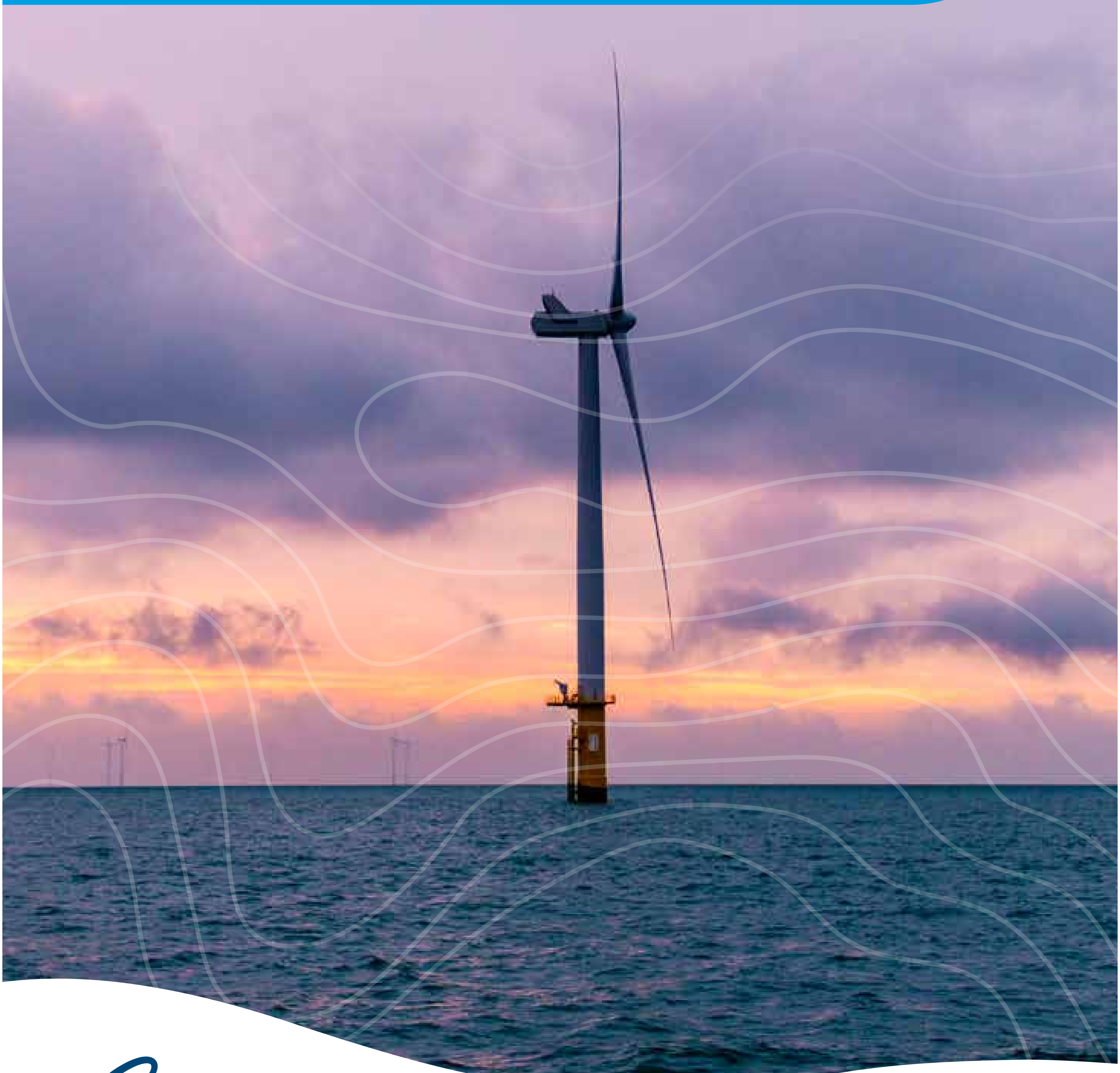
Appendix 5-12 Addendum:
Construction Methodology – Onshore Cable



ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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ESB Energy for generations

Oriel Offshore Windfarm
220 kV Onshore Cable

Construction Methodology

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Change History of Report

Date	New Revision	Author	Summary of Change
26/02/24	005	N.Bell	Transition Joint Bay methodology added
25/11/25	006	N.Bell	Updated to include amendments for the RFI

1 Preface

This report has been completed as a guide to provide suitable information on the standard construction techniques required to complete the Oriel Offshore Wind Farm 220 kV Onshore cable element. The different techniques required to complete the project have been provided in a step-by-step guide along with the civil work aspects regarding joint bay construction, passing bays, standard water crossing procedures and High Voltage (HV) 220 kV cable installation.

This report provides specific construction methodologies for this project. It is considered that the proposed methodologies are adequate for an understanding by the Planning Authority of the project.

The methodologies in this report are the current expected methodologies for the construction of this project. These approaches may require local variation during the detailed design and construction of the project depending on the best working practices and preferred construction techniques of the selected contractor. It is considered that such methodologies are adequate for an understanding by the Planning Authority of the project.

This report was updated in response to amendments of the onshore cable design resulting from a Request for Further Information (RFI) from An Coimisiún Pleanála (formerly An Bord Pleanála) regarding the planning application (case reference 319799) for the Oriel Wind Farm Project (hereafter referred to as “the Project”).

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2 Introduction

It is the policy of EirGrid and ESB Networks that, in so far as possible, high voltage underground cables shall only be installed under public roads. One of the key advantages of laying cables under roadways is that there is usually no permanent impact on the environment additional to that caused by the presence of the roadway. When an underground cable (UGC) is laid under an existing roadway the potential for impact is normally only a short-term impact during the construction phase.

The majority of joint bays proposed along the cable route will be located within the existing road or, if required, at suitable off-road locations which will be adjacent to the carriageway. The selection of joint bay locations involved technical and environmental evaluation of the sites to ensure that the area is suitable for construction works. At each joint bay a working area is required which provides adequate space for cable pulling and jointing around the joint bay. This working area will also provide space for movement of all construction vehicles. As the majority of joint bays will be located in the road a temporary passing bay will be constructed immediately adjacent to the public road to avoid road closures. Due consideration must also be given to the possible presence of existing underground and overhead services, traffic management requirements, landowner agreements and existing ground conditions. Once agreements with each landowner are reached, and following planning approval, site investigations are carried out to prove these locations suitability and allow the civil works commence. Refer to **section 3.2** of this report for further details on proposed site investigations. Refer to the Preferred Onshore Cable Route drawing included in the Planning Drawings.

A civil contractor carrying out the standard 220 kV trenching and ducting specification will complete between 30 to 50 linear metres of trench in a roadway per day depending on the site conditions. All road works involving cable and pipe laying e.g., watermains, broadband, television etc., require traffic management procedures when installing within public roads. It will likely be a temporary requirement that some roads are closed along particular sections of the cable route. This can have a temporary disruptive effect locally on residents over the period of the installation works. In the case of the N33, one carriageway may be closed with use of the other carriageway restricted and controlled by temporary traffic lights or a “stop and go” traffic management system. The traffic management plan and corresponding works shall be carried out with the agreement of the local authority.

All measures included in the Project to prevent and minimise impacts on the environment (as outlined in **volume 2C of the EIAR**) will be implemented as part of the installation of the onshore cable route. Furthermore, the contractor will be required to adhere to the Construction Environmental Management Plan (CEMP) (refer to **appendix 5.1 of the EIAR**). All works set out in this document will take place within the planning application boundary for the Project (as outlined on the planning drawings).

This report describes the construction methodology of the onshore cable route only, from the proposed landfall to the proposed substation.

3 Methods and Elements of Construction

3.1 Key Construction Elements

Refer to the Planning Drawings which outlines the Preferred Onshore Cable Route. This project will involve different methodologies of construction in order to lay the cable with the approach depending on site location of the cable route. The key points related to the onshore cable are outlined as follows:

- The cable route will run for approximately 20.1 km from Dunany Point, to the 220 kV substation proposed to be built off the N33, near Stickillin.
- A joint bay will be constructed approximately every 600-750 m, resulting in 29 joint bay locations along the cable route. A link box and communication chamber will be built beside each of the joint bays. General arrangement drawings for these three elements are shown in the Planning Drawings.
- A passing bay is required during the construction of a joint bay and during cable pulling, to allow traffic to continue on the road during construction. A standard passing bay is 60m long and 10m to 20m wide and will be reinstated as per existing ground conditions, following the construction of the joint bay. A standard layout is shown in the Planning Drawings.

For the cable route, there are three main elements of works. Site investigation works will be required prior to any trench or trenchless works to verify the construction method:

- **Trenching and ducting works** will be confined, where possible, to within the existing road corridor. The majority of the cable route will be completed using trenching and ducting. The corresponding cross section is shown in in the Planning Drawings. The standard works for trenching and ducting are described further in **Section 4.**
- **Trenchless crossing** methods are anticipated to be used in atypical locations where trench and ducting works are not feasible, for example at river crossings, rail lines, motorways etc.. It is anticipated, at this stage of the project, that Horizontal Directional Drilling (HDD) will be required for the following crossings:
    - the M1/Dublin-Belfast rail line crossing
    - the two River Dee crossings
    - Port Stream
    - Salterstown River

  The trenchless methods of construction are described further in **Section 5 and in Section 6.**
- **Open trench crossing methods** can be used for water crossings where existing bridges cannot accommodate the high voltage cables. This method is discussed further in **Section 6.** It is anticipated, at this stage of the project, the open trench method will be required for the following water crossing:
    - Port Stream crossing at Clonmore.

