Grid Connection Option 2 Construction Methodology Report

Planning Application 2 –
Grid Connection Planning Application
Loop-in Loop-out

Project:

Ballyfasy Wind Farm

Applicant:

Manogate Limited

Report Date:

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Document Reference:

25516-GCO2 Grid Construction Methodology-P1

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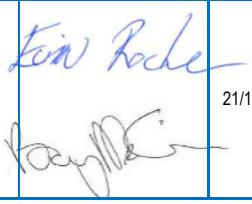
Document Control

Author(s)		Date	Reviewed by		Review Date	Revision Status	Comment
Name	Signature		Name	Signature			
E. Roche Project Engineer B. McGinn Chartered Engineer		21/11/2025	B. McGinn Chartered Engineer		21/11/2025	P1	Planning Issue

1.0 Introduction

This report has been prepared by Mable Consulting Engineers on behalf of Manogate Limited (the Developer), in support of a planning application for the proposed Ballyfasy Wind Farm.

The report is one of two reports addressing grid connection options for the project. It specifically outlines the construction methodology for Grid Connection Option 2 (GCO2). See report reference 25516-GCO1 Grid Construction Methodology for the construction methodology for Grid Connection Option 1 (GCO1).

This report has been developed in conjunction with the Environmental Impact Assessment Report (EIAR), which will accompany the planning application for the proposed development.

The report is to be read in conjunction with the following documents:-

- Environmental Impact Assessment Report (EIAR).
- Construction Environmental Management Plan (CEMP).
- Traffic Management Plan (TMP).
- The Grid Design Drawings.
- The Planning Drawings.

A list of the Grid Design Drawings is outlined in Appendix A.

1.1 Background

The Grid Connection Route (GCR) does not form part of the Ballyfasy Wind Farm Development Works but is being assessed as part of the preparation of the EIAR. The details provided on the Grid Connection are subject to detail design, in conjunction with ESB Networks (ESBN), EirGrid, Kilkenny County Council and other Stakeholders.

1.2 Scope

The purpose of this report is to provide details on the GCR Construction Methodology for GCO2.

1.3 Report Layout

The report is structured as follows: -

- Section 1 – Introduction.
- Section 2 – 110kV Grid Connection Overview.
- Section 3 – Consents.
- Section 4 – Construction Management.
- Section 5 – Grid Connection Route Construction.
- Section 6 – Grid Connection Route Crossings.

1.4 Statement of Authority

This Grid Route Construction Methodology Report Report has been prepared by Mr. Barry McGinn and Mr. Eoin Roche of Mable Consulting Engineers Limited.

Mr. Barry McGinn is a Chartered Engineer with over 28 years' experience in the design, construction and project management of civil and structural engineering projects including; Wind Farms, Solar Farms, Battery Storage, Electrical Substations, Flood Alleviation, and multiple other development types. Barry is a member of Engineers

Ireland and holds a BSc(Eng) in Structural Engineering, BEng (Ord) in Civil Engineering and Post Graduate Diplomas in Planning and Environmental Law, Construction Law & Contract Administration and Project Management.

Mr. Eoin Roche, the co-author of this report, holds a Bachelor of Engineering (Hons) in Structural Engineering and a Postgraduate Diploma (Distinction) in Sustainable Energy and the Environment. With five years of experience, Eoin has been involved in the design and construction of a diverse range of civil and structural engineering projects. His knowledge spans several critical areas of renewable energy infrastructure, including wind farms, solar farms, battery energy storage systems (BESS), synchronous compensators, and electrical substations and grid connection routes. Eoin's multidisciplinary background and experience in both traditional engineering and sustainable energy solutions enable him to effectively and accurately address the environmental and technical considerations of this report.

2.0 110kV Grid Connection Overview

GCO2 will involve the construction of approximately 2.34km of two sets of underground circuit ducts, spaced a minimum of 2 m apart, to accommodate 110 kV electrical cables connecting the proposed Ballyfasy 110 kV Substation to the Great Island–Kilkenny 110 kV overhead line at the crossing point within the site via a Loop-in Loop-out connection.

The Grid Connection works will consist of the installation of 6 No. ducts in an excavated trench to accommodate 3 No. power cables, 1 No. fibre communications cable to allow communications between the Ballyfasy Wind Farm Substation and Castlebanny 110kV substation, 1 No. spare fibre communications cable and 1 No. earth continuity duct where required. The connection includes 2 No. cable sealing end masts where there will be a new loop-in loop-out connection to the existing Great Island – Kilkenny 110kV overhead line (OHL).

The 110kV High Voltage Underground Cable Connection construction shall be in accordance with EirGrids 110kV, 220kV and 400kV Underground Cable Functional Specification (CDS-GFS-00-001-R2).

A list of drawings of the GCO2 along with site specific crossing details and typical construction details are contained in Appendix A. The drawings have been included separately as part of the application.

2.1 Grid Route Location

An overview of the GCO2 location is detailed in Figure 2-1.

