Sure Partners Limited

ARKLOW BANK WIND PARK PHASE 2 **ONSHORE GRID INFRASTRUCTURE**

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

VOLUME II

Chapter 6 Construction Strategy

ARUP

sse Renewables

Contents

6 Construction Strategy

6.1 Introduction

This chapter describes the strategy to construct the Arklow Bank Wind Park Phase 2 Onshore Grid Infrastructure (hereafter the 'proposed development'). The detailed description of the proposed development is provided in **Chapter 5** *Description of Development.*

This chapter has been prepared in accordance with Part 1 of Annex IV of the EIA Directive. This chapter has therefore been structured to describe the following:

- Indicative duration and phasing during the construction period;
- Land use requirements to support the construction of the proposed development;
- Likely activities required to prepare the site and undertake the enabling works to support the construction of the proposed development;
- Methodologies to undertake construction activities;
- An overview of employment and site management measures associated with the construction of the proposed development; and
- An overview of the Construction Environmental Management Plan (CEMP), which has been prepared to provide minimum requirements that the Contractor(s) will be required to implement during the construction of the proposed development (Refer to **Appendix 6.1** for the CEMP).

6.2 Approach

The approach to construction which has been adopted for the purpose of this EIAR is illustrated in **Sections 6.3 - 6.12** herein. This information describes the main construction activities that are relevant for the assessment of likely significant environmental effects.

The approach to construction outlined in **Sections 6.3 - 6.12** herein is considered to be the reasonable worst-case scenario, given the existing site constraints, the adjacent land uses and the various construction methodologies which could be considered by the Contractor(s). The construction of the proposed development will require mostly land-based works with some riverine works (at watercourse crossings).

The Developer, Sure Partners Limited (SPL), will ensure that the Contractor complies with the measures that have been outlined in this EIAR to avoid and/or reduce significant adverse effects that have been identified.

A Construction Environmental Management Plan (CEMP) has been prepared and accompanies this EIAR (**Appendix 6.1**).

The CEMP sets out the principles and control procedures to manage any likely significant effects on the environment from the construction phase. The Contractor(s) will establish detailed construction methodologies upon appointment, and will further develop the CEMP, while ensuring that all proposals comply with the requirements detailed in the CEMP.

The defined planning (red line) boundary for the proposed development includes all project elements, including ancillary infrastructure such as site access tracks, drainage and temporary working areas for site facilities.

Along the cable route, assessments to date have covered a 100m wide corridor to ensure that all relevant information was captured. The cable route corridor for the purpose of the planning consent application (red line boundary) will generally be 50m, while the working corridor width for construction purposes will generally be 30m. The 50m planning (red line) corridor, provides flexibility at construction stage, if minor re-routing is required within the planning corridor.

The planning corridor along the cable route, will be locally widened beyond the 50m corridor in a limited number of locations, to accommodate specific construction methodologies, such as at road and watercourse crossings.

At other areas (substation, landfall, temporary construction compounds and working areas) the planning (red line) boundary is shown on the planning drawings and encompasses both the permanent and temporary works requirements as described in **Sections 6.4** and **6.5**.

Most of the potential negative environmental effects of the proposed development will be associated with construction and installation activities. This EIAR identifies the measures required to avoid or minimise such potential impacts.

6.3 Indicative Construction Programme and Phasing

Subject to obtaining planning approval and the relevant permits and licences, on-site construction of the proposed development will commence in 2023 and is expected to be completed in 2024.

The construction of the other components of the Arklow Bank Wind Park Phase 2 (the Project) will overlap with the construction works for the proposed development, with the proposed development expected to be operational in 2025, with full build out of the Project expected post 2025.

The approach outlined below is considered to represent a reasonable worst-case scenario as to how the proposed development may be constructed. Whilst the general requirements detailed in this section will be followed, the Contractor(s), when appointed, will be responsible for the sequencing and implementation of the works in a safe and secure manner and in accordance with all statutory requirements. Notwithstanding this flexibility, as stated above, the Developer will ensure that the construction activities, and all associated environmental controls are carried out in compliance with the mitigation measures and good construction practice described in this EIAR.

6.3.1 Landfall

The landfall horizontal directional drilling (HDD) works at Johnstown North are currently scheduled to take approximately ten months and to be undertaken between September 2023 and June 2024. The actual HDD drilling and duct pull-back will take up to 14 days working 24 hours a day for each cable circuit.

The timeline in **Table 6.1** sets out the anticipated programme for the construction of the proposed landfall.

Table 6.1: Outline Construction Program – Landfall

Activity	Approximate Timing
HDD compound establishment at Johnstown North	1 month
Trenchless construction (HDD set up, bore and duct installation)	5 months
Transition Joint Bay (TJB) construction	2 months
Cable pull and jointing with onshore cable	2 months

6.3.2 Onshore Cable from Landfall to 220kV Substation (Including Road Crossings)

The timeline in **Table 6.2** sets out the anticipated programme for the construction of the proposed cable route. Construction will commence in 2023 and complete in 2024.

Table 6.2: Outline Construction Program – Onshore Cable Route

Activity	Approximate Timing
Cable compound establishment at Johnstown North	1 month
Cable trenching, joint bays and access track construction (including vegetation clearance)	6 months
HDD set-up, bore and duct installation - R772	4 months
HDD set-up, bore and duct installation - M11 Crossing Option	4 months
Cable installation	4 months
Cable jointing	4 months
Reinstatement	1 month
Cable testing	3 months

Activity	Approximate Timing
Full cable energised	1 month

For the onshore cable route, the works will be progressed on a rolling basis and in phases. Where no obstacles or constraints exist within or near the cable route, it is expected that progress rates for the trench excavation and installation of ducts will be up to:

- 80m/day in agricultural land
- 60m/day on sections with road crossings with full or single lane closure
- 30m/day on sections with road crossings maintaining two-way traffic
- 5m/day on sections with watercourse crossings (depending on span, flow, access, seasonal restrictions)

These rates will reduce where any obstructions or utility services are encountered.