3.2 Site Investigations

Site investigations along the proposed cable route will be carried out in advance of the approved designs being finalised and before the contractor commences civil works. These site investigations may include but not limited to digging trial holes, cable percussion boreholes, rotary boreholes, ground penetrating radar, and geophysical surveys to detail the cable route and to ensure that there is sufficient space to install a 220 kV cable trench, which typically measures approximately 1.425 m depth by 0.7 m wide. If the site investigation works identify areas where there is insufficient space to install the 220 kV cable trench, further investigation and design review of the cable route will be required for the affected area. Additional site investigations (e.g., trial holes [1]) may be required to gather additional information on the road cover available over existing bridges and culverts with the relevant local authority approval. This information may be used to prove the requirement for off-road alignments if insufficient cover exists. Drawings detailing the cable route will be completed following the site investigation. Additional trial holes or bore holes may be required at locations where trenchless methods are anticipated to be required in order to determine the geotechnical properties of the soil. This information will be required to complete the trenchless methods design. The most commonly used method of trenchless installation utilised on HV cable circuits in Ireland, at present, is Horizontal Directional Drilling (HDD). The cable design to date has been progressed to allow a full consideration of all environmental impacts. Final design will confirm details such as depths of drilling, however the extent of works will remain within the planning application boundary for HDD crossings.

The fields adjoining the public road along the cable route appear to be well drained and it is expected that very little ground water will be encountered during the ducting trench works. As the route approaches the shoreline the groundwater table may rise. If groundwater is encountered during site investigation works, then groundwater levels shall be recorded using standpipes.

[1] Note a trial hole is a small hole excavated by hand or by an excavator to collect information on the soil, strata, and/or service below the ground.

3.3 Contractor's Duties

In advance of starting the works, the Contractor or the appointed wayleave officer shall liaise with all directly impacted landowners. The Contractor will set out the cable route alignment, joint bay positions and river crossing alignments.

The Contractor shall obtain plans, maps and other relevant information about buried services from statutory authorities and other public utilities. Refer to **volume 2C, chapter 29: Material Assets** for a full range of measures to be included in the project regarding minimising disruption to utilities during construction. The Contractor shall also ensure that the relevant road opening licences have been obtained from the local authority.

The Contractor's general work requirements shall be:

1. Present professionally drafted traffic management plans for each stage of the works.
2. Secure each work area with adequate protective barriers and organise traffic signs and traffic management controls to the approval of the Engineer, in accordance with the approved **Construction Traffic Management Plan set out in volume 2A; appendix 5.9: Construction Traffic Management Plan (CTMP).**
3. In off road locations, a temporary hardstand working area will be created and fenced to facilitate the construction and associated traffic. These working areas will be removed upon completion of the cable installation and jointing works. Refer to description of passing bays in v**olume 2C chapter 5: Project Description.**
4. Provide secure and clean storage facilities for all ducting and trenching materials, cable installation equipment and cable drums.
5. Carry out a surface check for underground services with appropriate detection equipment.
6. Clean and sweep adjacent public roadways and footpaths during and after the works.

4 Trenching and Ducting

4.1 General Methodology

As stated in **section 3**, the majority of the 20.1 km onshore cable route will follow the trenching and ducting method. There are fibre ducts installed within the entire length of the cable trench. There is a separate additional fibre duct within the cable trench from the new 220 kV substation at Stickillin to the existing Drybridge - Louth 110 kV Overhead line for approx. 3 km along the N33. The duct will allow a fibre connection into the existing electricity network to provide communications to the new 220 kV Substation in the townland of Stickillin.

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

1. Saw cut to full depth of existing asphalt/bitmac layers and/or concrete surfacing. In grassed fields, carry out the works in accordance with specification.
2. A road planer or other approved method shall be used to remove the trench section of the road surface.

3. Commence excavation of this section of trench with due attention to the presence of other services and to the grade of the trench. Hand dig when within 500 mm of services and around trees. Note that a length of 12 m of proven excavation should be exposed ahead of any commencement of ducting. This is to allow for the bending of ducts to avoid obstacles and the possible requirement for digging back on re-commencement of new excavation if an obstacle is encountered within the 12 m.
4. Where possible, crossing of existing services shall be carried out at right angles. The Contractor shall provide a standard minimum 300 mm vertical clearance between the proposed ducts and the existing services to be crossed.
5. Where possible, the Contractor should ensure a minimum distance of 500 mm horizontal separation is maintained between the edge of the power ducts and existing services.
6. Simultaneously load and remove, excess material off-site for reuse, recovery or disposal in line with the waste hierarchy. In grassed fields the excavated soil shall be stored within the wayleave for future reinstatement.
7. Protect all services against damage due to trenching, ducting, backfilling and compaction.
8. Remove all ground water from the trench. Treat and dispose of the ground water in accordance with current legislation and best practice. Refer to measures set out in v**olume 2C, chapter 21: Soils, Geology and Hydrogeology.**
9. Grade, smooth and trim trench floor when the required depth and width have been obtained.
10. 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 trench cross section drawing shown in in the Planning Drawings.
11. Lay the bottom row of ducts in flat formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing (see **Figure 1)**. Fit a secure cap / bung to the end of each duct run to prevent the ingress of dirt or water.
12. Provide pits for lubrication. Bentonite grouting may or may not be used depending on the depth of the cable and ground conditions which impact cable rating.
13. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compacted without damaging ducts.
14. Place cable protection strips on compacted CBGM B directly over the ducts.
15. 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.
16. Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.
17. Place red cable protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.

18. 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.
19. For concrete and asphalt/bitmac road sections, carry out 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. (See **Figure 2**)
20. 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.
21. Clean and test the ducts in accordance with the specification by pulling through brush and mandrel. Install 12 mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes in preparation for cable installation at a later date. All the works should be witnessed by the Employer's Representative, who will represent the interests of the Employer in regard to ensuring that the quality of both materials and workmanship are in accordance with the Engineer's drawings and specifications.

Figure 1 : Standard 220 kV cross section (200 mm duct and CBGM B)

Figure 2 : Permanent Reinstatement of road surface over trench

4.2 Cable Route

The cable route will be confined to within the existing road corridor for the majority of the 20.1 km. The methodology for these works will be trenching and ducting.

There are locations along the route where trenching and ducting is not suitable because of water crossings, existing services, other infrastructure etc. The cable route needs to deviate from the public road at locations such as the M1/Belfast-Dublin railway crossing, the two River Dee crossings, both Port Stream crossings and Salterstown River. Trenching and ducting is not considered feasible at these locations because of shallow bridge decks which would not support the minimum depth of trench required and provide adequate structural strength to protect the cable. At these locations the methodology will likely be HDD or open trench.

There are other locations where existing infrastructure in the ground act as obstacles to the cable route and may require a slight change in methodology from the standard approach for trenching and ducting. The standard trench drawing is included in the Planning Drawings and the majority of the route will be completed using this approach. There are some locations where the standard approach is not feasible. This includes the two GNI crossings, as well as the many culverts and services located along the roads.

At the two GNI crossing locations, depending on the depth of the service, the preference is to cross under the service, where practicable and cable rating allows, with a minimum vertical clearance of 600 mm. Where the use of shallow depth trenching is intended, for each case, the Contractor shall submit to the Employer for approval design drawings and cross sections at the detailed design stage. The details shall be based on the standard drawings provided with the contract documents. A similar approach will be taken for any other service crossings. However, the minimum vertical clearance will depend on the utility service provider. The drawing for the trench crossing under a culvert/service is included in the Planning Drawings.

It is expected that culverts located along the proposed cable route, will need to be crossed. If the cover between the top of the existing culvert and road level is not suitable then the ducts will have to cross under the culvert. Where possible, the top of the culvert may be lowered or the culvert replaced in order to facilitate the required trench depth. The drawing for the trench crossing over a culvert is included in the Planning Drawings. A minimum vertical clearance of 300 mm is required between the bottom of the ducts and the top of the culvert.

The cable route may cross over a bridge, if the structure is in good condition and the depth of cover from the deck of the bridge to the road is sufficient to accommodate the minimum depth of trench. The drawing for the trench crossing over a bridge is included in the Planning Drawings.

Between the M1 motorway and the onshore substation site the cable route is located along the northern side of the N33 national road. This avoids the requirement to cross the carriageway of the N33. Between the onshore substation and Joint Bay 4 (a distance of approximately 2.5km) the onshore cable trench will be located close to the northern boundary of the easement for the N33. The N33 roadway, along this section, is located on a shallow embankment (approximately 1-2m in elevation). The location of the cable trench along the northern boundary avoids interaction with the embankment. This also avoids the cable trench passing over the top of two cattle crossings which are too shallow to accommodate the required depth of trench.