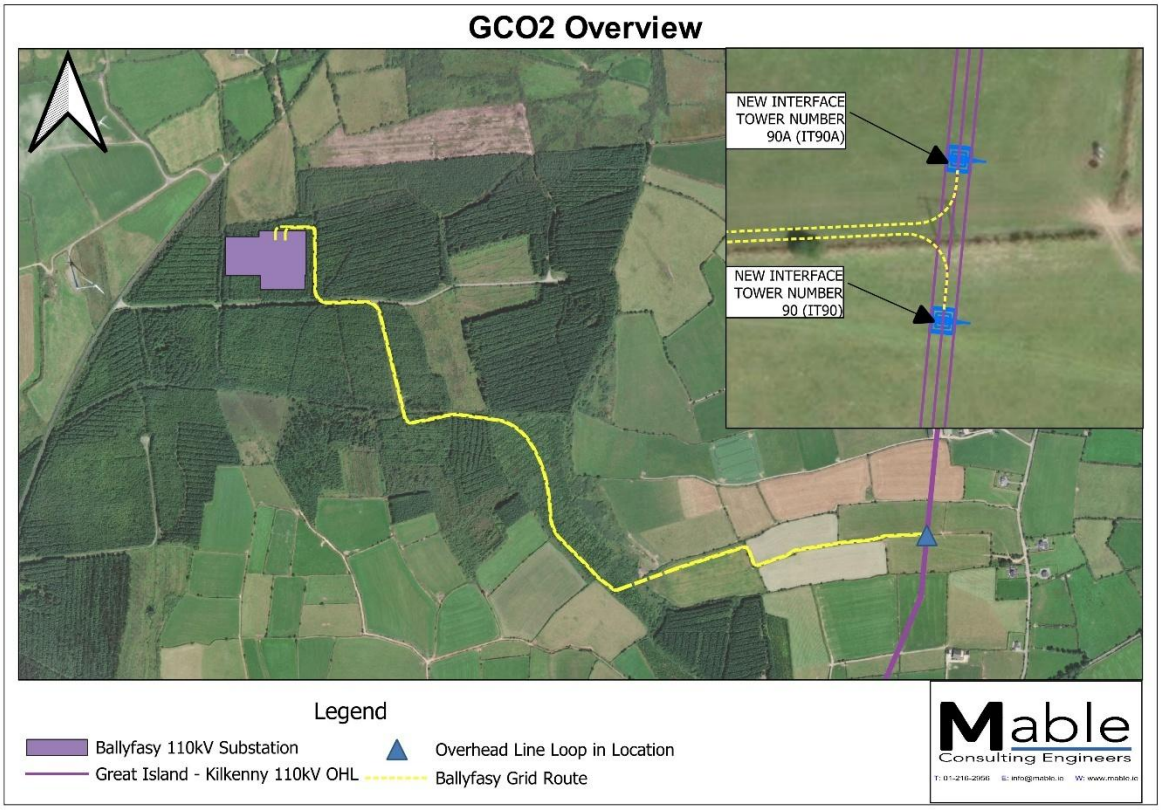


Figure 2-1 – GCO2 Overview

2.2 Grid Route Summary

The key elements of the proposed Grid Connection Route (GCR) are outlined in Table 2-1.

Item	Description
Substation Details	
Ballyfasy Substation	Ballyfasy Substation is to be constructed as part of Ballyfasy wind farm. The substation is located at the Northwestern corner of the site.
Grid Construction Details	
Grid Constructed in Private lands	2.34km
Total Length of Grid	2.34km
Infrastructure Details	
Ducting	6 No. ducts in an excavated trench to accommodate 3 No. power cables, 1 No. fibre communications cable, 1 No. spare fibre communications cable and 1 No. earth continuity duct where required
Joint Bays	6 No. Joint Bays are to be constructed as part of the grid route construction – 2 No. for each circuit
Communications Chambers	6 No. Communications Chambers are to be constructed as part of the grid route construction– 2 No. for each circuit
Earthing Link Boxes	6 No. Earthing Link Boxes are to be constructed as part of the grid route construction– 2 No. for each circuit
Cable Sealing End Masts	2 No. Cable Sealing End Masts will be constructed to break in to the existing Great Island – Kilkenny 110kV OHL.
Crossings Details	
Watercourse Crossings	1 No. Watercourse Crossing has been identified along the grid route which will be crossed using the horizontal directional drilling method
Culvert Crossings	No Existing culvert crossings were identified along the grid route, however there will be culverts constructed as part of the Wind Farm development. The Grid Route will be constructed in coordination with the Wind Farm infrastructure.
Access Tracks Crossings	No Existing Road crossings were identified along the grid route, however there will be access tracks constructed as part of the Wind Farm development. The Grid Route will be constructed in coordination with the Wind Farm infrastructure.
Other Works	
Ancillary Works	All associated infrastructure, line outages and traffic management required for the construction of the substation and grid connection route

Table 2-1 – Grid Route Summary

3.0 Consents

The key consents, licenses, notifications and permissions required for the GCR construction include the following:-

- Planning Permission and associated Planning Compliance.
- Commission for Regulation of Utilities (CRU) Authorisation and Licence to Generate.
- OPW Section 50 of the Arterial Drainage Act 1945.
- 3rd Part Land Agreements.

4.0 Construction Management

4.1 Safety and Health

The contractor shall ensure compliance with all safety legislation and guidelines including but not limited to the following:

- Safety, Health and Welfare at Work Act 2005.
- Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291/2013).
- Safety, Health and Welfare at Work (General Application) Regulations 2007 – 2020.
- H.S.A. Code of Practice for Avoiding Danger from Underground Services.
- H.S.A. Code of Practice for Safety in Excavations.
- EirGrid's Functional Specifications for Underground Cables.
- ESB Code of Practice Documents.
- CIF Construction Safety Partnership Guidelines.

4.1.1 Project Supervisor Design Process (PSDP)

The design and construction the proposed grid connection works are governed by the Safety, Health and Welfare at Work Act 2005 and also by S.I. No. 291 of 2013 the Safety, Health and Welfare at Work (Construction) Regulations 2013 (H&S Construction Regulations).

The scale and scope of this project requires that a Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) are appointed by the Developer (referred to as the client in the Construction Regulations).

The role of the PSDP is to ensure co-ordination of the work of designers throughout the project. This role is being performed by TOBIN up to the end of the planning stage of the project.

The Developer will appoint a PSDP for the construction stage of the project, the PSDP will report directly to the Developer. The duties of the PSDP will include:-

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project;
- Work with and coordinate designers to design out safety, health and environmental risks at source where possible so as to eliminate / reduce these risks during the construction stage and during the operation, maintenance and decommissioning;
- Prepare a written Safety and Health Plan for the project taking into account any particular risks;
- Communicate necessary control measures, design assumptions and residual risks to the PSCS so they can be dealt with in the Construction Stage Safety and Health Plan;
- Ensure that the work of designers is coordinated in terms of Health, Safety and the Environment;
    - Coordinate the designers involved in the project, including any temporary works designs during the construction stage;
- Organise co-operation between designers;
- Prepare a safety file for the completed development and give it to the client;
    - The safety file is to include relevant detail on the project's design, operation, maintenance and decommissioning;
- Notify the HSA and the client of non-compliance with any written directions issued.

4.1.2 Project Supervisor Construction Stage (PSCS)

The role of the PSCS is to manage and co-ordinate health and safety matters during the construction stage.

The Developer will appoint a PSCS for the construction stage of the project, the PSCS will report directly to the Developer. The duties of the PSCS will include:-

- Development of the Safety and Health Plan for the construction stage and update as required as work progresses;
- Notify the Health and Safety Authority (HSA) before work commences;
- Provide required safety file information to the PSDP;
- Report accidents / incidents to the HSA and the client;
- Coordinate the implementation of the H&S Construction Regulations, monitor compliance and take corrective action where necessary;
- Organise cooperation between contractors;
- Coordinate the checking of safe work procedures and monitor compliance with the H&S Construction Regulations;
- Review and approval of contractor method statements and risk assessments;
- Coordinate arrangements to ensure workers have Safe Pass and relevant Construction Skills Certification Scheme (CSCS) cards;
- Coordinate measures to restrict entry to site;
- Provide a site induction to all site personnel and carry out Toolbox Talks as necessary;
- Maintenance of the site Safety Files which are to include detail on personnel on site, their training details and induction date;
- Coordinate the appointment of a Safety Representative (when there are 20+ people on site);

Notify the HSA and the client of non-compliance with any written directions issued.

4.1.3 Preliminary Health and Safety Plan

During the detailed design stage of the Project a Preliminary H&S Plan will be prepared by the PSDP and circulated to designers, potential contractors and other stakeholders. This plan will identify potential safety hazards associated with the site and the works and assess the associated risks. Mitigation and control measures will be recommended to minimise the identified risks.

The Preliminary H&S Plan will then be developed further by the PSCS to create the Construction Stage H&S Plan for the works. This plan will address all safety and health aspects of the construction process and provide relevant contact details and emergency response procedures for the Project.