The current schedule envisages that trench excavation and installation of duct sections will be undertaken between May and October 2023.

Cable pulling and jointing is currently programmed to be undertaken between December 2023 and March 2024.

The expected construction steps for each cable section (of up to 700m) is presented in **Table 6.3**.

Table 6.3: Outline Construction Phases & Activity Durations – Onshore Cable Route (per cable section of up to 700m)

Phase	Activity & Approximate Duration
Excavation / Ducting	A minimum of 2 weeks depending on terrain/crossings for cable route Excavate and prepare joint-bay: 5-7 days (precast) or 10-12 days (cast in-situ)
Cable and Fibre Optic Pulling and Jointing	Pull cables into joint-bays and jointing activities: 3 weeks per joint bay Back fill joint bay: 2-3 days
Total Duration	A minimum of 7 weeks per 700m cable section

The HDD option (if used) across the M11 is currently scheduled to take c. four months in total, of which the actual HDD drilling and duct pull-back will take up to 7 days working 24 hours a day for each cable circuit. This work is planned to be undertaken between June and November 2023, dependent on any seasonal restrictions.

The HDD across the R772 is currently scheduled to take c. four months in total, of which the actual HDD drilling and duct pull-back will take up to 7 days working 24 hours a day for each cable circuit. This work is planned to be undertaken between December 2023 and March 2024, dependent on any seasonal restrictions.

6.3.3 Onshore 220kV Substation

The timeline in **Table 6.4** sets out the anticipated programme for the construction of the proposed onshore 220kV substation. Construction is planned to be undertaken between January 2023 and December 2024.

Table 6.4: Outline Construction Program - Substation

Activity	Approximate Timing
Site set-up	1 month
Site prep, civil construction and GIS building construction	11 months
Electrical installation and pre-commissioning	8 months
Commissioning and energisation	4 months

6.3.4 Connection from Substation to Transmission Network

The overhead line (OHL) connection from the substation to the transmission network is scheduled to take a total of four months and is planned to be undertaken within the timeframe of August to November 2024.

An outage of the existing OHL between the Arklow substation and the Lodgewood substation will be scheduled by EirGrid to maintain grid stability while these works are undertaken. The outage will be agreed with EirGrid as part of their work to securely coordinate outages on the National Electricity Transmission Network (NETN).

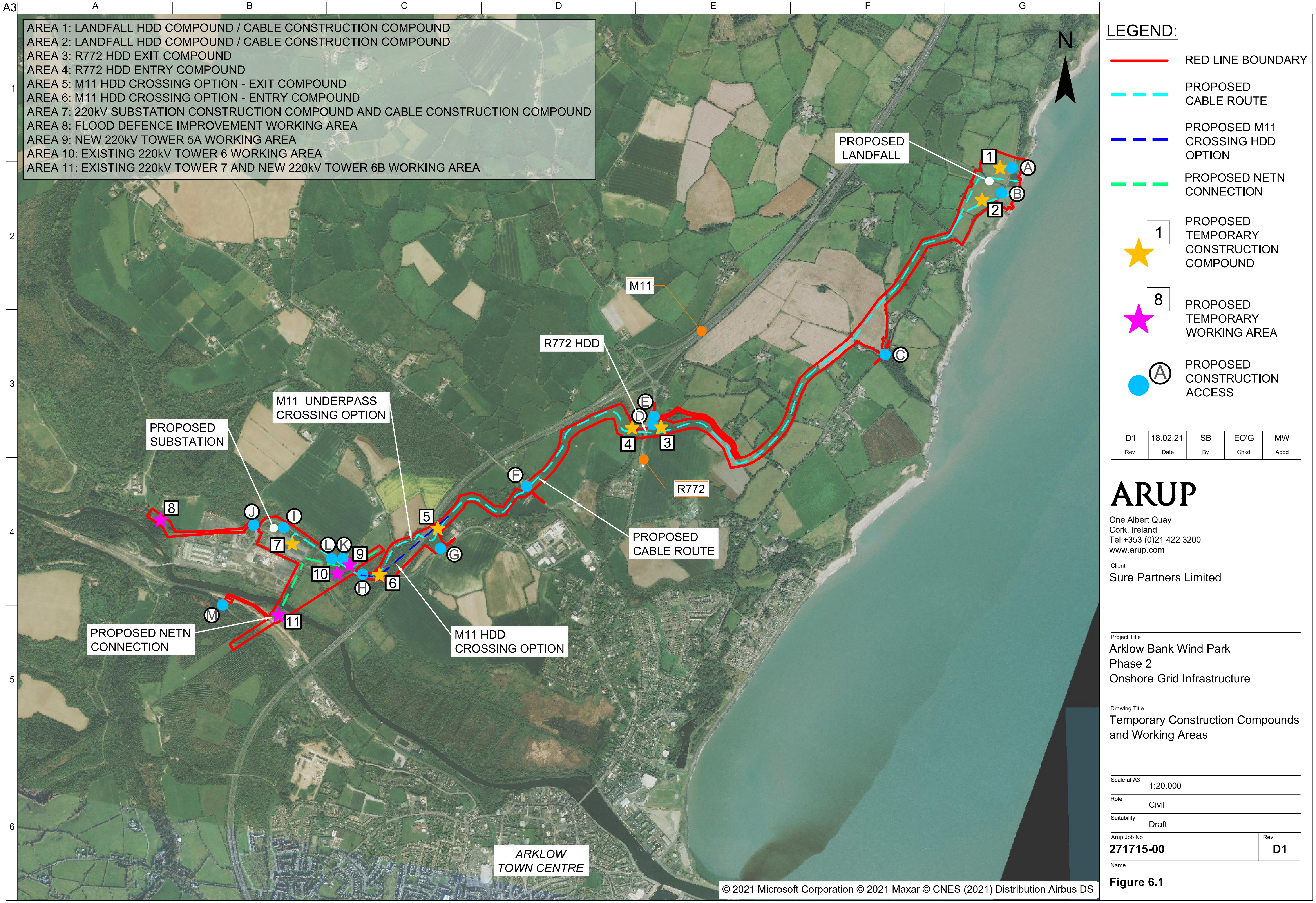
6.4 Temporary Construction Compounds, Working Areas and Access Points

Several temporary construction compounds and working areas are required to allow construction of the proposed development.