4.3 Other Considerations

Aspects of trenching which require particular attention include: 1. management of trench spoil, 2. trench de-watering, 3. adding CBGM B. Industry accepted best practice will be applied at all times in dealing with the above.

1. **Soil management**: For all trenching along the road, all excavated material will be removed off-site for reuse, recovery or disposal in line with the waste hierarchy, thus preventing any contaminated run-off to roadside drains during heavy rainfall. In off road areas where the topsoil will be set aside within the wayleave for later reinstatement, these stockpiles will be stored at least 15 m back from drains and watercourses on level ground with a silt fence inserted at the base.
2. **Trench de-watering**: Ground water and surface water accumulating in the base of trenches will not be pumped directly to roadside drains or watercourses unless it is clean and free from solids. Where groundwater is encountered and needs to be removed, it will be treated prior to being released in roadside drains or watercourses. Groundwater will be discharged to a designated percolation area / silt dewatering bags designated by a competent person if the soil is not waterlogged. The bags are secured over the outlet pipe from the pump and silt laden water can then be pumped through the bags which traps the silt during the dewatering process. The bags need to be monitored and emptied as they filter the silt for the water. The project supervisor shall monitor any pumping activities on site and the quality of water being pumped and discharged. In the case of heavy contamination, the water will either be tankered off site for disposal in a licensed facility or pumped to a portable on-site settlement tank for treatment. These operations

will be monitored by a designated competent member of the construction team on a regular basis to ensure that they are working effectively.

3. **Adding CBGM B**: Temporary storage of CBGM B 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.

5 Trenchless Crossings

5.1 Site Specific Locations

Based on the current design, it is anticipated that Horizontal Directional Drilling (HDD) be used for five locations. The locations identified for trenchless crossings are the following, and are shown on **Figure 3** and **Figure 4** herein:

- The M1/Belfast-Dublin railway crossing;
- Two crossings of the River Dee;
- Port Stream, Togher Road; and
- Salterstown River.

The following considerations should be noted for the locations mentioned:

- In discussions to date, Irish Rail and Transport Infrastructure Ireland (TII) have indicated that they are open to the completion of a HDD under the Dublin to Belfast railway line and the M1. For the crossing of Irish Rail infrastructure, settlement monitoring analysis needs to be completed prior to the works to determine the depth of the drill. Irish Rail require that the drill be a minimum of 4.7 m below track level. Irish Rail require other design considerations to be completed prior to construction, in order to demonstrate the constructability of the HDD and its' negligible impact on the railway. Similar requirements are needed for crossing under the motorway where TII require a minimum clearance of 5 m. These will be completed during the final design process. However, the final design considerations won't impact on the extent and nature of the works assessed as part of the Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) for the Project.
- A detailed site investigation at drill locations will need to be conducted and include, where possible, borehole information and, if required, geo-physical ground profiling to identify the route of least resistance. This would provide a better understanding of ground conditions.
- Consultation with experienced contractors as part of the project design have confirmed that the proposed depths over the length of approximately 250 m are feasible. There have been numerous HV cable projects installed to date where drills over 250 m have been successful

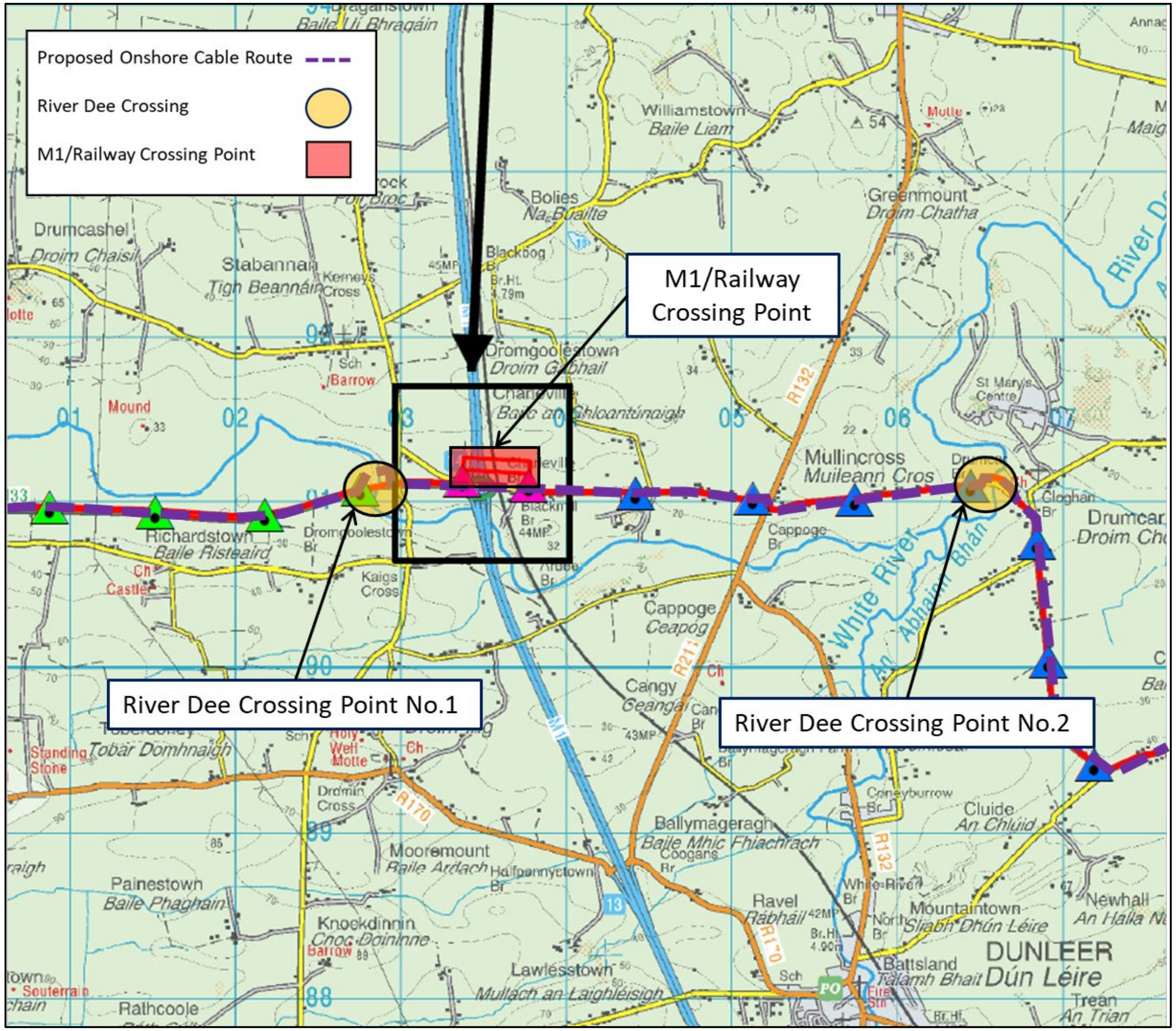

Figure 3: HDD locations; 2 no. River Dee crossings and the M1/Belfast-Dublin Railway Crossing

Figure 4: HDD location; Salterstown River Crossing

5.2 Horizontal Directional Drilling (HDD)

HDD is suitable for installing pipes and cables up to 1500 m in length, the longest HDD proposed is c. 250 m at the M1/Railway crossing. It can be used in a wide range of soil types, including soft to hard dry saturated clays, silts, sands, mudstones and soft rocks. Any joints in the pipes must be capable of resisting the tension placed on them during the cable installation. **Figure 5** shows an indicative HDD section.

To illustrate better what is involved with the HDD proposals, high level HDD alignment drawings are detailed in the Planning Drawings. There are two drawings, one showing the M1/Railway Crossing Point and the other showing the River Dee Crossing Point No.2. The drawings show the proposed crossing points, the construction compound space required and the approximate profile of the HDD route. **Figure 6** and **Figure 7** illustrate what a standard HDD set up looks like on site.

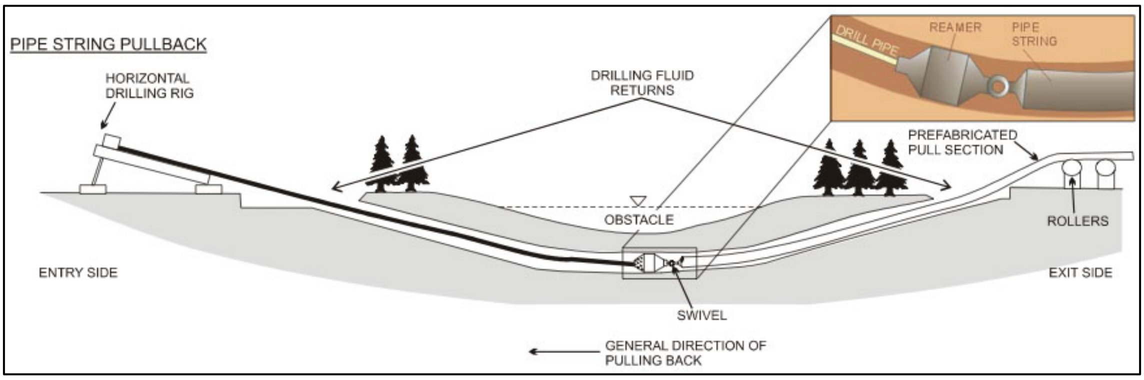

Figure 5: Standard HDD section drawing

Figure 6: HDD rig set up on regional road.