The Construction Stage H&S Plan will detail the site induction and training requirements for site personnel.

4.1.4 Documentation and Communication

All relevant safety documentation will be readily available on site and communicated clearly to all relevant personnel. This will include, but is not limited to, service drawings, results of detection surveys, risk assessments, and associated method statements.

Safety-critical information will also be shared in advance with the Local Authority and with any subcontractors or utility providers working in the same area.

Toolbox Talks and Site Meetings will be carried out regularly to ensure that safety procedures are understood and followed throughout the duration of the works.

4.1.5 Training and Competency

All workers involved in underground cable installation or excavation shall be trained in excavation safety, underground services awareness, and the safe use of detection and hand tools. Only individuals who have received relevant, up-to-date training such as those holding SOLAS-accredited Construction Skills Certification Scheme

(CSCS) cards for relevant categories will be permitted to carry out excavation or service-related tasks. Site supervisors shall verify training records and ensure that only competent personnel undertake high-risk activities. Regular refresher training and on-site supervision will be carried out to maintain a safe work environment.

4.1.6 Risk Mitigation

Prior to the commencement of works, a comprehensive risk assessment shall be carried out in accordance with the Health and Safety Authority's guidance. This will include identifying all known and potential overground and underground services using up-to-date utility records, site surveys, and appropriate detection technologies such as cable locators and ground-penetrating radar.

In areas where services are known or suspected to be present, safe digging practices must be followed, including hand-digging or vacuum excavation techniques, to prevent accidental contact with live or pressurised systems.

Contractors must maintain minimum clearance distances from existing infrastructure as set out in the HSA Code of Practice for Avoiding Danger from Underground Services. Particular attention will be paid to ensure adequate separation between the newly installed cables from existing water, gas, telecommunications, electrical, and other services.

4.2 Preliminary Requirements

Prior to any works commencing on site, the proposed design for the grid connection works including proposed traffic management will be reviewed and agreed with Kilkenny County Council's Road Engineer.

The proposed works will also be reviewed and agreed with other relevant stakeholders. Below is a non-exhaustive list of stakeholders whom the Developer will liaise with prior to commencement of the works:

- Kilkenny County Council.
- EirGrid.
- ESBN.
- Inland Fisheries Ireland (IFI).
- Uisce Éireann.
- Gas Networks Ireland (GNI).
- EIR.
- The Office of Public Works.

The below is a non-exhaustive list of tasks the Developer/ contractor shall carry out prior to commencement of the works:

- Consents from relevant stakeholders as per Section 3.0 will be sought.
- Ground conditions along the route of the cable to be comprehensively assessed through detailed site investigations.
- A Construction Stage Traffic Management Plan will be prepared and agreed with Kilkenny County Council.
- An on-site assessment of the works area will be carried out.
- A targeted method statement will be developed, outlining the construction methodology and incorporating all mitigation and control measures detailed in the planning application, supporting reports, and any relevant planning conditions.
- All existing overground and underground services will be identified and marked on site prior to the commencement of construction activities.

4.3 Temporary Construction Compounds

All plant and equipment will be stored either within the Grid Connection works area or in the Temporary Construction Compound located within the Ballyfasy Wind Farm Construction Site. Oils and fuels will be securely stored in a designated bunded area within the Ballyfasy Wind Farm Temporary Construction Compound, in compliance with environmental and safety regulations.

4.4 Traffic Management

Please refer the Traffic Management contained within the EIAR for further details.

4.5 Invasive Species Best Practice Measures

Please refer the Biodiversity Chapter of the EIAR for details.

4.6 Waste Management

Please refer the Waste Management contained within the EIAR for details.

4.7 Implementation of Environmental Mitigation Measures

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

4.8 Construction Hours

The hours of construction activity will be limited to avoid unsociable hours, where possible. Construction operations shall generally be restricted to between 07:00hrs and 19:00hrs on weekdays and between 07:00hrs and 14:00hrs on Saturdays.

It may be required to carry out works outside of the above hours, any such out of hours working will be agreed in advance with Kilkenny County Council.

4.9 Employment

For the Grid Connection construction, a peak workforce of approximately 10 persons is anticipated. There will be peaks and troughs in the numbers, with a larger workforce during the general cabling works.

4.10 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 18 months.

Development Element	Estimated Construction Duration
Substation Works	18 Months
Grid Ducting Works	2 Months
Cable Sealing End Mast Works	3 Months
Reinstatement Works	2 Months
Cable Installation Works	2 Months
Commissioning	1 Month

Table 4-1 – Estimated Construction Duration

5.0 Grid Connection Route and Substation Construction

The following is a non-exhaustive list of items that will be adhered to during the construction of the GCR:

- Works will be supervised by the contractors site management team and other relevant stakeholders at all times.
- Trenching works will be undertaken in a manner to ensure that no more than circa. 250m sections of trench is opened at any one time.
- No spoil shall be stored within 50m of any watercourse.
- Cabins, containers, workshops, plant, materials storage and storage tanks shall not be located near any surface water channels and will be located beyond the 50m hydrological buffer at all times
- At watercourse crossings, the contractor will be required to adhere to the environmental control measures outlined within the EIAR, the CEMP and best practice construction methodologies.
- If dewatering is required as part of the proposed works e.g. in trenches for underground cabling or in wet areas, water will be treated prior to discharge.

5.1 Substation Construction

The proposed sequence of works is as follows:

1. The Onsite Substation compound area will be outlined using ranging rods or wooden posts.
2. Perimeter drains will be installed or upgraded to collect surface water run-off from the Onsite Substation compound. This will involve the installation of check dams, silt traps and level spreaders to manage surface run-off effectively.
3. Topsoil will be stripped and carefully stockpiled for future landscaping use.
4. Subsoil will be excavated and retained on site by incorporated it into the perimeter of the compound area.
5. The Onsite Substation compound will be formed by constructing compacted layers of suitable hardcore;
6. The foundations for the substation building will be excavated down to the level indicated by the designer and concrete trench fill will be poured;
7. Steel reinforcement will be laid in place over the concrete trench fill and concrete foundations will be poured;
8. The blockwork walls for the building will be built up from the foundations to DPC level and the floor slab will be constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
9. Scaffold will be erected around the outside of the building;
10. The blockwork will then be raised to wall plate level and the gables & internal partition walls formed.
11. The concrete roof slabs will be lifted into position;
12. The construction and components of the substation buildings will be accordance with EirGrid requirements; The timber roof trusses at the building will be lifted into position using a telescopic loader or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.
13. Installation of a domestic foul wastewater holding tank to hold effluent from the toilets within in the substation building;
14. Installation of a rainwater harvesting tank to collect rainwater from the roofs of the substation building for toilet flushing and hand washing;
15. Construction of foundations for CCTV security monitoring poles and palisade fencing will be commenced;
16. Construction of the transformer bund, equipment plinths etc. within the substation compound will be carried out;
17. Construction of underground cable ducts and trenches within the substation compound will be carried out;

18. Installation of electrical equipment within the substation compound and buildings including transformers, busbars, circuit breakers, cable supports, switchgear, panels etc. and all associated cabling.
19. CCTV Security Monitoring will be mounted on steel columns anchor-bolted to reinforced concrete foundations.
20. Perimeter security fencing and gates will be installed around the compound perimeter on completion of the installation of all electrical components within the compound including those described below.
21. On completion of the ground works areas to be returned to green filed will be re-topsoiled and landscaped

5.1.1 Grid Trenching Methodology

Cable ducts will be placed within a trench with a typical depth of 1315mm and width of 825mm.