The locations of the compounds and working areas, including associated access, are listed in **Table 6.5** and shown in **Figure 6.1**. The cable construction corridor is considered to be the route from the Transition Joint Bay at the landfall to the onshore 220kV substation site, more detail can be found in **Section 6.5.3.3**.

Table 6.5: Temporary Construction Compounds, Working Areas and Access Points

Compound or Working Area	Construction Access Point	Location	Activity
1	A	Johnstown North	Landfall HDD Compound / Cable Construction Compound Access to Cable Construction Corridor
2	B	Johnstown North	Landfall HDD Compound / Cable Construction Compound Access to Cable Construction Corridor
-	C	Johnstown South	Access to Cable Construction Corridor
3	D	R772 (East)	Access to Cable Construction Corridor HDD Exit Compound
-	E	R772 (East)	Access to Cable Construction Corridor
4	F	R772 (West)	Access to Cable Construction Corridor HDD Entry Compound
5	G	M11 (East)	HDD Crossing Option - Exit Compound Access to Cable Construction Corridor
6	H	M11 (West)	HDD Crossing Option – Entry Compound
7	I	Avoca River Business Park	220kV Substation and Cable Construction Compound
8	J	Shelton Abbey	Working Area: Flood Defence Improvement Works
9	K	Kilbride	Working Area: Installation of new OHL Tower 5A
10	L	Kilbride	Working Area: Decommissioning of existing OHL Tower 6
11	M	Ballyraine Lower	Working Area: Decommissioning of existing OHL Tower 7 and installation of new OHL Tower 6B



Rev	Date	By	Chkd	Appd
D1	18.02.21	SB	EO'G	MW

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Project Title
Arklow Bank Wind Park
Phase 2
Onshore Grid Infrastructure

Drawing Title
Temporary Construction Compounds and Working Areas

Scale at A3: 1:20,000
Role: Civil
Suitability: Draft
Arup Job No: 271715-00
Rev: D1
Name: **Figure 6.1**

Do not scale

6.4.1 Landfall Temporary Compounds

The planning application includes two temporary construction compounds at Johnstown North.

One temporary construction compound will support HDD operations (HDD Compound). This compound will be up to 4,900m^2 in area. The other temporary construction compound (Cable Construction Compound) will support the construction of the eastern end of the onshore export cable. This compound will be up to 15,000m^2 in area.

There are two options for the location of these compounds, one in each of the two adjacent fields, which are located on the western side of the R750 road. The HDD Compound may be in the northern field and the Cable Construction Compound in the southern field, or vice versa as shown on **Figure 6.2** and **Figure 6.3**.

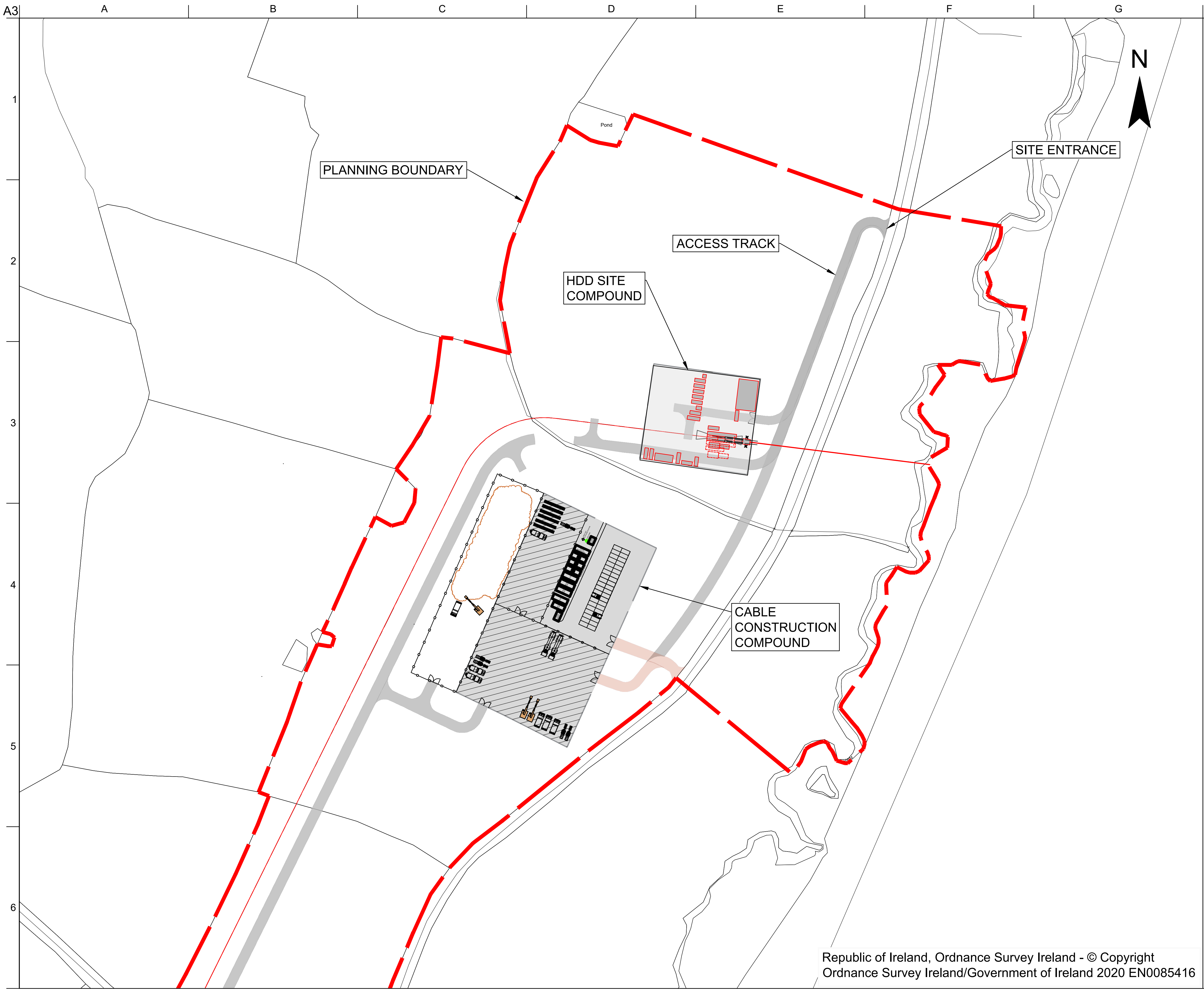
To ensure that a reasonable worst-case scenario is assessed, both options have been considered in this EIAR. The Developer, in consultation with the HDD construction Contractor, will decide which compound location is to be used, with the other location then being used as the Cable Construction Compound for the onshore cable.