Figure 7: Standard HDD site on local road where HDD was used to go underneath a bridge (bridge parapet walls visible)

5.2.1 Methodology

5.2.1.1 Setting up the site

The drilling Contractor prepares for example, a 30 m x 20 m site area within the agreed site area. Areas that are overgrown with thick vegetation have a section of vegetation removed and disposed of by a licensed waste Contractor. The three water course crossing locations are not particularly overgrown with vegetation. Clearance at the River Dee and Salterstown crossings will be undertaken in accordance with the measures included in Chapter 19: Onshore Biodiversity. Where required, the area is levelled by the front bucket of a 180° excavator. The working area may need to be stripped of topsoil, and instead may be overlain with a suitable geotextile and appropriate stone bedding. To ensure adequate access at all times, security fencing would be positioned around rig up and exit area boundaries.

A 180° excavator is used to create entry and exit pits (approx. 2.0 m x 1.5 m x 2 m), with a steel box of the same dimensions placed in the ground. The resultant spoil from excavation is bundled in 0.5 mm PVC liner within the designated working areas. The steel box controls drilling fluid returns from the borehole. The fluid is pumped down the drill string and through the downhole motor, which uses the hydraulic power of the fluid to generate mechanical power and rotate the drill bit.

The surveyor orientates the drill bit, and the driller pushes the drill string into the ground, maintaining the bore path. The drilled cuttings are flushed back by the drill fluid flowing via nozzles in the bit, up the annulus to the surface, where they are separated from the fluid fraction for disposal.

Aspects of this crossing method which could give rise to potential impacts will be addressed by best practice construction methods under the following headings: 1. site access and ground preparation, 2. bentonite preparation, injection and re-cycling, 3. Bentonite release and 4. site re-instatement.

1. **Site access and ground preparation**: The access track and works area around the HDD launch and reception areas at both sides of the river will be top-soil stripped, laid with terram and surfaced with suitable aggregate material to prevent ground damage and associated wash-out of solids toward the river. The works area will be a minimum of 15 m back from the river and within this zone, the natural vegetative cover will not be altered and no construction traffic will use the area so that the natural filtering capacity of the vegetation if required will remain intact. Stripped topsoil will be stored on level ground at least 15 m back from the river and ringed by silt fencing to prevent solids washout.
2. **Bentonite preparation, injection and re-cycling**: The area around the bentonite batching, pumping and re-cycling plants will be bunded using terram and sandbags in order to contain any spillages. One or more lines of silt fences will be interposed between the works area and the river on both banks to prevent solids laden runoff from the works areas reaching the watercourse. Spills of bentonite or bentonite contaminated with drill arisings from any aspect of the bentonite handling process will be cleaned up immediately and transported off site for disposal at a licensed facility. Any bentonite spills on the road will be immediately visible and be removed to secure skips on site. In addition, as stated above it is proposed to locate any bentonite containment pits a minimum of 15 m from streams and rivers to prevent any possibilities of bentonite entering these watercourses. If arisings are being temporarily stored on site they will be held in adequately sized sealed skips to prevent leakage, with adequate freeboard to accommodate intense rainfall during the storage period without overflowing.
3. **Bentonite release:** A number of geologies are considered unsuitable for HDD because they increase the chances of bentonite being lost and eventually breaking up through the overburden into the watercourse. A standard example is fissured or fractured rock. A thorough geotechnical assessment of the possible routes of the two River Dee crossings and the Togher Road Water Crossing will be undertaken to determine the suitability of the site for this installation method. The drilling process will be constantly monitored to detect any possible leaking of bentonite into the surrounding geology and possible breakout. This can be gauged by monitoring pumping rates and pressures as well as observing for a bentonite plume. If any of these signs appear, then drilling and bentonite pumping will be stopped immediately, and an attempt made to bypass the affected section by using a higher viscosity bentonite mix. If this fails, then an alternative crossing alignment or an alternative crossing method will be considered. This would only arise in cases where the soil through which the HDD was directed is unsuitable for this process. Site Investigations will be used to inform the final design of the HDD i.e. depths and route of tunnel under crossings. The possibility of any bentonite breaking through into the watercourse above during the HDD process is therefore negligible.

4. **Site reinstatement**: While silt fences remain in place, all the temporary surface dressings on access tracks and working areas will be removed for offsite disposal and stored topsoil replaced and reseeded. The area will be reinstated to the satisfaction of the landowner.

5.2.1.2 Drilling Fluids Circulation System

During the works, the bore is supported by drilling fluids, which also assist in cutting the soil and removing the cuttings from the bore. The drill rig circulation system consists of five tanks, two solids separating cycles, a mud pump and mud-mixing hopper. Both a high-speed linear shale shaker and a desander/desilter are used to remove solids from the system. The drilling rig and fluid handling units may be placed on bunded 0.5 mm PVC contain any fluid spills and storm water run-off.

The drilling fluid volume, pressure, pH, weight and viscosity are monitored constantly. The amount of cuttings produced is also monitored, to prevent over cutting and ensure hole cleaning is maintained.

Drilling fluid returns are circulated through mud cleaners by centrifugal pumps, and then pumped back downhole. Solids removed from the drilling fluid are directed into tipping skips. Drilling fluids returning to the surface are diverted through a conductor pipe to a mud pan on the surface. This mud is then lifted to the shale shaker by a hydraulically powered centrifugal pump. The mud returns are pumped to the circulation system trailer by means of a bunded centrifugal pump.

5.2.1.3 Bore Construction

The surveyor at the driller's console uses a steering system guided by tri-axial magnetometers and accelerometers, which provide real time directional information, to navigate the bores. The pilot bore may be steered horizontally and vertically as it progresses and can also be curved to bypass obstacles.

The drill unit, with a removable head matched to the soil conditions, pilot bores underground with a series of drill stems that push and rotate the head. Once the first pilot hole is completed, a hole-opener or back reamer is attached to the drill stem at the exit side and pulled back through the bore to the entry side. This enlarges the bore wall to accommodate the ducting and allow the cable to be pulled into place. A drill pipe is added at the exit side to provide a mechanical presence constantly within the bore.

5.2.1.4 Pipe Stringing and Ducting Pull Through

Following the completion of the bore, the ducts need to be laid out in a single straight line. The ducts will then be welded together and once all of the welds are completed, a towing assembly consisting of tow heads, a swivel and a reamer is used to pull the ducts into the bore. Close attention is paid to modelled drag forces during pullback with constant monitoring of load stress undertaken to ensure that modelled tensile stress, collapse pressures, hoop stress and buckling stress are not exceeded.

5.2.2 Waste Disposal

During drilling, the Fluids Technician and Drilling Superintendent are responsible for the control and minimisation of waste fluid. The following procedures will minimise the fluids used:

- Cleaning and recirculating the drilling fluid.
- Ensure no additional drilling fluid is needed by maintaining fluid properties (pH, density, viscosity, gel strength, shear strength) while drilling.
- Ensure all cuttings are being circulated out of the borehole and the critical annular fluid velocities are not exceeded, maintaining laminar flow to prevent eddying and sloughing of the borehole. This can be done by monitoring borehole volumes, flow rates, pressures and drag characteristics.

The drilling fluid used will be certified for used in drilling water wells etc. The fluid is inert clay, classified as freshwater drilling muds and wastes. Any excess fluid will be disposed of via a licensed waste Contractor.

The drilled cuttings are classified as soil and stones not containing dangerous substances and are stored on site for disposal via a licensed waste Contractor.

The fluids and cuttings are suitable for disposal to landfill as they are non-hazardous wastes. MSDS (Material Safety Data Sheets) and COSHH (Control of Substances Hazardous to Health) Sheets for all materials will be kept safe.

The Contractor will provide a site office, mess and welfare facilities. These units will be powered by a bunded and silenced generator and water will be stored in on-site tanks. The units will be serviced on a weekly basis which includes removal of all wastewaters by a licensed Contractor.

5.2.3 Reinstatement of site

Prior to reinstatement, the ducts are tested and proved, and the as-built alignment surveyed to provide an accurate as constructed record.

On completion of the works, a backhoe or 360° excavator is used to carefully remove the stone and geo-membrane, which are then transported to a licensed disposal unit. Topsoil will be imported to sites where necessary, and the area reseeded. The site area is then reinstated as per the landowner and statutory requirements.

Typical plant to be utilised on site would compromise of 2 No. 4x4 Twin cab pick-up truck, 1 No. Luton Box Van, JCB 3CX 180° Backhoe Loader, Terrain 7 m Telehandler, and a JCB Fastrac and 2000-gallon bowser. This typically requires a crew of approximately 6 people.

