be excavated once most of the reinstatement has been completed on the first section.

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



Figure 10: Typical 110 kV Underground Duct Installation

10.2 Ducting Installation Methodology

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

1. Grade, smooth and trim trench floor when the required 1315 mm depth and 825 mm width have been obtained.
2. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with the specification and compact it so that the compacted thickness is as per the drawings.
3. Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers/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.
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 11).

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

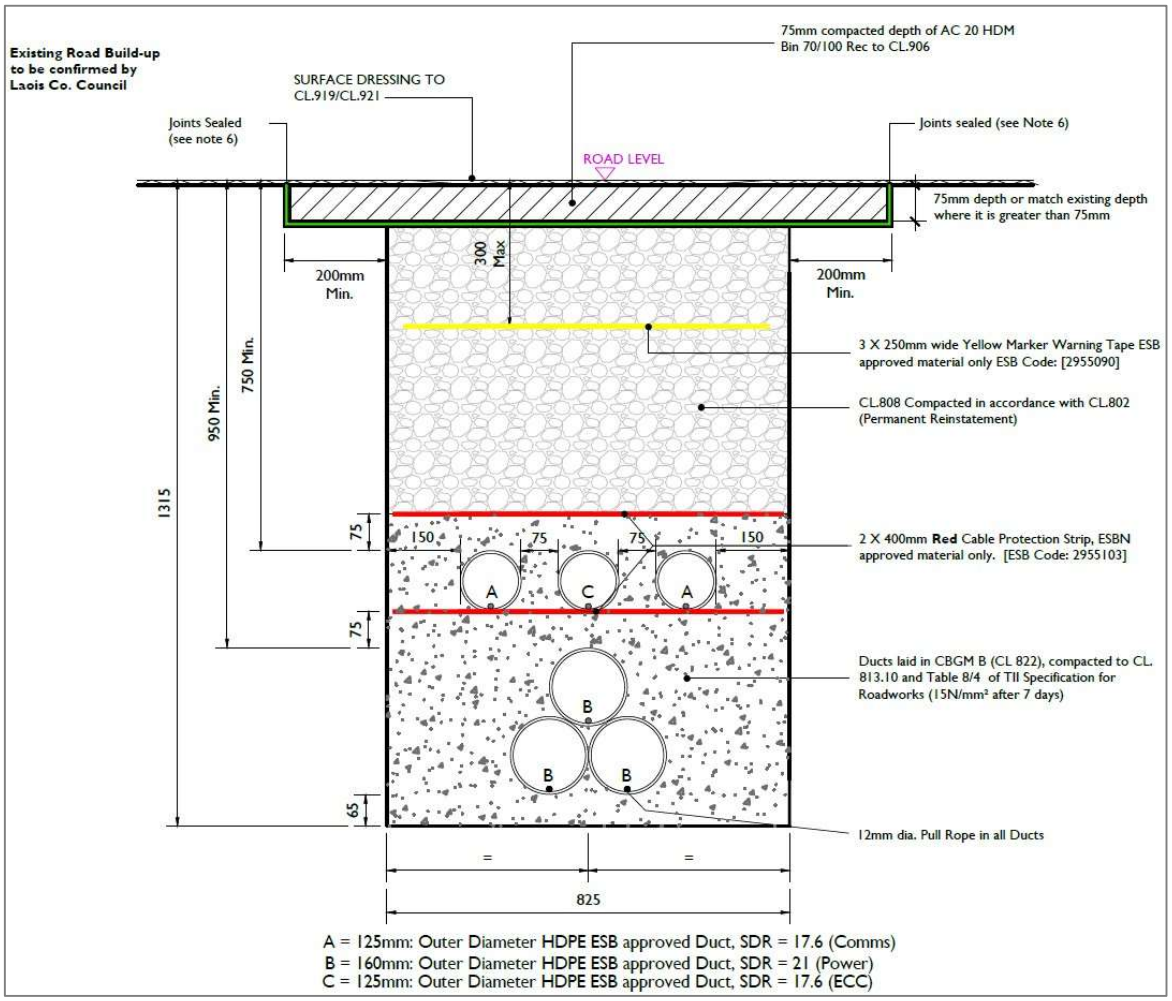


Figure 11: Typical Trench in Roadway

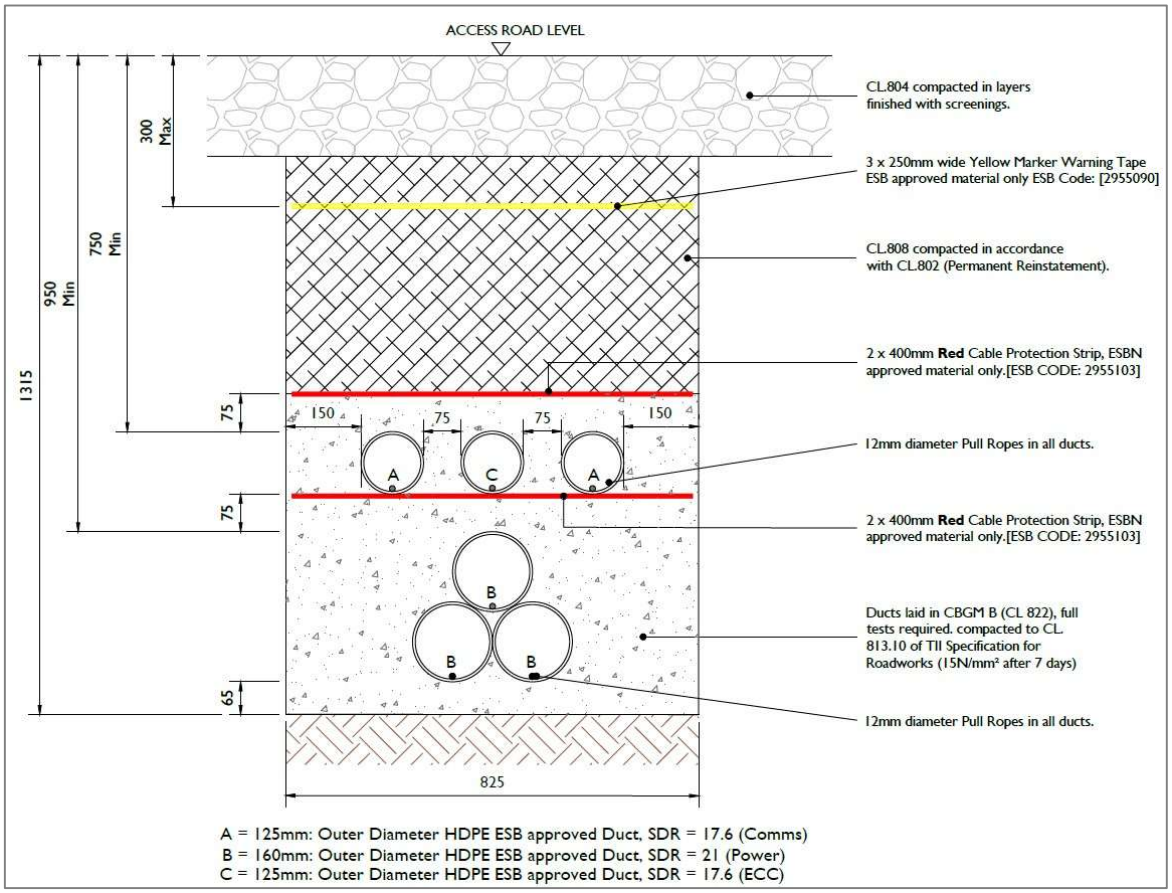