Each compound will be accessed via existing entrances between the fields and the R750 road. Temporary traffic management signage will be erected on the R750 on the approach to the access gates, which will provide advance warning of the presence of the site entrance.

A temporary access track, approximately 4.5m wide, suitable for the delivery of plant, equipment and materials, will be formed from the existing field access gate, on the western side of the R750 public road to each compound location. In the interests of health and safety, localised widening, in the form of passing places, may be required along the compound access track. Where required, passing places will generally be up to 30m long and 5m wide, inclusive of a non-load bearing shoulder.

The Cable Construction Compound will necessitate minor earthworks involving topsoil stripping. Additional earthworks will be required for the HDD Compound at the landfall site as described in **Section 6.9.1**.

Figure 6.4 below provides a typical layout for a HDD Compound with a ‘mud pit’ arrangement. Alternatively, the ‘mud pit’ may be replaced with a containerised ‘mud lab’. The two options (both of which are assessed in the EIAR) are described in **Section 6.5.2.3**.



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Project Title
Arklow Bank Wind Park
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Drawing Title
Typical Landfall Temporary Compound Arrangement Option 1

Scale at A3 1:2,000

Role Civil

Suitability For Information

Arup Job No 271715-00

Rev D1

Name
Figure 6.2

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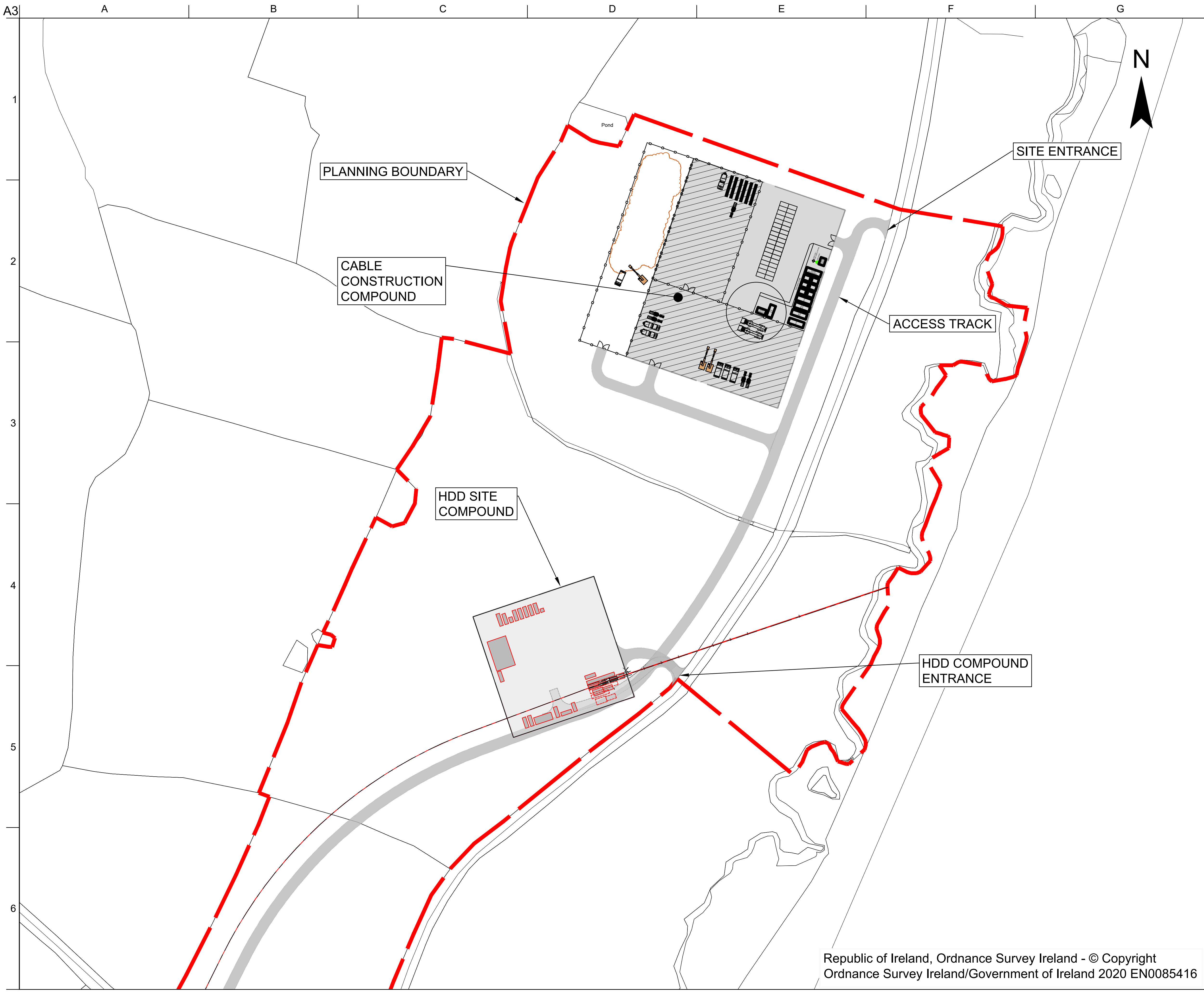