Typical trench layouts for a GCR constructed in a green field and a public road are outlined on drawings 25516-410, 25516-411, and 25516-412.

The proposed sequence of works is as follows:

1. The preliminary tasks outlined in Section 4.2 will be carried out.
2. Pollution control measures will be implemented in advance of any excavation works being undertaken as agreed with Kilkenny County Council and other relevant stakeholders.
3. Circa 250m of trench will be excavated to the required dimensions.
4. Ccable Ducting will be carried out as outlined in Section 5.1.2.
5. Once reinstatement of the previous 250m of trench has been substantially finished, the next 250m of trench will be excavated.

5.1.1.1 Excavation and Fill Material Volumes

As part of construction of the proposed grid route, materials such as stone aggregate and concrete material will be required. The material estimates for the grid route are outlined in Table 5-1 below.

Item	Quantity (m^3)
Imported Stone Aggregate	967
Concrete	1598

Table 5-1 – Excavated and Fill Material Volumes

5.1.1.2 Managing Excess Material from Trench

Excavated material will be recycled/ incorporated into the works as appropriate.

Excavated materials from grassed areas (topsoil, subsoil) will be stored separately for use during the reinstatement of areas as part of the wind farm works. Stockpiles will be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Environmental Manager.

5.1.2 Cable Ducting Methodology

The proposed sequence of works is set out below:

1. Grade, smooth and trim trench base when the required depth and width have been obtained.
2. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material. Depth of CBGM B to be as per the Grid Design Drawings.
3. Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing.

4. Fit a secure cap / bung to the end of each duct run to prevent the ingress of debris or water.
5. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact.
6. Place red cable protection strips on compacted CBGM B directly over the ducts.
7. Lay the top duct onto the freshly compacted CBGM B including the cable protection strips above the bottom row of ducts.
8. Fit a secure cap / bung to the end of each duct run to prevent the ingress of debris or water.
9. Surround and cover duct with CBGM B material in accordance with the drawings and thoroughly compact.
10. Place red cable protection strip on top of compacted CBGM B over each set of ducts as shown on the Grid Design Drawings.
11. Depending on the location of the cable trench and duct, 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 Grid Design Drawings.
12. Reinstate existing surface. For road sections, carry out temporary or permanent reinstatement in accordance with the grid design drawings and the specification of Kilkenny County Council or private landowners if works are in private lands.
13. Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12 mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes in preparation for cable installation at a later date. All the works will be witnessed by ESBN's Clerk of Works as required.

Typical trench layouts for GCO2 within a access track and within landscaped areas are shown in Figure 5-1 & Figure 5-2