Figure 12: Typical Trench in Off -Road Section

10.3 UGC Installation on Private Land

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

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

10.4 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.

10.5 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 13).

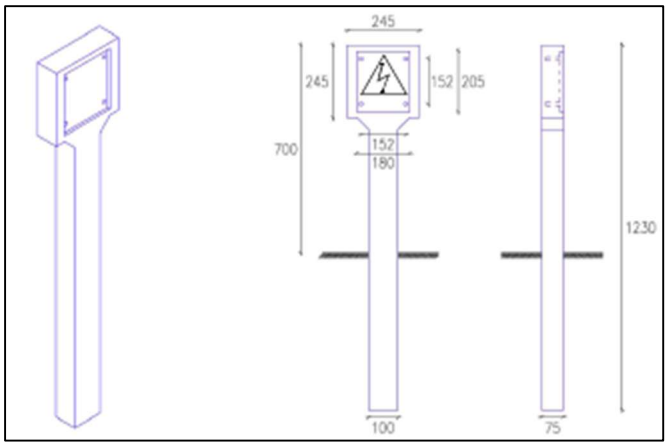


Figure 13: Typical ESB Marker Post Example

10.6 Managing Excess Material from Trench

All excavated material will be temporarily stored adjacent to the trench prior to re-use in the trench reinstatement (where applicable). Stockpiles will be restricted to less than 2 m in height. Where excess material exists, it may be used in the reinstatement of the borrow pit as part of the proposed 110 kV substation. Excavated tar from the public road network will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility.