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Project Title
Arklow Bank Wind Park
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Drawing Title
Typical Landfall Temporary Compound Arrangement Option 2

Scale at A3: 1:2,000
Role: Civil
Suitability: For Information
Arup Job No: 271715-00
Rev: D1
Name: **Figure 6.3**

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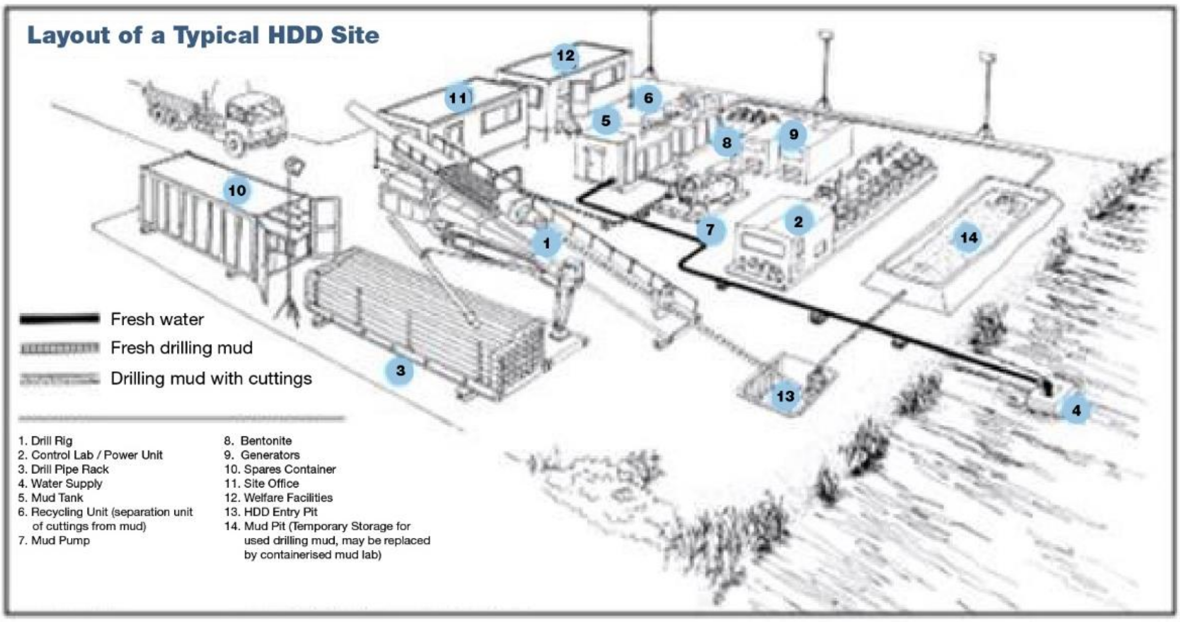


Figure 6.4: Typical HDD Compound with a mud pit

Double height stacked welfare and offices may be used to maximise the available footprint and minimise the interface with adjacent works.

The HDD Compound will likely accommodate the following:

- Drilling unit;
- Drill strings;
- Drilling mud (naturally occurring non-toxic lubricant for the drill operation) equipment;
- Workshops;
- Welfare facilities;
- Offices;
- Stores;
- Material & equipment storage;
- Construction waste storage;
- Road access;
- Vehicle parking;
- Gate facility to control access and egress, as well as providing security;
- Wheel wash prior to exiting;
- Temporary power, either via connection to existing electricity supply or from diesel generator;
- IT/telecommunication connection;
- Secure bunded area for fuel storage and chemicals, and generators;

- Signage and lighting;
- Topsoil stockpile; and
- Surface water runoff management.

The Cable Construction Compound will predominantly serve the onshore cable laying Contractor on the eastern section of the onshore cable from the landfall to the onshore 220kV Substation. This Cable Construction Compound, the proposed layout for which is shown in **Figure 6.5**, will likely comprise the following:

- Workshops;
- Welfare facilities;
- Offices;
- Stores;
- Material & equipment storage;
- Construction waste storage;
- Road access;
- Vehicle parking;
- Gate facility to control access and egress, as well as providing security;
- Wheel wash prior to exiting;
- Temporary power, either via connection to existing electricity supply or from diesel generator;
- IT/telecommunication connection;
- Secure bunded area for fuel storage and chemicals, and generators;
- Signage and lighting; and
- Surface water runoff management.

The material storage area will also allow for storage of:

- Topsoil;
- Cable drums;
- Fibre optic cable drums;
- Ducts (if required); and
- Cable installation equipment.