5.2.4 Weather Monitoring

Works will not be carried out during extreme rainfall. Met Eireann provides a 5-day weather forecast via its website (www.met.ie). The Contractor shall monitor this and other appropriate weather forecasts on a regular basis, at least daily. The forecast maps total rainfall, averaged over six hours, in the following bands:

- < 2 mm/hr (denoted by blue and green shading);
- 2-3 mm/hr (denoted by yellow shading); 3-6 mm/hr (denoted by orange shading); and
- >6 mm/hr (denoted by red shading).

Measures to limit the generation of sediment-laden runoff are to be implemented by the Contractor, according to the following predicted rainfall bands as set out in **Table 1** below.

Table 1 Predicted Rainfall Bands

Category	Predicted Rainfall	Action
Red	>6mm/hr	• Excavation works to be reviewed; • Stockpiled materials and excavations to be covered; • Silt fences, check dams and other sediment control measures to be inspected hourly.
Orange	3- 6 mm/hr	• The Contractor shall have regard to the existing ground conditions with respect to possible erosion of sediments, and halt excavation works if necessary; • Impermeable matting to be placed adjacent to stockpiled materials and excavations for installation if the rainfall intensity increases; • Silt fences, check dams and other sediment control measures to be inspected hourly.
Blue, Green, Yellow	<3mm	• Silt fences, check dams and other sediment control measures to be inspected hourly.

5.3 Land Requirements at entry and exit locations

Where it is located off the roadway, HDD requires a construction access track, which will be 4 m wide.

A temporary construction compound of minimum 30 m x 20 m consisting of a stone platform will also be laid down. This will be re-instated to the original ground condition upon completion of the construction works. The compound will allow for the launch pit and equipment needed to power the drilling equipment.

5.4 Pipe Stringing Land Requirements

As previously mentioned, prior to pulling the ducts through the bored hole, the ducts need to be laid out in a straight line and then welds completed between each duct. The ducts will then be pulled through in one pull. Depending on which side the pull is happening from, space will be required on the other side for the pipe stringing. The length of the pipe stringing area will need to match that of the length of the bored hole. Pipe stringing will take place within the temporary construction compounds.

5.5 Traffic Management

No disruption to traffic on the M1 motorway or the Dublin-Belfast railway line is anticipated as the works will be carefully planned, monitored and managed, and the construction techniques and methodologies are well established.

6 Water Crossings

6.1 Water Crossings Site Specific Locations

Existing road bridges over water courses cannot always accommodate high voltage cables. In such cases it will be necessary to find an alternative route for the cable, such as passing underneath the water course. Five water crossings have been identified as part of the onshore cable route. These are all shown below in **Figure 8 .**

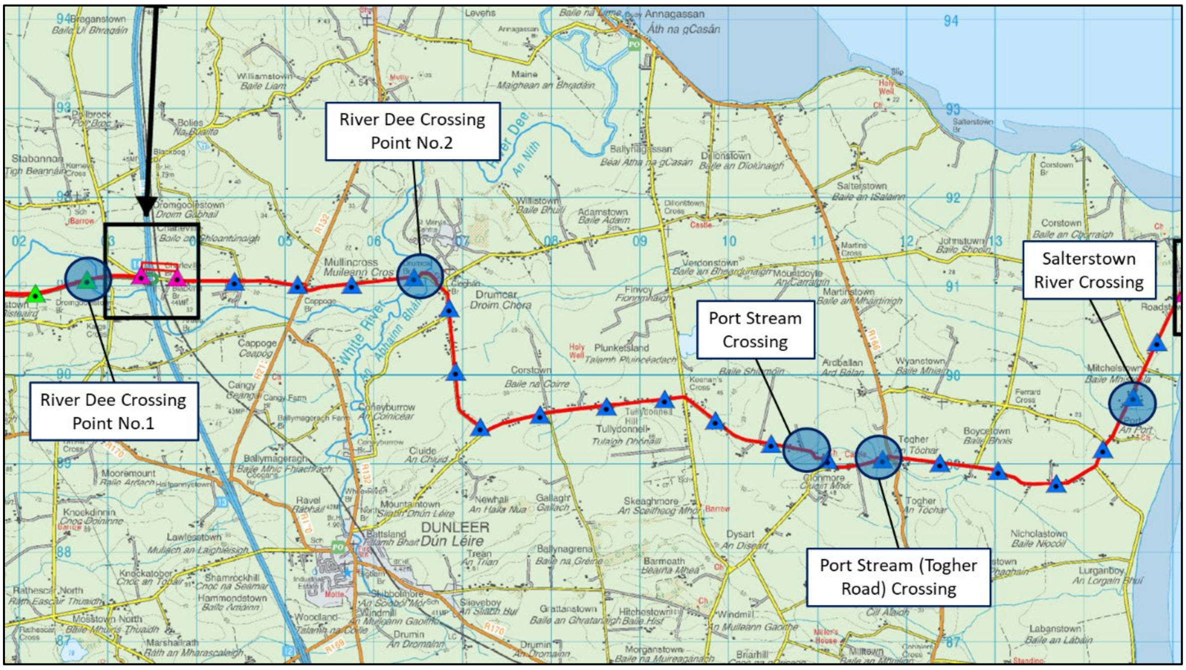

Figure 8: Locations of water course crossings

Both of the River Dee crossings and the Port Stream at Togher and the Salterstown Stream will be crossed using trenchless methods i.e HDD because the existing road bridges cannot accommodate the cable. A crossing of the Port Stream at Clonmore will be undertaken using open trench techniques.

Crossings of smaller ditches and drains will be carried out by open trench using damming and overhead pumping.

All watercourse crossings will be undertaken in accordance with the measures set out in **chapter 19: Onshore Biodiversity** including adherence to the Inland Fisheries Ireland (IFI) Guidelines During Construction Works in and Adjacent to Waters. Where applicable, the construction shall take place outside the salmon spawning period from October to April unless otherwise agreed with IFI. In addition, all method statements for watercourse crossings will be issued to the IFI for approval prior to works commencing.

Appropriate measures will be put in place by the Contractor to prevent ground damage on the access routes to watercourse crossings on both banks, particularly where the ground is soft or slopes steeply toward a crossing. This will prevent solids reaching a watercourse from damaged access tracks. The Planning Drawings includes details for drainage ditch, stream and river crossings.

6.2 Trenchless Watercourse Crossings

It is proposed to use HDD at these crossings and the Port Stream crossing at Togher, the trenchless crossing methods have been covered in **Section 5.**

6.3 Ditch/Drain Crossing Open Trench

The crossing of ditches and drains along the route will be achieved by damming and pumping of the water flow overhead. Silt traps, such as geotextile membrane, straw bales etc. shall be placed downstream of the trenching location prior to construction to minimise silt loss. A dam will be constructed using sandbags and suitable clay material. Temporary pump sump(s) shall be provided to house the pumps used to move the water downstream. The pumping rate shall be suitable to move the flow rates. The cable ducts will then be installed in the ditch / drain bed as described in **section 4.** Following the installation of the cable ducts, the bed of the ditch / drain shall be re-instated with original or similar material. The duration of this process will vary depending on the site location, crossing length, ground/weather conditions etc.; however, it would typically take 3-7 days to complete each crossing.

6.4 Stream/River Crossing Open Trench

6.4.1 Open Cut - Damming and fluming

Two open trench crossings are proposed for two streams: Newhall stream and Port stream at Clonmore. The crossing of the stream/river will be achieved by fluming the existing river flow through one or more pipes depending on the size of the flows in the stream/river. The flume pipe(s) will be approx. 10 m long and the diameter suitable to accommodate the existing flows.

Under the supervision of an aquatic ecologist, substrate shall be removed at the stream crossing areas where construction will take place (and replaced post-construction)

1. The flume pipe(s) shall 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. shall be placed downstream of the in-river trenching location prior to construction, to minimise silt loss.
4. Excavate the proposed trench in the dry stream bed and under the flume pipe(s). If required, a temporary pump sump can be established, and a pump used to remove any additional water.
5. Install the cable ducts in the stream bed as described in Section 4 or install a precast concrete slab incorporating the ducts, ensuring the designed cable route alignment is maintained.

6. Following the installation of the cable ducts, the stream bed shall be re-instated with original or similar material replaced under the supervision of the aquatic ecologist.
7. Once the stream bed is appropriately re-instated the dam and the flume pipe(s) shall be removed thus restoring the stream to its original condition.

6.4.2 Open Cut - Damming and pumping

1. The crossing of the stream/river will be achieved by damming the existing river upstream of the proposed crossing area.
2. Under the supervision of an aquatic ecologist, substrate shall be removed at the stream crossing areas where construction will take place (and replaced post-construction).
3. Silt traps, such as geotextile membrane, straw bales etc. shall be placed downstream of the in-river trenching location prior to construction, to minimise silt loss.
4. A dam will be constructed using sand bags and suitable clay material.
5. Temporary pump sump(s) shall be provided to house the pumps used to move the water downstream. The pumping rate shall be suitable to move the flow rates of the existing stream. This will be monitored throughout the pumping period.
6. Install the cable ducts in the stream bed as described in Section 4 or install a precast concrete slab incorporating the ducts.
7. Following the installation of the cable ducts the stream bed shall be re-instated with original or similar material under the supervision of the aquatic ecologist.
8. Once the stream bed is appropriately re-instated the dam and the pumps shall be removed thus restoring the stream to its original condition.