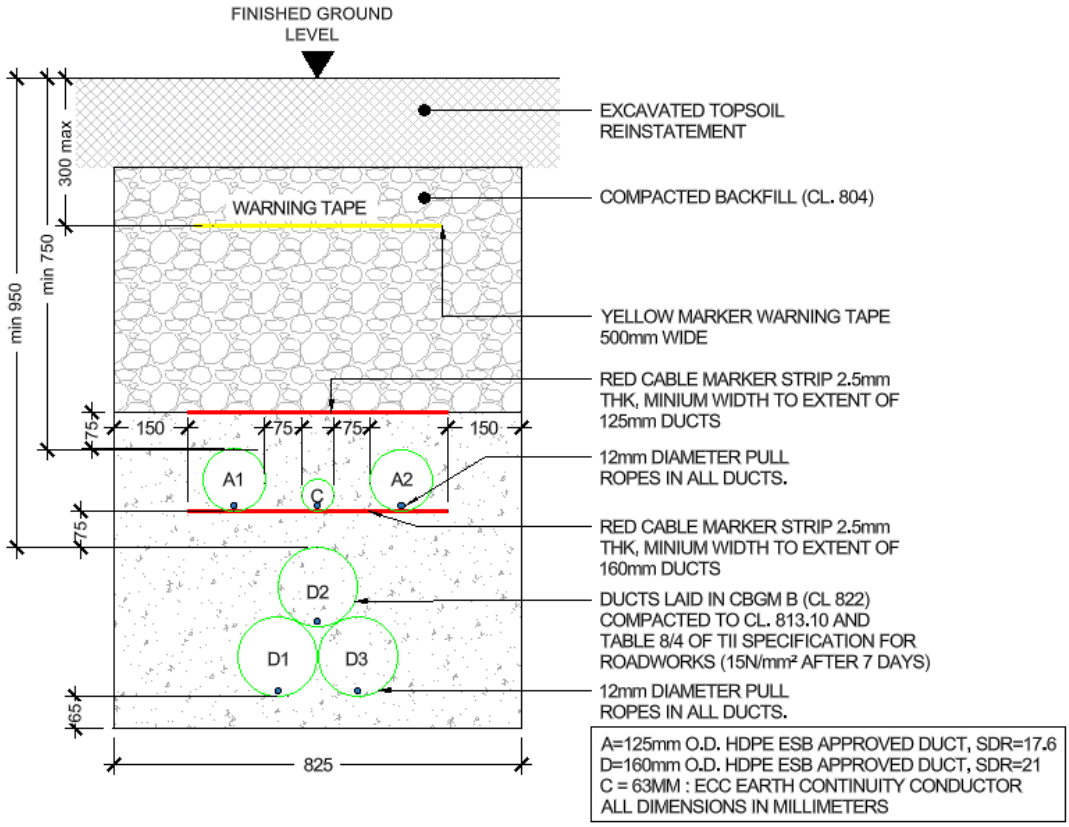


Figure 5-1 - Typical Cable Trench Layout in Soft Landscaped Area

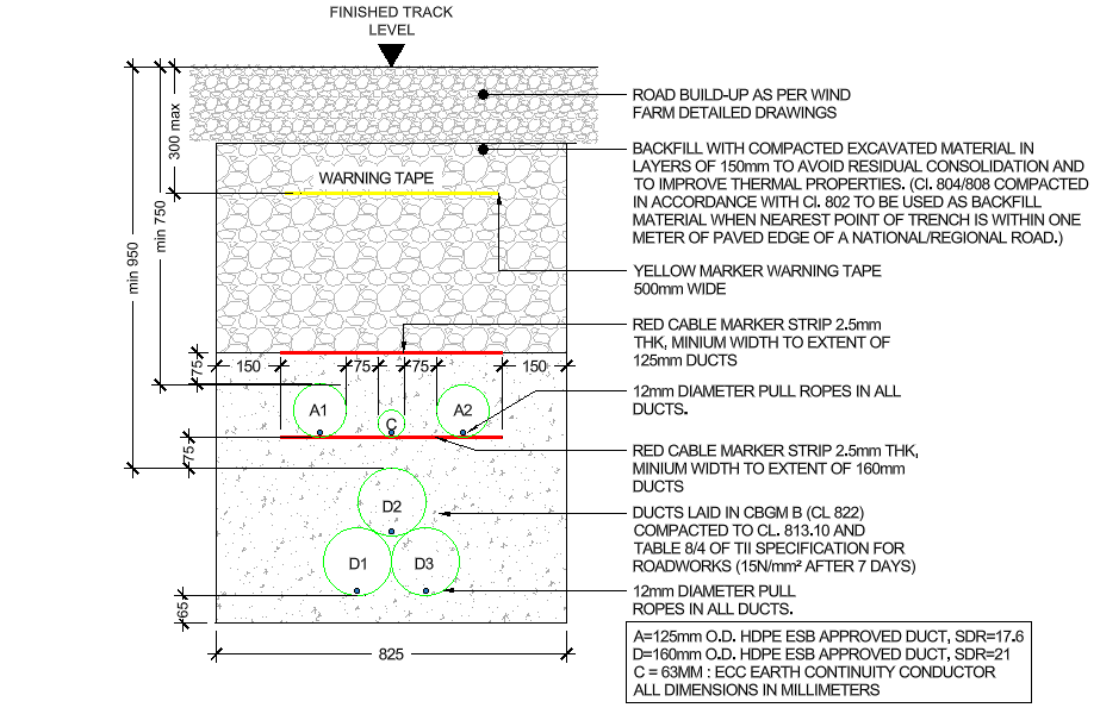


Figure 5-2 - Typical Cable Trench Layout in Access Track

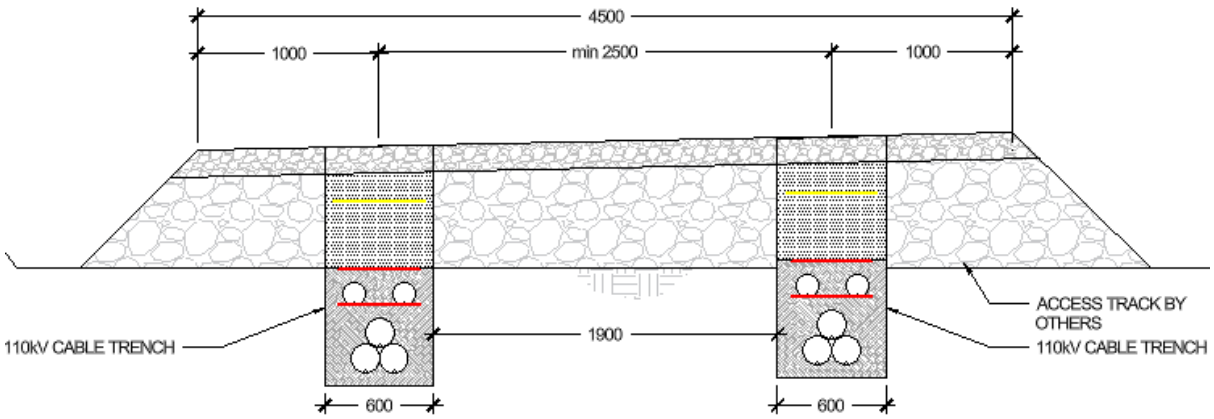


Figure 5-3 - Typical Grid Spacing

5.2 Horizontal Direction Drilling (HDD)

Horizontal Direction Drilling is a method of drilling under obstacles such as roadways, bridges, railways, water courses, etc. in order to install cable ducts under the obstacle with no impact. This method is employed where installing the ducts using standard installation methods is not possible or impractical. There is 1 No. location on this GCR route which will require HDD, this is outlined in Section 6.0.

Details on HDD crossings are outlined in the design drawings in Appendix A – Grid Design Drawings.

The drilling methodology is as follows:

1. A works area of circa. 50m^2 will be established 50m of both sides of the crossing.
2. The drilling rig and fluid handling units will be located on one side of the bridge and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
3. Entry and exit pits (1m x 1m x 2m) will be excavated using an excavator, the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.

4. A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.
5. The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the watercourse.
6. A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
7. The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
8. Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side.
9. Once all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
10. The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
11. The ducts will be cleaned and proven, and their installed location surveyed.
12. The entry and exit pits will be reinstated to the specification of ESBN, EirGrid and Kilkenny County Council.
13. A transition coupler will be installed at either side of the bridge/ following the HDD as per ESBN and EirGrid requirements, this will join the HDD ducts to the standard ducts.

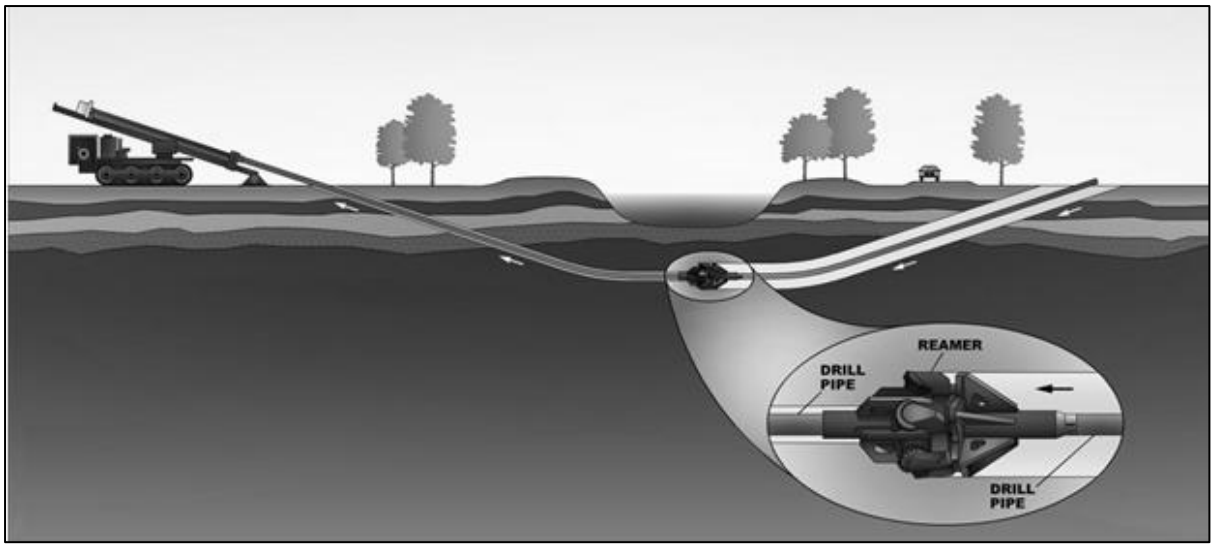


Figure 5-4 – Typical HDD Installation

5.2.1 Precast Joint Bays and Associated Chambers

Joint bays will be provided to meet the requirements of standard cable drum lengths and/or as required to limit cable pulling forces. Joints Bays are to be installed as shown on the grid design drawings and approximately every 650m - 850m along the UGC route to facilitate the jointing of 2 No. lengths of Grid Cabling. The Joint Bays will be typically 6m x 2.5m x 2.05m pre-cast concrete structures installed below finished ground level.