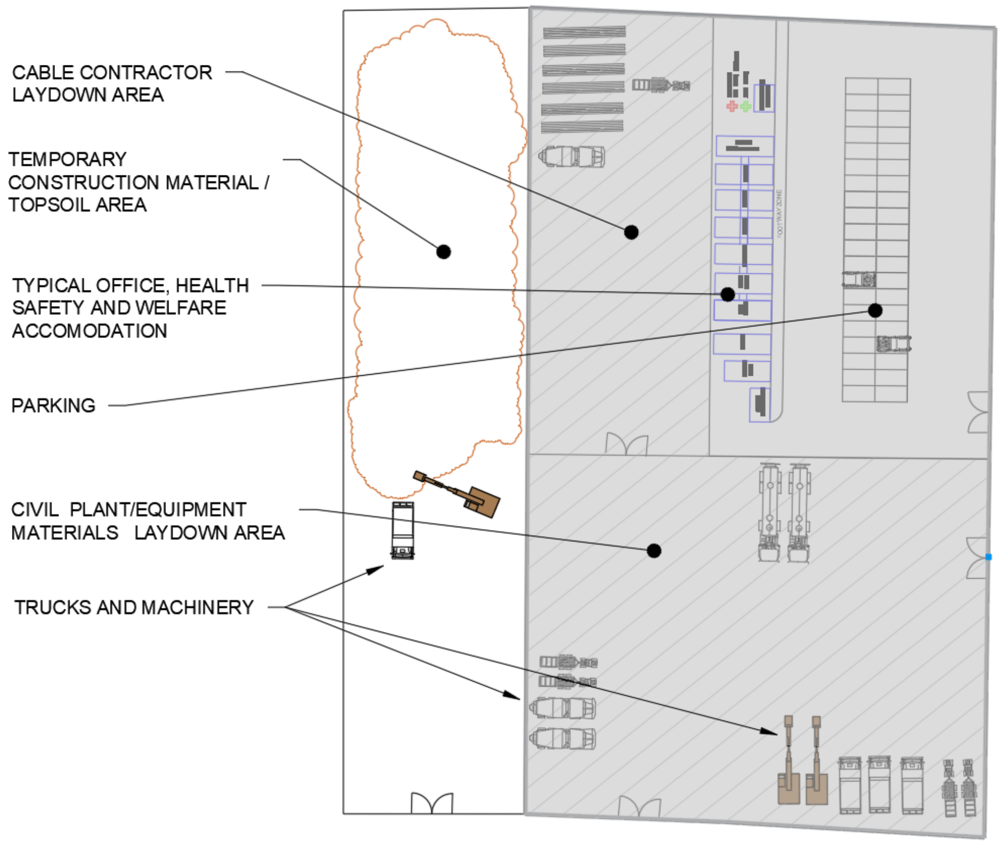


Figure 6.5: Typical Temporary Cable Construction Compound

6.4.2 Onshore Cable HDD Temporary Compounds

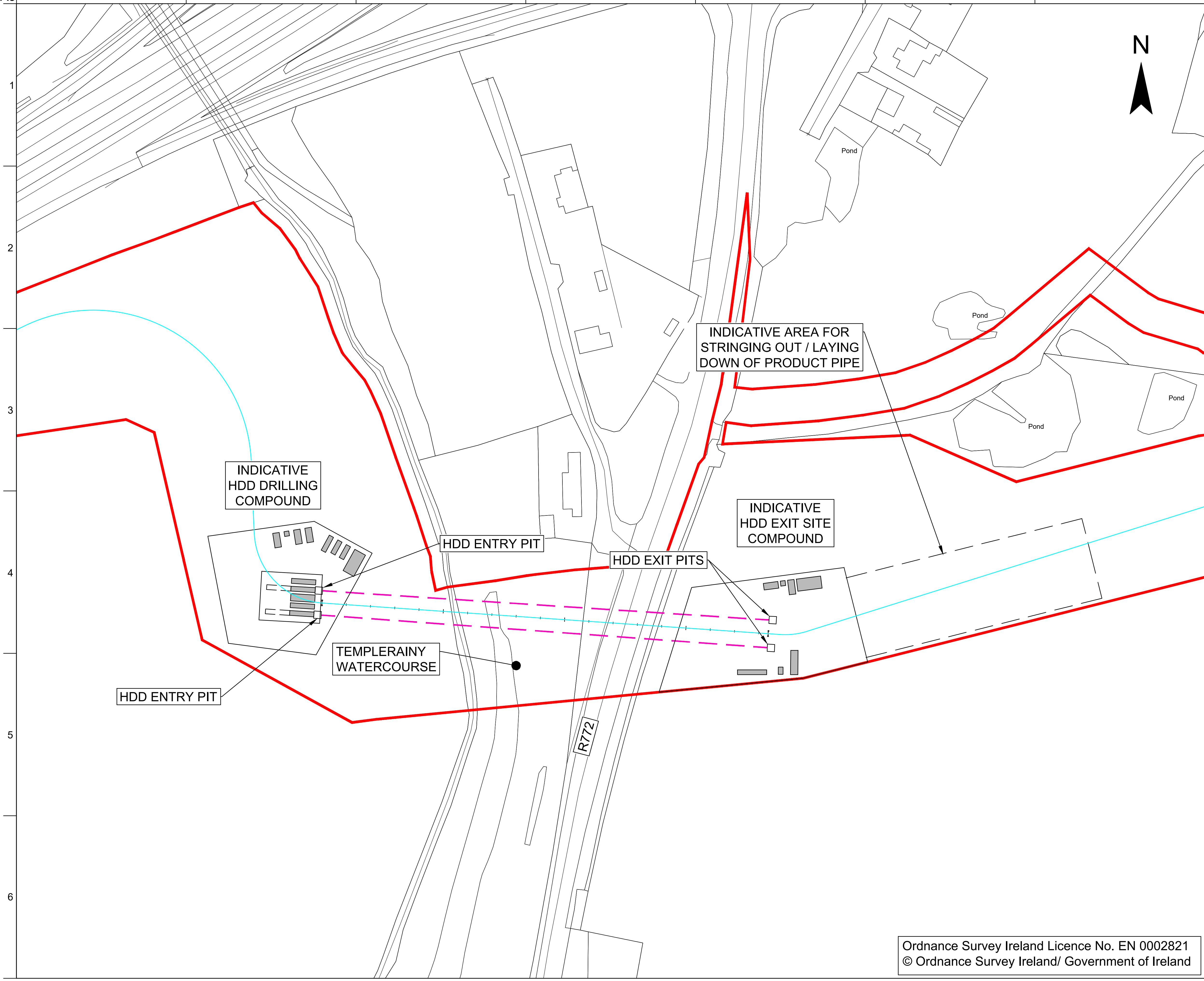
Temporary construction compounds will be required for the HDD operations at the crossings of the M11 and R772 roads. Each entry and exit compound is up to 3,000m^2 in area, excluding the HDD compound on the west of the M11, which is located in an area of immature woodland, which will be up to 4,000m^2 in area, including an access route.