6.4.3 Open Cut Crossing Methodology

There are currently two open cut crossing's locations for the onshore cable route one crossing of the Port Stream and one crossing of the Newhall Stream. If any further water course crossings are identified and the open cut crossing method is suitable, then it would be proposed to undertake the works during the May to September period in order to avoid the period of salmon and trout spawning. Furthermore, if feasible, the trenchless crossings will also be undertaken at this time, as the ground conditions would be at their best in the areas adjoining the site. Works will only begin when weather conditions are suitable and the long-term forecast indicates no adverse conditions. Works will take place subject to the approval of IFI and only following their agreement based on receipt of an approved method statement from the Contractor.

Note that no watercourses can be entered or crossed without prior notice to and approval by the IFI. Aspects of these crossing methods which are highlighted for best practice construction are detailed below and relate to the following aspects: 1. site access and ground preparation, 2. In-stream habitat damage within the footprint of the crossing and immediately downstream, 3. watercourse damming process, 4. trench excavation, 5. de-watering of the trench excavation, 6. pumping over, and 7. site reinstatement.

Site access and ground preparation: The access track to the watercourse crossing will be prepared in the same way as that for the joint bays, i.e. topsoil stripping, followed by terram laying and the addition of a layer of aggregate to protect the ground from rutting. This will also be undertaken parallel to the crossing point in order to protect the bank from heavy vehicle damage. Bog mats will also be provided in areas where peat is present.

1. In-stream habitat damage: All clean coarse surface material (gravel, cobbles and boulders) on the bed of the river or stream to a depth of 20 cm will be removed. A thinner layer will be removed if deeper material is mainly clay or sand. This will be set aside back from the watercourse on a geotextile base for use to reinstate the stream bed surface.
2. Watercourse damming: At damming and pumping sites the damming will be undertaken using sandbags and/or clean stone covered with an impermeable layer of thick polythene or similar material in order to minimise the use of clay materials. If managed carefully, these materials should be reusable at several crossing sites. At sites to be flumed the diameter of the flume pipe will be chosen to accommodate flows at the time with spare capacity to cover that predicted over the following 3-7 days that the works would be expected to last. Construction of the dam around the flume pipe will require use of clay material to create a practical seal. In this case the dam will be designed to reduce to a minimum the amount of clay to be used. The clay used will be puddle clay or equivalent.
3. Trench excavation: material excavated from the trench (and an upstream pump sump if required) will be placed on terram on level ground as far back from the watercourse's edge as is practicable and surrounded on its downslope side by a silt-fence to prevent solids re-entering the stream. This material if deemed suitable can be used to partially backfill the trench. However, a significant amount will be in excess and will be removed off site under licence from the County Council.
4. De-watering of watercourse crossing excavation: De-waterings of the excavation will be treated on site using settlement tanks before the settled water is returned to the watercourse. A second tank in series with the first will be used if the first isn't sufficient to remove enough solids. Following treatment in settlement tanks, water arising from dewatering activities should be allowed to percolate to ground, not returned to the river. Local ground conditions will be taken into consideration for the appropriate siting of the percolation area.
5. Pumping over: Pumped over water will be directed to a splash plate to prevent erosion of the riverbed at the downstream side.
6. Site reinstatement: The surface coarse substrate which was set aside will be used to reinstate the stream bed after the ducts have been installed and the flume pipe has been removed as well as all the damming materials. All surfaces will be re-instated to the satisfaction of the landowner and re-seeded to assist soil stabilisation. A silt fence will be placed along the riverbank where the works were undertaken in order to prevent solids washed off the works area during heavy rainfall entering the stream while the surface adequately re-vegetates. This measure will be particularly important at sites which slope to the edge of the watercourse.

7 Joint Bay Details

7.1 Site Specific Locations

The onshore cable will run for 20.1 km from Dunany Point to the substation off the N33. Joint bays will be constructed approximately every 600-750 m, resulting in 29 joint bays. Joint bay dimensions are typically in the order of 8 m long, approx. 2.5 m wide and approx. 2.5 m deep and are designed to be covered over and the road above reinstated or if located in off-road areas to be available for agricultural use following reinstatement. The 29 no. joint bays are proposed to be located in the following roads (Refer to the Planning Drawings).

- 1 no. transition joint bay (TJB) at landfall
- 1 no. joint bay on the local road after the landfall
- 2 no. joint bays on the Coast Road
- 3 no. joint bays on the Togher Road section between Togher and the Coast Road
- 7 no. joint bays on the Togher Road section between Togher and the Castlethomas/Drumcar Road
- 3 no. joint bays on the Castlethomas/Drumcar Road
- 5 no. joint bays on the Mullinscross/Drumcar Road to M1/railways crossing
- 8 no. joint bays on the N33 to substation

Standard arrangements for joint bays, communication boxes and link boxes are shown in in the Planning Drawings. Access to chambers is required for future maintenance and repair of the cable.

7.2 Standard construction and cable jointing

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

1. The Contractor shall 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. (See **Figure 9**)
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 NRA Specification for Roadworks. (See **Figure 10**)

6. Pre-cast concrete construction. Place pre-cast concrete sections on sand bedding. (See **Figure 11**)
7. Carry out temporary reinstatement of surface as specified.
8. Temporary joint bay covers may be used as temporary reinstatement. These covers are placed over the constructed joint bay and are then removed at the cable installation stage of the project.
9. 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.
10. The cable is supplied in pre-ordered lengths on large cable drums (See **Figure 12**). 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 shall 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 (See **Figure 13**). 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.
11. Once the "two sections" of cable (total of 6 conductors) are pulled into the joint bay (see **Figure 14**), a jointing container is positioned over the joint bay and the cable jointing procedure is carried out in this controlled environment. (See **Figure 15**)
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.

7.3 Other Considerations

During construction of joint bays careful consideration will be given to the following activities: 1. site access and ground preparation, 2. soil excavations, 3. pit de-watering, 4. concrete pouring (for in-situ structures) and 5. backfilling with thermal sand. Best practice construction methods will be used to ensure installation of the joint bays has minimal impact on nearby watercourses: Therefore, the following applies to all joint bay locations:

1. **Site Access and Ground preparation:** The area around the edge of the proposed joint bay which will be used by heavy vehicles will also be surfaced with a terram cover and stone aggregate to minimise ground damage, where required. All surface water will be managed during these works as set out in **chapter 21 and 22 of the EIAR.**
2. **Soil excavations**: All soil temporarily stockpiled on site will be placed at least 15m back from the nearest watercourse on level ground and will be ringed at the base by silt fencing

and be regularly monitored by a designated competent person for signs of solids escape. In which case an additional line of silt fencing with straw bales will be added.

3. **Pit de-watering**: 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 de-watering.
4. **Concrete pouring:** 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.
5. **Back-filling with thermal sand:** Temporary storage of thermal sand if required will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g. using sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.

Figure 9 : Standard Joint Bay Under Construction (in-situ)

Figure 10 : Completed joint bay prior to cable installation (in-situ)

Figure 11 :Standard joint bay under construction (pre-cast)

Figure 12 : HV cable pulling procedure (Standard drum set-up)

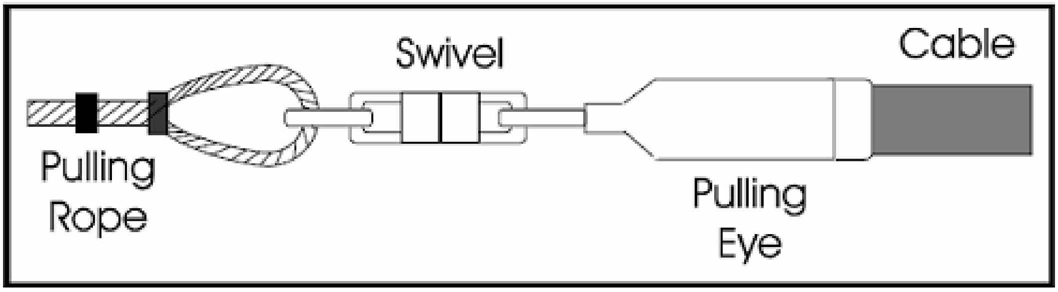

Figure 13 : Swivel and pulling eye

Figure 14 : HV cable pulling procedure (Standard pulling winch set-up)

Figure 15 : HV cable jointing container

8 Landfall and Transition Joint Bay

The offshore export cable will make landfall approximately 700 m south of Dunany Point, Co. Louth.

The offshore export cable will be installed in a buried trench in the intertidal area and will connect to the TJB located above the high water mark.

A geotechnical investigation of the landfall above the high water mark was conducted in 2021. This included the drilling of four cable percussion boreholes and a rotary borehole and a geophysical survey of seismic refraction and electrical tomography. The investigation determined that the subsoil deposits were suitable for installation of the cable at the landfall within a dug trench. The technique for installation is described in the following sections.

8.1 Intertidal Area Export Cable Installation

Figure 16 below details a typical scenario which would apply when floating in a cable at the proposed landfall. The subsea cable will be pulled ashore at high tide and lowered into an open trench within the beach. The trench would be backfilled as the tide recedes.