In line with the 'Interim Guidance to Road Authorities regarding the proposed placement of Medium or High Voltage electricity assets, including ducts, cables, and associated infrastructure under public roads', joint bays will be installed with a minimum cover of 600mm below finished access track level and shall have a precast concrete cover installed prior to backfilling back up to road level.

In association with Joint Bays, Communication Chambers will be installed at each joint bay location to facilitate communication links between the Ballyfasy Wind Farm substation and the proposed Great Island – Kilkenny 110kV OHL. The Communications chambers will typically be 1.3m x 1.03m x 1.294m pre-cast concrete structures.

Earth Sheath Link Chambers will also be installed 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. The Earthing Sheath Link Chambers will typically be 1.75m x 1.25m x 1.2m pre-cast concrete structures.

Earth Sheath Link Chambers and Communication Chambers will be located in close proximity to Joint Bays with a minimum distance of 2.3m and a max distance of 10m from the centre of the joint bay to the centre of the chambers. Earth Sheath Link Chambers and Communication Chambers will typically be pre-cast concrete structures with an access cover at finished surface level.

The following criteria will apply to the selection of joint bays, earthing link boxes and C2 Communication Chambers:

- Joint bays, link boxes and C2 chambers will be kept away from access points.
- Adequate room will be provided in front of and behind each joint bay, link boxes and C2 chambers location to accommodate cable drums, vehicle used for maintenance and pulling equipment.
- All proposed joint bay locations will be proven by trial holes and in areas of poor ground conditions the use of bore holes may be necessary.
- The selection of joint bay, link boxes and C2 chambers will take account of the maximum calculated pulling forces and tensions
- Where cross-bonding of the cable sheath is employed, joint bay positions will be constrained and will require that minor sections are of substantially equal length.
- Splicing of fibre optic cable will take place in specific C2 chambers as determined at detailed design stage.

5.2.1.1 Joint Bay Construction Methodology

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

1. Excavate a trench to suitable bearing strata (100kN/m^3), including for a sump in one corner.
2. Grade and smooth the trench and lay a 75mm deep layer of blinding concrete on 200mm Layer of Clause 804 or similar acceptable material, subject to site ground conditions.
3. Install Pre-cast joint bay sections on the 75mm blinding layer.
4. Where joint bays are located under the access track surface the joint bay will be backfilled with compacted layers of Clause 804 and the track surface temporarily reinstated.
5. Precast concrete covers may be used as temporary reinstatement of joint bays at off road locations. These covers are placed over the constructed joint bay and are then removed at the cable installation stage of the project.
6. At a later date to facilitate cable installation and jointing, reinstate traffic management signage, secure individual sites, re-excavate three consecutive joint bays and store excavated material for reuse.
7. The cable is supplied in pre-ordered lengths on large cable drums 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.
8. Once the “two sections” of cable (total of 6 conductors) are pulled into the joint bay, a jointing container is positioned over the joint bay and the cable jointing procedure is carried out in this controlled environment.

9. Following the completion of jointing and duct sealing works in the joint bay, place and thoroughly compact cement-bound sand in approximately 200 mm layers to the level of the cable joint base to provide vertical support. Install additional layers of cement-bound sand and compact each layer until the cement-bound sand is level with the top of the joint. Install an additional 100 mm cement-bound sand layer. Install cable protection strip. Backfill with cement-bound sand to a depth of 250 mm below surface
10. Once Backfilled, a precast concrete cover will be installed to comply with the 'Interim Guidance to Road Authorities regarding the proposed placement of Medium or High Voltage electricity assets, including ducts, cables, and associated infrastructure under public roads'.
11. Permanent reinstatement including placement of warning tape at 400 mm depth below finished surface will then be installed.

A typical detail joint bay and associated chambers are shown in Figure 5-5.

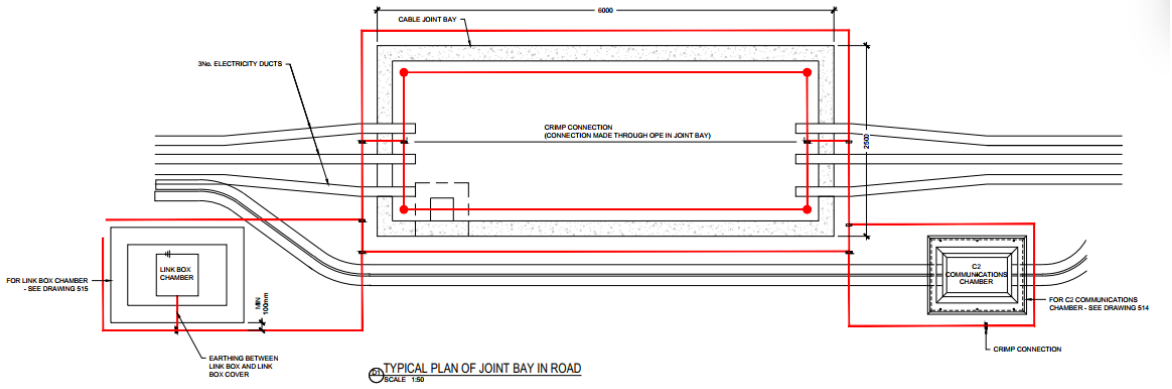


Figure 5-5 – Joint Bay and Associated Chambers Arrangement (Plan View)

5.2.2 Loop-In Masts

5.2.2.1 Existing 110kV OHL

The proposed Ballyfasy Wind Farm 110kV loop-in station will connect into the existing Great Island - Kilkenny 110kV overhead transmission line. The proposed design for the 110kV Loop-In from the existing OHL will require two new mast structures, which will be constructed under the existing Great Island - Kilkenny 110kV OHL. The two new end masts will be placed either side of existing Pole set No.90. Pole set structure No. 90 will be removed after the installation of the two new cable interface masts.

The existing OHL conductor will be terminated at these towers and the line will connect to the Ballyfasy substation via underground cable.

5.2.2.1.1 Mast Construction Methodology

1. Safety measures will be put in place for the duration of the works, these will include physical barriers such as Heras Fences and goal posts to restrict plant from coming too close to the OHL.
2. Mast sites will be scanned for underground services such as cables, water pipes, etc. Consultation with landowners will help to identify hazards and ensure there are no unidentified services in the area.
3. For each leg of the 2 No. masts (8 legs in total), a foundation approximately 4 m × 4 m × 3 m deep is required. To allow for safe construction, the excavation will be stepped back, which requires additional area to be excavated, or sheet piles will be used if the ground material is not suitable for benching. The formation levels (depths) will be checked by the onsite engineer. Excavated material will be temporarily

stored close to the excavation, and excess material will be used to form berms along the site access roads.