10.7 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 Solar Farm substation. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds.

Joints bays are to be installed with various separation distances approximately between every 220 m – 780 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 14). 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 solar farm substation and the existing 110 kV node at Coolnabacky 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 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

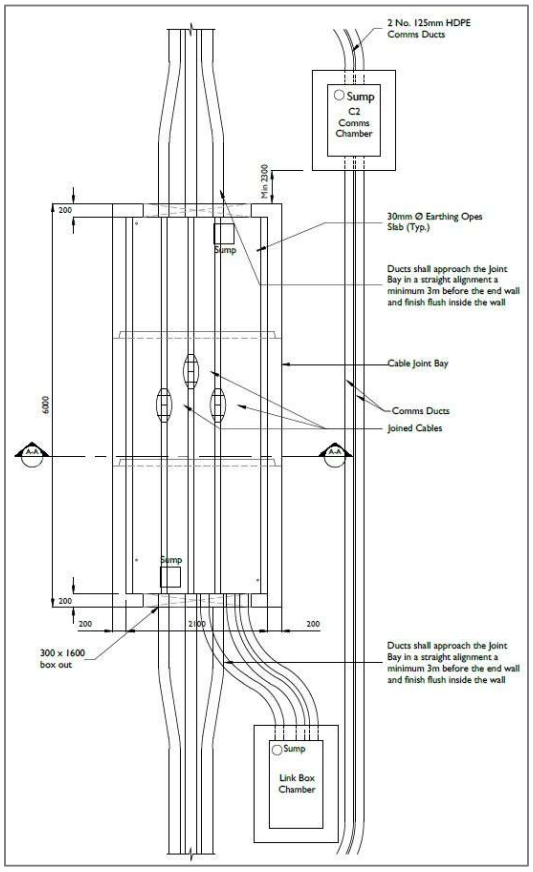


Figure 14: Typical Joint Bay and Link Box Plan Layout

10.9 Joint Bay Construction and Cable Installation

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

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

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

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

Temporary storage of cement bound sand (if required) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g. using 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 15)



Figure 15: 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/Transport Infrastructure Ireland (TII) Specification for Roadworks. (Figure 16)



Figure 16: Completed Joint Bay prior to Cable Installation (In-Situ)

6. Pre-cast concrete construction. Place pre-cast concrete sections on sand bedding. (Figure 17)



Figure 17: 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 18). 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 18: 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 19)



Figure 19: 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

10.10 Major Watercourse Crossing

Where the cable route intersects with existing watercourses, a detailed construction method statement will be prepared by the contractor prior to the commencement of construction and is to be approved by the Local Authority and relevant environmental agencies. Crossing existing culverts will be implemented using either an undercrossing or an overcrossing, depending on the depth of the watercourse. The culvert crossing methods are detailed in Figure 20 and Figure 21 below.