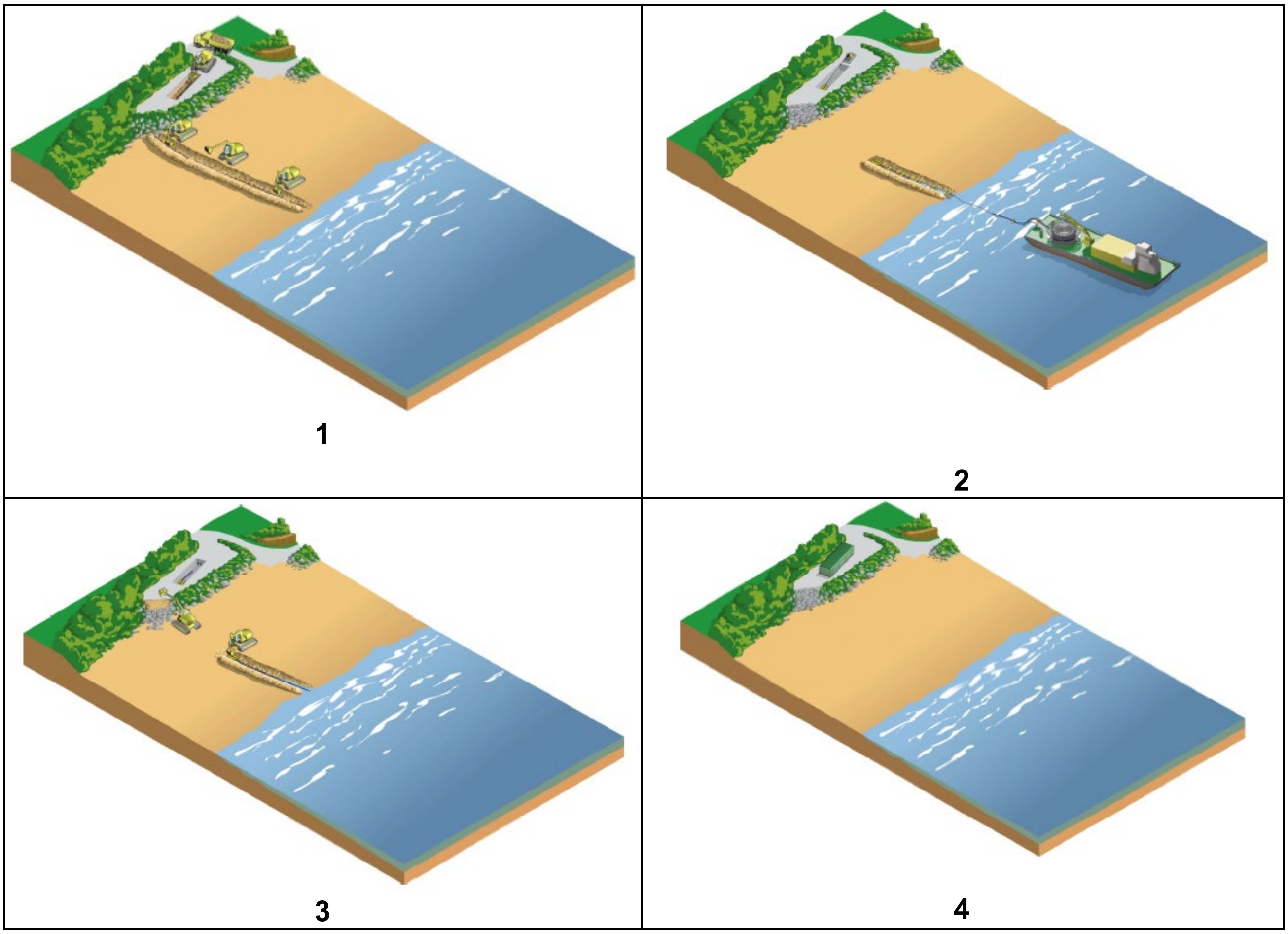

Figure 16 Typical Scenario of Installing a Cable Trench at Landfall Location

A 30m wide working area would be defined between the high water mark and the low water mark along the route of the proposed cable. Prior to the cable laying vessel arriving on site, a trench will be excavated on the beach to provide a cable route between the low water mark and the high water mark.

The trench will be backfilled immediately after installation of the cable and the beach returned to its prior condition. The exact location of the cable shall be recorded using precise survey grade equipment.

A winch wire will be pulled offshore where it will connect to the cable which is floated towards the shoreline using work boats. For long float in operations, a jack up barge (backhoe excavator) may be required for the excavation and reinstatement through the intertidal zone and also during the floating where there may be altercourses between the TJB and cable laying vessel.

The barge should be positioned ideally no more than 1 km from the shoreline. Divers would typically be used to remove the floats at the low water mark and rollers shall be positioned along the beach to guide the cable along the trench. The cable can be floated ashore during high tide or alternatively pulled along the beach through rollers during low tide. Once the cable is anchored at the TJB, the cable laying vessel can continue out to sea laying the cable along the seabed as it transits to the OSS location. The excavated trench out to the low water mark shall then be backfilled and the ground reinstated.

The final detailed method for installation will be dependent on the results from the detailed site investigation for the intertidal area and the contractor selected for the work.

A photograph illustrating the cable installation techniques is presented in Figure 17 for information.

Figure 17 Photo Installation of Cable Trench at Landfall Location

Alternatively, self-powered bespoke installation tools may be used. These are usually tracked vehicles, that excavate a trench, lay the cable, and then bury the cable simultaneously. These are Remotely Operated Vehicles (ROV) type systems, controlled from and connected to the offshore installation vessel.

9 Temporary Construction Compounds

The installation of high voltage underground cables will require temporary construction compounds to accommodate temporary storage, contractor offices, etc. These compounds are typically, but not always, located in close proximity to the works area. The compounds have been selected for this project based on a variety of factors, including operational requirements.

In the case of this project, a number of suitable sites have identified which will serve as temporary construction compounds.

The location of the temporary construction compounds has had regard to a variety of criteria, including the following:

- Availability for the duration of the construction project
- Proximity to the works area
- Road capacity and traffic safety; and
- Environmental sensitivities.

The construction phase will see the delivery of construction material such as ducting, cabling, and bulk material like concrete or pre-cast joint bay materials to these temporary construction compounds.

All temporary construction compounds will be secured with hoarding / fencing around their perimeter as appropriate. Temporary construction compounds will include facilities such as construction phase car parking and welfare facilities and temporary material storage areas as necessary. Any discharges from temporary welfare facilities will be connected to a sealed holding tank to be emptied and disposed of off-site by a licenced contractor to an approved licenced facility, located in the wider area.

Where an access road is required, engineering stone fill will be laid and compacted and maintained as required for the duration of the works. Once the works are completed, the engineered stone fill will be removed, and the land will be reinstated to its original condition. All construction workers will be required to use the designated access / egress routes only. Storage of fuel and refuelling will be undertaken within bunded areas. Water will be brought to site via tankers as required. Security lighting will be directional and cowled. The Contractor will regularly review security lighting in this regard, to inform adaptive management if necessary and report the monitoring findings regularly to the developer and to the local authority.

10 Transition Joint Bay (TJB) Access Tracks

The installation of transition joint bay (TJB) (Option 2) will require a permanent access track to accommodate construction access and maintenance access. Engineering stone fill will be laid and compacted and maintained as required for the duration of the construction works. Once the construction works are completed, the engineered stone fill will remain in situ to allow maintenance access. It may be necessary to carry out repairs to this access track over the lifetime of the cable circuit due to general wear and tear from maintenance traffic. In the case of a fault during the operational phase of the cable circuit the access track will facilitate a repair of the cable circuit.

11 Passing Bays

To avoid road closures during cable pulling and jointing activities temporary passing bays will be constructed to maintain traffic flow around joint bays, typically under a stop-go traffic management system. The 20.1 km onshore cable has 29 no. joint bays located 600-750 m apart. The cable route is proposed to run along a number of local and regional roads before it crosses under the M1/railway and continues along the N33. For the local and narrow roads, a passing bay is required next to the joint bays to allow for traffic to continue to flow during the cable pulling and cable jointing works. There are 16 no. locations proposed for passing bays. The remaining 13 joint bay locations include 8 joint bays located along the N33 and 1 joint bay located at the N33/M1 intersection. The roads in these locations are deemed to be of sufficient width that temporary traffic management will allow traffic to continue to flow. The last joint bay is located on the local road approaching Dunany Point, where a passing bay is not proposed. These proposals are subject to agreement from the local council.

The 29 no. joint bays and 16 no. passing bays are proposed to be located in the following roads, as set out in **Table 2**. (Refer to Planning Drawings).