4. To aid construction, a concrete pipe will be placed into each excavation to allow operatives to level the mast at the bottom of the excavation. The reinforcement cage will be prepared and strapped to the concrete pipe with spacers as required. The reinforcement will be lifted into each excavation using the excavator with chains/slings. The base and body section of each mast will then be assembled next to the excavation.
5. Concrete trucks will pour concrete directly into each excavation in distinct stages.
6. A final concrete pour will encase the mast leg, with the finish brought up to 300 mm above the finished ground level. Each mast leg will be shuttered with metal panels to form the required shape.
7. Once the concrete has set (after approximately five days), the shuttering will be removed, and any sheet piles used will also be taken out.
8. 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 dealt with as per the waste management plan.
9. For the masts located under the existing line, the line will be de-energised by ESB so work can commence on the construction of the masts.
10. 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.
11. Once the base section of each mast is completed and the concrete sufficiently cured, it is ready to receive the mast body.
12. A hardstand area for a crane will be created by laying geogrid material on the ground surface and overlaying this geogrid with a suitable grade of aggregate.
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 5-6 – Cable End Masts

5.2.3 Surface Cable Markers & Marker Posts

Surface Marker posts will be used on non-roadway routes to delineate the cable route and joint bay positions. Marker posts will also be placed in the event that burial depth is not to standard. Marker posts will be in accordance with Figure 5-7. The design of the marker posts shall be agreed with EirGrid and ESBN as part of the detailed design process.

Figure 5-7 below shows a Typical Cable Marker Post.

Figure 5-7 Typical Cable Marker Post

6.0 Grid Connection Route Crossings

6.1.1 Existing Underground Services

In order to facilitate the installation of the underground cable, it will be necessary to cross or relocate/ divert existing underground services such as drainage lines, water mains, telecom networks or electrical cables. Crossing existing services will be carried out using open trenching with either crossing under (undercrossing) or crossing over (overcrossing), depending on the depth of the service. Where this method is not suitable, the "no dig" HDD method will be used.

At detailed design stage a detailed survey and scan of existing services in the public road will be carried out. Records of existing service at the time of construction of will also be obtained from utility companies. These will be used to select the most appropriate routing of the grid connection route to avoid clashing with existing services as far as is practicable.

This process will be carried out in coordination with all relevant stakeholders outlined below:

- Kilkenny County Council.
- ESBN.
- Gas Networks Ireland.
- Uisce Éireann.
- EIR.
- All other relevant stakeholders which may be encountered/ affected during the works.

Crossing of existing services are listed in Appendix A – Grid Design Drawings.

6.1.1.1 Existing Service Requests

Uisce Éireann

Uisce Éireann records for services in the vicinity of the Grid Connection were requested. A response from Uisce Éireann outlined that no Uisce Éireann services were present along the grid connection route. It is not envisaged that the grid connection route interacts with the existing Uisce Éireann services.

Group Water Scheme

Group Water Schemes and their protection zones in the vicinity of the development were reviewed. It is noted that the nearest GWS and protection zone is at a distance of 2km from the development. It is not envisaged that the grid connection route interacts with any GWS.

Gas Networks Ireland

Gas Networks Ireland (GNI) service records were obtained. a review of the service records showed that there are no gas connections in the vicinity of the grid connection route. It is not envisaged that the grid connection route interacts with the existing GNI services.

ESBN

ESBN records for overground and underground services in the vicinity of the GCO2 were obtained. There are no underground ESBN services present along the grid connection route. No overhead lines were observed on along the route. It is not envisaged that the grid connection route will interact with existing ESBN services, except for the Great Island–Kilkenny 110 kV overhead line, into which the loop-in LOOP-OUTconnection is proposed to be made.

Eir

Eir records for overground and underground services in the vicinity of the GCR were obtained and reviewed. There are overground Eir services along the route. It is not envisaged that the grid connection route interacts with the existing Eir services.

Surface Water

Kilkenny County Council were contacted for surface water services in the area.

Surface water services were reviewed on the ground during GCR walkover inspection. There are localised drainage features such as valleys along the route. There is no piped surface water sewer network present along the grid route.

6.1.2 Culvert Crossings

Crossing existing culverts will be carried out using open trenching with either an undercrossing or an overcrossing depending on the depth of the culvert. The culvert crossing methods are detailed in Figure 6-1 & Figure 6-2.

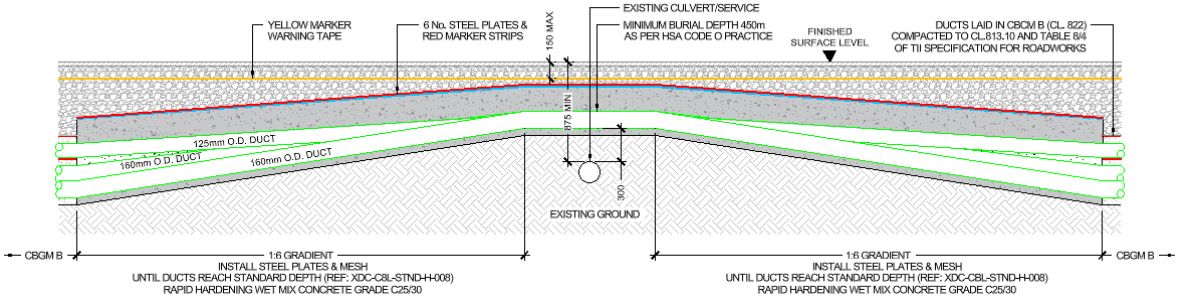


Figure 6-1 – Culvert/ Service Overcrossing

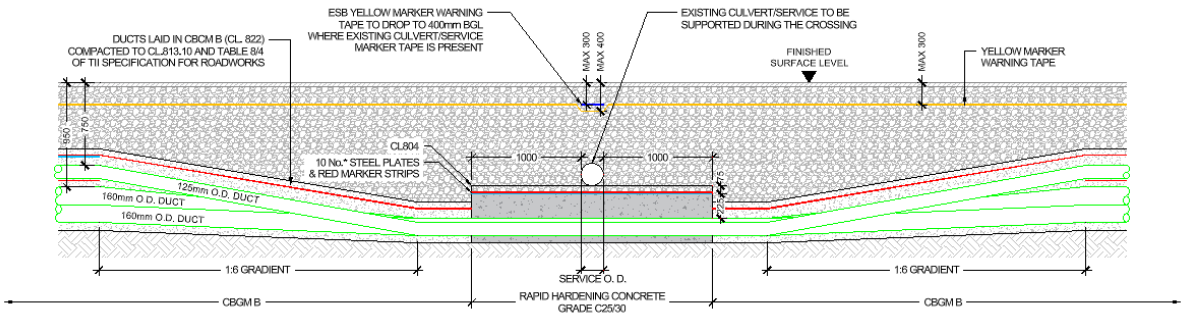


Figure 6-2 – Culvert/ Service Undercrossing

6.1.3 Watercourse Crossings

The proposed grid connection route consists of 1 No. Watercourse crossings which Horizontal Directional drilling will be deployed. The Watercourse Crossing is located at ITM Coordinates 662246E 625609N.