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

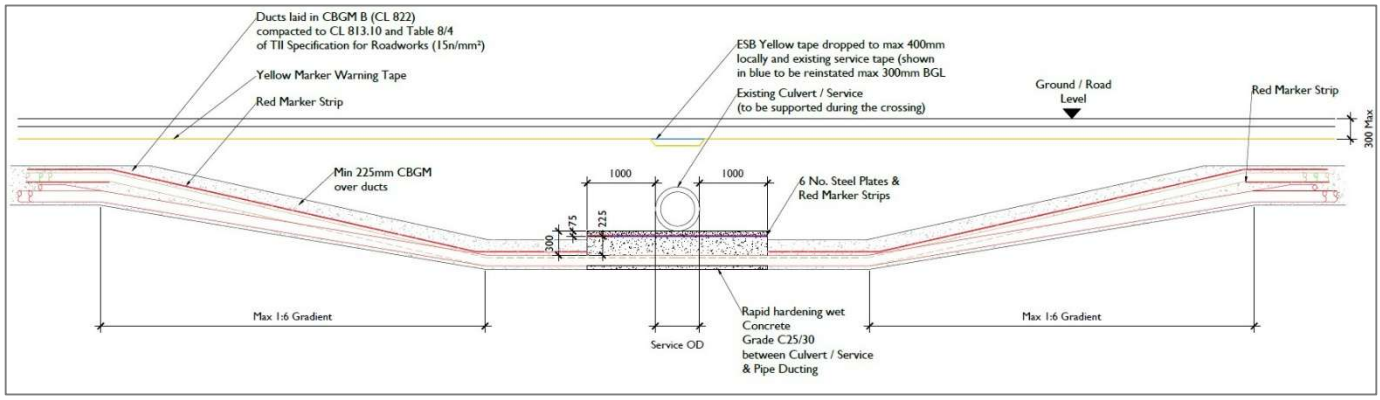


Figure 20: 110 kV UGC Culvert/Service Undercrossing

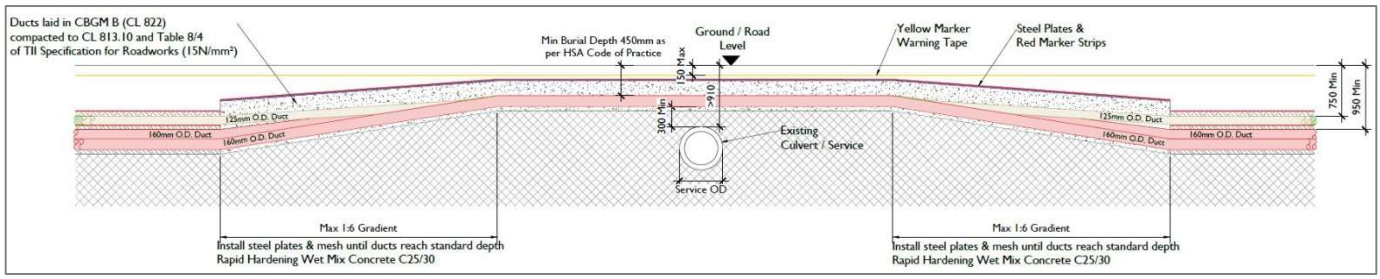


Figure 21: 110 kV UGC Culvert/Service Overcrossing

10.10.1 Bridge 1 Overcrossing – Open Trench Installation

ITM Coordinates: Eastings – 653458.0289, Northings – 701493.2993

This bridge is located between JB-16 & JB-17, along the L-3813 local road approx. 50m southeast of Cattle Grid 1.

In order to accommodate the installation of the UGC trench, the road will need to be raised by approx. 0.11m. It should be noted that due to the raised roadway in this section, the bridge walls will also need to be raised proportional to the road level through the installation of handrails. All works will need to comply with local county council & TII specifications.

In raising the road by approx. 0.11m, this will enable the ducting to be installed at a minimum of 0.45m below the road surface in line with EirGrid specification XDC-CBL-STND-H-006 Sheet 002 Rev 00. This raised road detail is indicatively shown in drawing 300100925-DR-515 which will needed to be viewed in conjunction with this OCM.