Table 2 Joint Bay and Passing Bay Locations

Road Section:	Joint Bay Numbers:	Passing Bay Numbers:
Local road after Landfall	1	1
Coast Road	2	2
Togher Road section between Togher and the Coast Road	3	3
Togher Road between Togher and the Castlethomas/Drumcar Road	7	5
Castlethomas/Drumcar Road	3	3
Mullinscross/Drumcar Road to M1/Railways Crossing	5	2
N33 from M1/Railway crossing to substation	8	None proposed

Passing bays will be constructed in lands adjacent to the existing road carriage. Passing bays are between 60 m in length and 10m or 20 m width. The width is made up of a 5 m road section and an additional area of 5-15 m is required for topsoil storage removed during passing bay construction. Example photos are shown in **Figure 18 and Figure 19** below. A standard arrangement of a passing bay is shown in the Planning Drawings.

Figure 18 : Passing Bay example photo 1

Figure 19 : Passing Bay example photo 2

11.1 Standard Construction

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

1. The passing bay shall be set out by the Contractor as per the drawings.
2. Refer to **chapter 19: Onshore biodiversity for** measures on hedgerow removal. The existing hedgerow shall be removed by the Contractor outside of the bird nesting season. The ditch and hedge shall be cleared and disposed of to a licensed landfill facility.
3. The temporary wayleave stockproof fencing shall be installed and tied into the existing fence or hedge at either end of the passing bay.
4. Topsoil shall be stripped and stockpiled in a bund within the wayleave for reinstatement on site following removal of the passing bay. The topsoil bund shall be no more than 1.5 m in height.
5. Any drains shall be cleaned out and piped for the length of the passing bay or diverted around the perimeter of the passing depending on the topography.
6. Where required, Eir ducting and chambers shall be installed to facilitate the undergrounding of overhead cables and removal of the overheads and poles.
7. Standard passing bay build-up: Clause 6N sub-base or similar approved material shall be laid on geotextile separator membrane and compacted in layers in accordance with the specification. The layers shall be 150 mm in thickness and compacted using a road roller. The 6N will be capped off with a layer of Clause 804 or similar approved material.
8. The surface shall be graded to permit drainage to the outer edge of the passing bay and a verge constructed of Kelly blocks shall be constructed around the outer edge to retain the clause 804 material and provide a buffer for vehicles using the passing bay.
9. Passing bays shall be temporarily coned/barriered off to prevent them being used until such time as cable pulling and jointing operations are commencing at the adjacent joint bay.
10. Following completion of the cable pulling and jointing works, or date instructed by the Engineer, the passing bay shall be excavated and excess material will be removed off-site for reuse, recovery or disposal in line with the waste hierarchy .. The drainage ditches shall be opened, and pipes removed.
11. The topsoil shall be re-spread, cultivated and seeded dependant on the time of the year to the satisfaction of the landowner.
12. The temporary stockproof fencing shall be removed.
13. A new ditch shall be constructed where required and hedging shall be replanted to match existing. All fencing will be reinstated as specified or to match existing. All drainage will be reinstated to match the previous drainage.

12 Construction Programme

12.1 Programme Narrative and Assumptions

A project specific programme will be completed for the onshore cable route once a Contractor has been appointed. A high-level programme has been provided below to give an estimation of the construction time involved with the project. A number of conservative assumptions have been made to produce the indicative programme:

- This programme does not include site investigation works.
- The programme is shown in months and weeks, Working days in a month – 21 days
- Trenching and ducting and joint bay installation will be completed by two civil crews working in parallel. The length of the cable route is 20,100 m with 29 no. joint bays. Each segment of ducting between joint bays is on average is between 600 m and 800 m long:
    - The assumed cable route length for each segment between joint bays is between on average 600 – 800 m. Trenching and ducting will take place at a rate of 30 to 50 m/day – 14 days per 600-800 m segment
    - Joint bays will be pre-cast. Joint bay excavation, installation and backfill with temporary reinstatement – 3 days per joint bay. In – situ joint bays may be required at certain locations depending on local conditions.
    - 29 no. locations where a 700 m segment and joint bay excavation/installation/backfill is required. Each individual segment and joint bay – 17 days (shown as 3 weeks and in some case 4 weeks)
    - Crew 1 will start at the substation off the N33, completing the first 700 m segment of trenching and ducting, and then completing Joint Bay No.1. This crew will continue to complete the route until Joint Bay No.15.
    - Crew 2 will start at Joint Bay No.16, then complete the 700 m segment of trenching and ducting and works towards Dunany Point (illustrated in **Figure 20)**.

- The HDD locations will be completed by a separate Contractor, as this is specialist work and requires specialist equipment. These works will be incorporated into the programme but won't impact on the overall programme time. Therefore, these activities are not indicated in the programme.

- A smaller civil crew will assist the duct cleaning and proving subcontractor. It is estimated that the cable cleaning and proving will take between 3 to 5 days (shown as 5 days – 1 week)

- During the road closure (refer to **volume 2A; appendix 5.9: Construction Traffic Management Plan (CTMP)** to complete the trenching and ducting a smaller civil crew will also be on site to complete the passing bay installation. Passing bays are only required at 16 of the joint bay locations – 5 days per passing bay (shown as 1 week)

- A small civil crew will assist the cable installation subcontractor by opening the joint bays for cable pulling and reinstating after and cable jointing works. Cable pulling and jointing – 15 days (shown as 3 weeks)

- Reinstatement of the passing bays and final joint bay reinstatement – 5 days
- Site Numbers – Based on similar scale projects, assuming one Contractor is appointed to complete the entire cable route, there will be 40 to 50 persons on site. This includes two trenching and ducting crews, a traffic management crew, a road reinstatement crew, site management, a PSCS co-ordinator, a health and safety supervisor and other office staff. There will, at times, be other sub-Contractors on site to complete specialist works such as HDDs, cable installation etc.

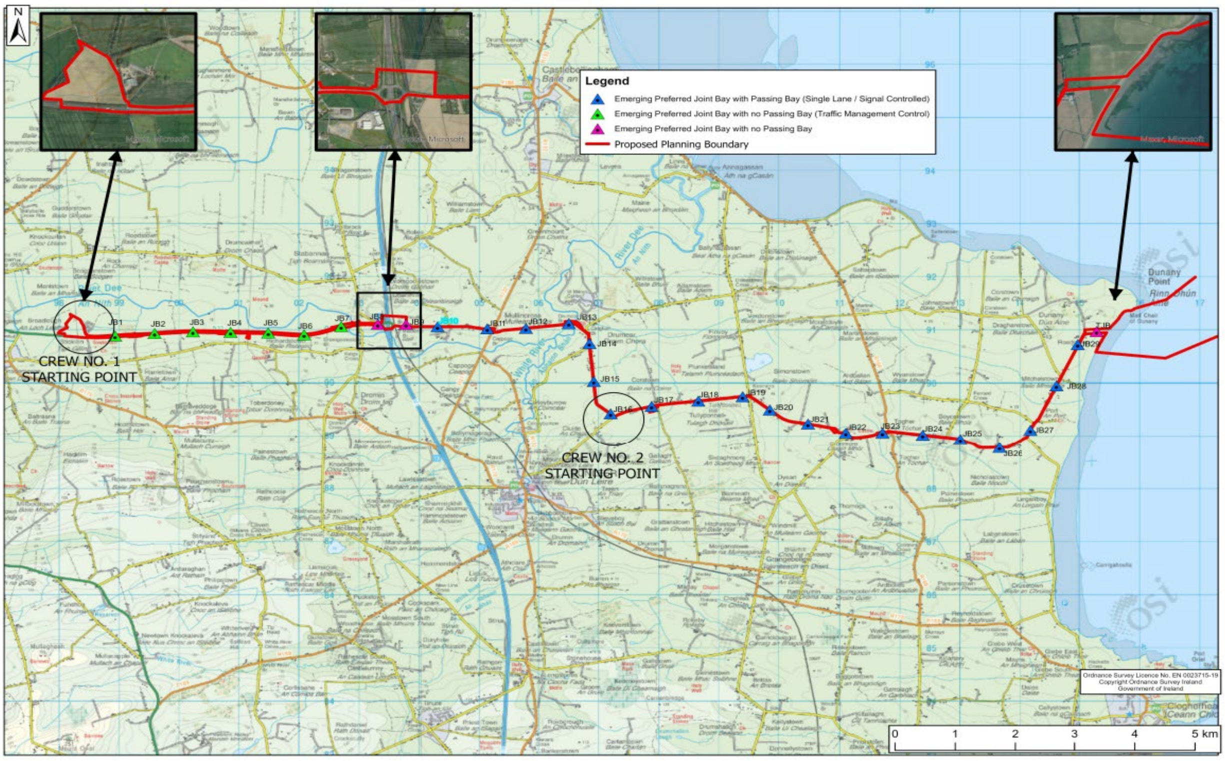

Figure 20: Joint Bay Numbers and crew starting points

12.2 Indicative Construction Programme

An indicative programme is shown on **Figure 21 below.**

		Year 1												Year 2											
No.	Months	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1	Passing Bay Installation	■	■	■	■	■	■	■	■	■															
2	Joint Bay Installation	■	■	■	■																				
3	Trenching and Ducting		■	■	■	■	■	■	■																
4	Cable Pulling and Cable Jointing					■	■	■	■	■	■	■	■	■	■										
5	Ground Reinstatement										■	■	■	■	■	■	■	■	■	■	■	■	■		

Figure 21 Proposed construction programme for the onshore cable installation months