An additional area, clear of obstructions, of typically around 50m wide x 100m long will be required, within the planning (red line) boundary, to string out the ducts before being pulled into the bore profile. The area for duct stringing may vary slightly subject to any spatial constraints, topography etc., however no modification to the existing land, such as clearance of vegetation and topsoil stripping, will be undertaken.

The location of the HDD temporary compounds is specific to the orientation of the route crossing of the roads.

A preliminary design of the HDD profile for each crossing has identified the entry and exit points, which require the compound to be located around that point to facilitate safe and correct execution of the HDD operation.

Refer to **Figure 6.6** and **Figure 6.7** for a proposed layout of the compounds associated with each HDD.



LEGEND

- PROPOSED HDD PIPES
- RED LINE BOUNDARY
- CABLE ROUTE

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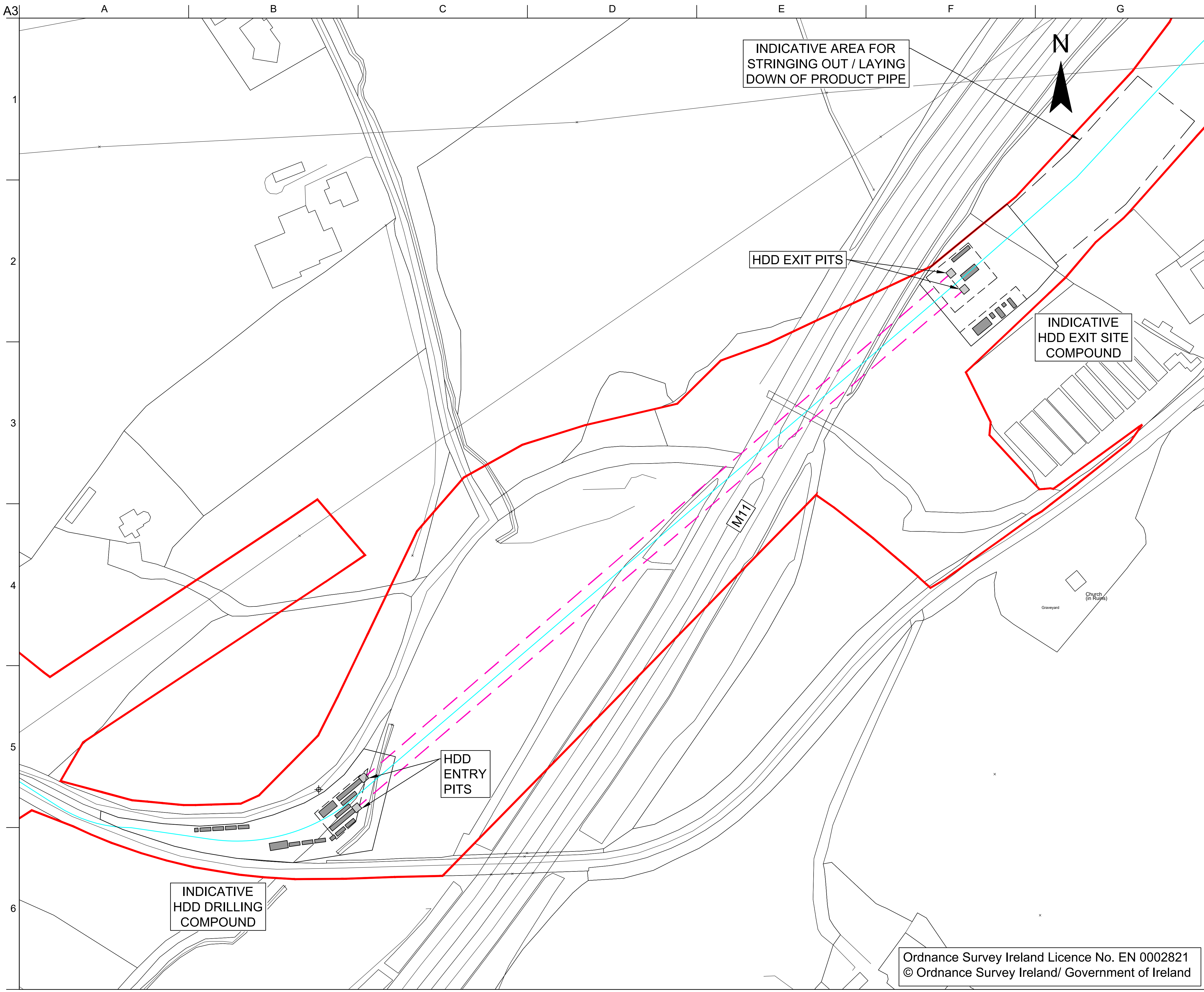
Drawing Title
Indicative HDD Compounds for R772 Crossing

Scale at A3: 1:1,500
Role: Civil
Suitability: Draft
Arup Job No: 271715-00
Rev: D1
Name: **Figure 6.6**

Do not scale



LEGEND

- PROPOSED HDD PIPES
- RED LINE BOUNDARY
- CABLE ROUTE

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Drawing Title
Indicative HDD Compounds for M11 Crossing

Scale at A3: 1:2,000
Role: Civil
Suitability: Draft
Arup Job No: **271715-00**
Rev: **D1**
Name: **Figure 6.7**

Do not scale

The temporary R772 & M11 HDD compounds will likely accommodate the following:

- Drilling unit;
- Drill strings;
- Drilling mud (naturally occurring non-toxic lubricant for the drill operation) equipment;
- Workshops;
- Self-contained welfare facilities;
- Offices;
- Stores;
- Material storage;
- Construction waste storage;
- Road access;
- Vehicle parking;
- Gate facility to control access and egress, as well as providing security;
- Wheel wash prior to exiting;
- Temporary power, either via connection to existing electricity supply or from diesel generator;
- Secure bunded area for fuel storage and chemicals, and generators;
- Signage and lighting;
- Water bowser parking; and
- Surface water runoff management.

6.4.3 Onshore 220kV Substation Temporary Compound

A temporary construction compound, up to 10,000m^2 in area will be required for the substation site, as well as to support the construction of the western end of the onshore export cable from the landfall to the new 220kV substation and the connection from the substation to the NETN.