Figure 22: Bridge 1 - East Elevation View

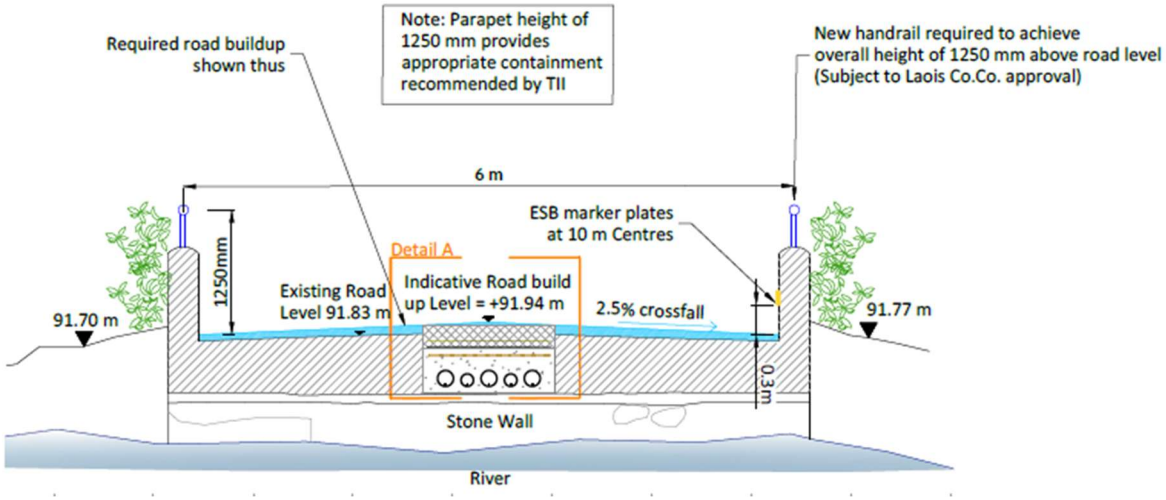


Figure 23: Bridge 1 – Indicative Raised Road Open Trenching detail

10.10.2 Culvert 1 Undercrossing – Open Trenching

ITM Coordinates: Eastings – 653505.7679, Northings – 701923.8520

The undercrossing of this concrete pipe is located between JB-17 & JB-18, along the L-3813 local road approx. 40m northeast of Cattle Grid 2. The culvert will remain in place (where possible) and the ducting will be installed below the culvert to provide minimum separation distances in accordance with EirGrid specifications as mentioned in section 10.1. Refer to Figure 20 for the required culvert undercrossing specification.



Figure 24: Culvert 1 - Concrete Pipe under the L-3813



Figure 25: Culvert 1 - Pipe running across the Road

10.10.3 Culvert 2 Undercrossing – Open Trenching

ITM Coordinates: Eastings – 653671.0769, Northings – 702079.9106

The undercrossing of this precast culvert is located between JB-17 & JB-18, along the L-3813 local road approx. 245m northeast of Culvert 2. The culvert will remain in place (where possible) and the ducting will be installed below the culvert to provide minimum separation distances in accordance with EirGrid specifications as mentioned in section 10.1. Refer to Figure 20 for the required culvert undercrossing specification.



Figure 26: Culvert 2 – Precast culvert under the L-3813



Figure 27: Culvert 2 – Overgrown under the road View

10.11 Watercourse Damming and Reinstatement Methodology

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

Duration: 1-2 Days per location

Personnel, Machinery & Equipment:

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

10.11.1 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.

10.11.2 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.

10.11.3 Standard Methods – Reinstatement of the Watercourse at Dam and Flume Locations

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

10.11.4 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.

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 planning and environmental report at least of “Medium” sensitivity), will be avoided between Oct 1st and April 30th as per IFI and Loughs Agency guidelines.
3. All plant and equipment will be serviced and cleaned before entry to site to limit risk of oil spillage and for biosecurity.
4. Where temporary fluming or flow diversion are in situ, in a watercourse frequented by salmon or trout, (at least medium sensitivity) all fish within the designated area will be subject to fish rescue and translocation downstream by a fisheries biologist. Fish rescue will be conducted under Section 14 authorisation (DCCAE/ IFI) or Section 69 authorisation (Loughs Agency) where appropriate.
5. Works will be carried out in dry weather with low flows in the streams with forecast for dry weather for the duration of the works – approximately 2 days.
6. Machinery used will stay on the public road; machinery will not be permitted to enter the stream channel.
7. The road edge adjacent to the watercourse will be lined with sandbags and silt fences (multiple fences recommended) as appropriate to prevent runoff from the trenching works reaching the stream. The design of these multiple features shall also allow for the safe removal of accumulated silt away from the channel, particularly through staged removal of the most contaminated upper fence before the lower ones, and the removal of the final fence only when it is clear of any silt.
8. Clean sandbags will be used to dam flows on the upstream side of the culvert. Sandbags will be placed by hand at a suitable location to take advantage of any natural pool but set back from the works to permit unhindered excavation of the existing culvert.
9. A second sandbag dam will be placed on the downstream side of the culvert to prevent backflow into the works and contain any groundwater seepage that is likely to be turbid.
10. Sandbagging requires careful attention to detail if it is to be effective. All bags must be laid neck uppermost and seams aligned. Bags must not be overfilled, or they will not tamp together or will burst with ease. Additional bags will be filled ready to raise freeboard of dams.
11. Flume placement for temporary flow diversion or permanent replacement of culverts will follow guidelines issued by IFI and CIRIA to ensure that fish passage is not impeded.
12. If topography permits, the water will be piped over the road by gravity flow, otherwise, it will be pumped. Discharge will be via break tank or similar approved storage onto a splash-plate or riprap (gabion basket) to dissipate energy and avoid scour or erosion of the stream bend or banks. The pump will be filled with a screen, so fish aren’t drawn into the pump intake.
13. The use of pump sumps will be considered within the dammed area. These will be lined to prevent scouring. The intention is to intercept clean groundwater ingress and pump it out rather than allowing it to get silted in the works area by segregating off areas.