A detailed construction method statement will be prepared by the Contractor prior to the commencement of construction and agreed with Kilkenny County Council, IFI, the OPW, and other relevant environmental agencies.

It is proposed to horizontal directional drill (HDD) approximately 1.5m beneath the watercourses and bridge foundations. The depth may increase subject to geotechnical investigations and IFI Requirements. Drilling will take place outside the 50m watercourse buffer.

IFI have published guidelines relating to construction works along water bodies titled 'Guidelines on Protection Of Fisheries During Construction Works In and Adjacent To Waters (IFI, 2016)". These guidelines will be adhered to during the construction of the grid connection route.

Table 6-1 outlines a summary of the proposed crossing.

Watercourse Name	Crossing Structure	Dimensions	Crossing Method	ITM Coordinates
Unnamed	N/A	N/A	Horizontal Directional Drilling	662246E 625609N

Table 6-1 – Watercourse Crossing 1 Summary

6.1.4 Other Crossings

Although unlikely, based on the preliminary site walkover along the wind farm development, the route may encounter a number of smaller crossings, including wind farm circuit cable ducts and drainage pipes. It is envisaged that the grid connection works and the wind farm infrastructure will be constructed in parallel.

These crossings and associated installation works will be managed using appropriate protection measures, agreed methodologies, and close coordination with the wind farm contractor to ensure safe working practices and to avoid damage to existing infrastructure.

The method selected for crossing each feature will depend on the depth, condition, and type of service. Construction will follow the Details set out in Appendix A – Grid Design Drawings listed in Appendix A , ensuring minimal impact on existing services and compliance with all relevant standards.

Appendix A – Grid Design Drawings

Drawing List:

Drawing List	Mable Consulting Engineers T: 01-216-2656 E: info@mable.ie W: www.mable.ie			Created By:	ER
				Checked By:	BMG
				Date Created:	21/11/2025
				Status	Planning
Drawing Title	Drawing Number	Scale	Page Size	Description	
Grid Connection Option One					
Grid Connection Option One Site Layout Map Key Plan	200	1:10000	A1	Planning Issue	
Grid Connection Option One - Site Layout Map 1 of 7	201	1:2500	A1	Planning Issue	
Grid Connection Option One - Site Layout Map 2 of 7	202	1:2500	A1	Planning Issue	
Grid Connection Option One - Site Layout Map 3 of 7	203	1:2500	A1	Planning Issue	
Grid Connection Option One - Site Layout Map 4 of 7	204	1:2500	A1	Planning Issue	
Grid Connection Option One - Site Layout Map 5 of 7	205	1:2500	A1	Planning Issue	
Grid Connection Option One - Site Layout Map 6 of 7	206	1:2500	A1	Planning Issue	
Grid Connection Option One - Site Layout Map 7 of 7	207	1:2500	A1	Planning Issue	
110kV Substation Compound Option 1 - Tail Fed Station – Key Plan	250	1:500	A1	Planning Issue	
110kV Substation Compound Option 1 - Tail Fed Station	251	1:200	A0	Planning Issue	
Substation Compound Option 1 - Elevations 1 of 2	252	1:200	A1	Planning Issue	
Substation Compound Option 1 - Elevations 2 of 2	253	1:200	A1	Planning Issue	
Temporary Site Construction Compound Layout And Building Details	254	As Shown	A1	Planning Issue	
Typical Horiziontal Directional Drilling Under Watercourse	260	As Shown	A2	Planning Issue	
Typical Horiziontal Directional Drilling Under Watercourse Culvert	261	As Shown	A2	Planning Issue	
Glenpipe Road Bridge 1.0 Crossing	262	As Shown	A2	Planning Issue	
Glenpipe Road Bridge 2.0 Crossing	263	As Shown	A2	Planning Issue	
Grid Connection Option Two					
Grid Connection Option Two Site Layout Map Key Plan	300	1:10000	A1	Planning Issue	
Grid Connection Option Two - Site Layout Map 1 of 2	301	1:2500	A1	Planning Issue	
Grid Connection Option Two - Site Layout Map 2 of 2	302	1:2500	A1	Planning Issue	
110kV Substation Compound Option 2 - Loop Station – Key Plan	350	1:500	A1	Planning Issue	
110kV Substation Compound Option 2 - Loop Station Station	351	1:200	A0	Planning Issue	
Substation Compound Option 2 - Elevations 1 of 2	352	1:200	A1	Planning Issue	
Substation Compound Option 2 - Elevations 2 of 2	353	1:200	A1	Planning Issue	
Interface Mast Detail	354	1:200	A3	Planning Issue	
Typical Horiziontal Directional Drilling Under Watercourse	360	As Shown	A2	Planning Issue	
Detailed Drawings					
EirGrid Substation Building Plan & Elevations	400	1:100	A1	Planning Issue	
IPP Substation Building Plan & Elevations	401	1:100	A1	Planning Issue	
Site Compound Details & Access Road Details	402	As Shown	A3	Planning Issue	
Rainwater Harvesting and Foul Tank Details	403	1:50	A3	Planning Issue	
18m High Lightning Rod Details	404	As Shown	A3	Planning Issue	
Substation Gate & Fence Details	405	1:50	A3	Planning Issue	
Typical Property Boundary Fence and Gate Detail	406	1:50	A3	Planning Issue	
Relay Tower Details	407	1:200	A3	Planning Issue	
Typical 110kv Cable Trench Details	410	1:20	A3	Planning Issue	
Typical Grid Connection Spacing Details	411	1:50	A3	Planning Issue	
Typical 110kV Cable Trench Details Through Public Road 1 Of 2	412	1:20	A3	Planning Issue	
Typical 110kV Cable Trench Details Through Public Road 2 Of 2	413	1:20	A3	Planning Issue	
Standard Existing Service Under-Crossing; Ducts In Full Flat Formation	414	As Shown	A3	Planning Issue	
Standard Existing Service Over-Crossing; Ducts In Full Flat Formation	415	As Shown	A3	Planning Issue	
Typical 110kV Cable Trench Open Drain Crossing	416	As Shown	A3	Planning Issue	
Joint Bay Typical Earthing Arrangement	420	1:50	A3	Planning Issue	
Joint Bay Typical Arrangement	421	1:50	A3	Planning Issue	
Joint Bay Reinstatement	422	1:50	A3	Planning Issue	
Standard C2 Chamber General Arrangement	423	1:20	A3	Planning Issue	
Link Box Chamber General Arrangement	424	1:20	A3	Planning Issue	

Enclosed Separately