14. Any spoil generated will be removed to designated safe area clear of the flood plain. Some of this spoil will be saturated and will require bunding and sheeting over.
15. If bank material needs to be removed, it will be stored separately and reinstated according.
16. The ducting will be advanced passed the culvert and the existing culvert will be excavated 'in the dry' and a new culvert, sized for a 100-year rainstorm event, will be installed with appropriate gradient, headworks, and outfall. A precast concrete culvert, concrete pipe or HPDE pipe will be used. Culverts will be embedded to at least 300mm below the existing stream bed to ensure backwatering. Culverts will avoid a significant change in gradient (i.e., >3%). After embedding, replacement culverts will be filled with clean washed gravels and cobbles to replace lost habitat and facilitate fish movement.
17. Dry stone headworks will be placed at the culvert intake and discharge and the stream bed adjacent to the works will be reinstated at the direction of the project aquatic ecologist.
18. The ECoW will determine the quality of any water trapped between the two dams – visual inspection and turbidity meter. If this water is clean, it will be left in situ. If it is not clean, it will be removed from the works area prior to removal of the dams. If required, dewatering of the works area prior to dam removal will be undertaken by pumping from the stream bed to either a) the cable trench for percolation or b) taken back to the wind farm site for treatment at an existing settlement pond or c) treatment using a mobile water treatment system such as Siltbuster® or similar. The most efficient method will depend on the volume of water present and the available percolation.
19. The upstream dam will then be removed to permit flow though the new culvert. This will be done in phases, so a large volume of water isn't released at once. The downstream dam will be removed in a similar manner.

11 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 50 m exclusion zones and barriers (silt fences) between any excavated material and any surface water features to prevent sediment washing into the receiving water environment;
- If dewatering is required as part of the proposed works e.g. in trenches for underground cabling or in wet areas, water must be treated prior to discharge;
- The contractor shall ensure that silt fences are regularly inspected and maintained during the construction phase;
- If very wet ground must be accessed during the construction process bog mats/aluminium panel tracks will be used to enable access to these areas by machinery. However, works will be scheduled to minimise access requirements during winter months;
- The contractor shall ensure that all personnel working on site are trained in pollution incident control response. A regular review of weather forecasts of heavy rainfall is required, and the Contractor is required to prepare a contingency plan for before and after such events;

- The contractor will carry out visual examinations of local watercourses from the proposed works during the construction phase to ensure that sediment is not above baseline conditions. In the unlikely event of water quality concerns, the Environmental Manager and ECoW will be consulted;
- Excavations will be left open for minimal periods to avoid acting as a conduit for surface water flows.
- Only emergency breakdown maintenance will be carried out on site. Emergency procedures and spillage kits will be available and construction staff will be familiar with emergency procedures.
- Appropriate containment facilities will be provided to ensure that any spills from vehicles are contained and removed off site. Adequate stocks of absorbent materials, such as sand or commercially available spill kits shall be available;
- Concrete or potential concrete contaminated water run-off will not be allowed to enter any watercourses. Any pouring of concrete (delivered to site ready mixed) will only be carried out in dry weather. Washout of concrete trucks shall be strictly confined to a designated and controlled wash-out area within the solar farm sites; remote from watercourses, drainage channels and other surface water features;
- Entry by plant equipment, machinery, vehicles and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or 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.

12 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.

12.1 Underground Cables

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

12.2 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.

12.3 Water Mains

Uisce Eireann will need to be consulted and advised on details of the project and associated technical information with as much available information as possible. Early engagement between Uisce 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.

13 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 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.

14 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.

15 Invasive Species Best Practice Measures

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

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

16 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.

17 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.

18 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.

Table 3: Estimated Construction Duration (Activities Run Concurrently)	
Development Element	**Estimated Construction Duration**
Construct 110kV Substation	14 months
Overhead Line Structures	3 months
Underground Cable	6 months
Cable Testing and Commissioning	6 weeks
Connection to Existing OHL and Commissioning	3 months
Total	18 Months

Table 5: Estimated Construction Duration