Double height, stacked welfare and offices may be used to maximise the available footprint and minimise the interface with adjacent works.

The substation Contractor's compound will be established within the footprint of the permanent works at the Shelton Abbey substation site.

The connection substation works and the transmission substation work will be programmed accordingly, to accommodate the presence of the substation temporary construction compound. This will require the movement of the contactor's compound around the site depending on the phase of construction.

Refer to **Figure 6.8 - Figure 6.10** for indicative layouts of the compound for different stages of construction.

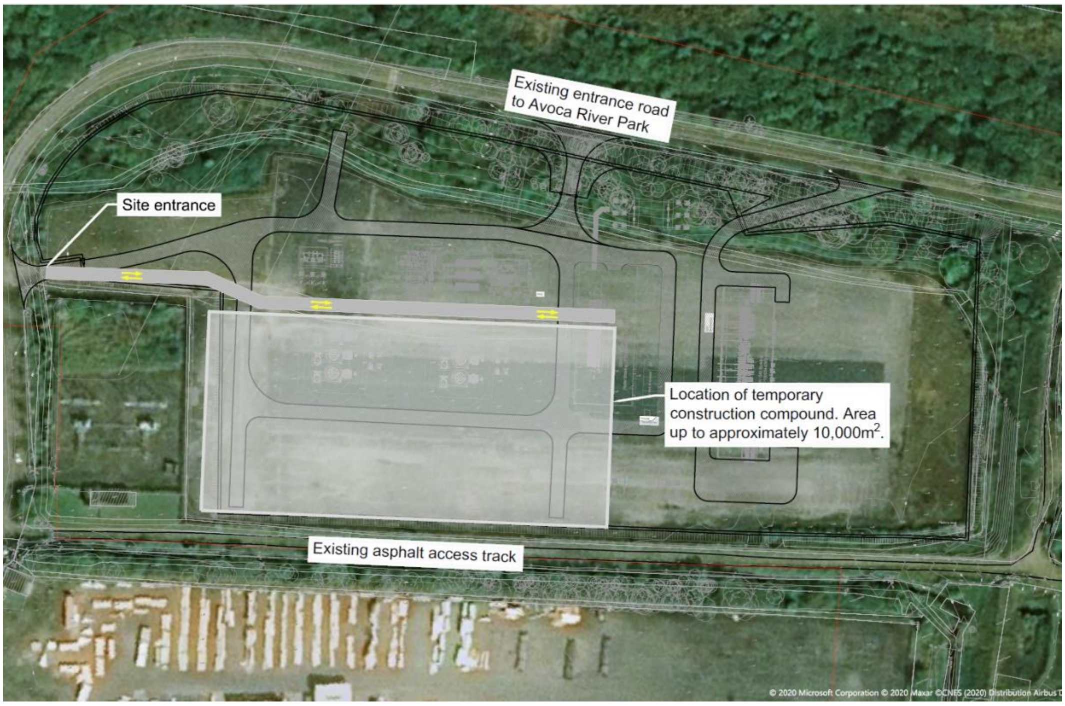


Figure 6.8: Indicative Substation Construction Compound Stage 1

Figure 6.9: Indicative Substation Construction Compound Stage 2

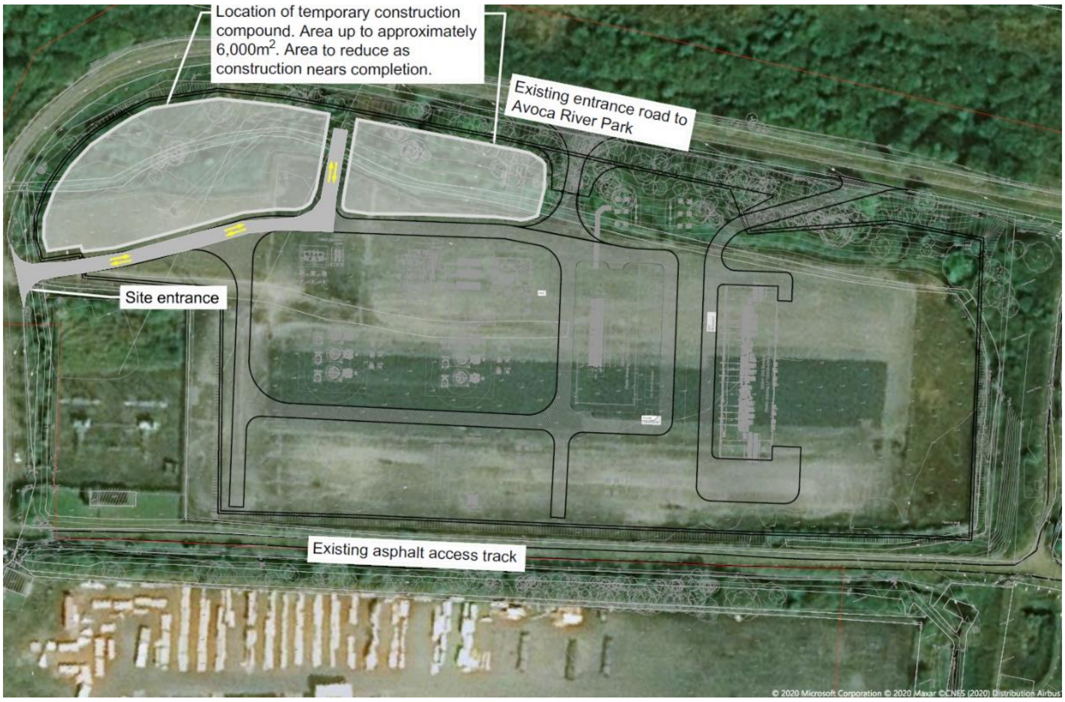


Figure 6.10: Indicative Substation Construction Compound Stage 3

The temporary construction compound will likely accommodate the following:

- Workshops;
- Welfare facilities;
- Offices;
- Stores;
- Material storage;
- Construction waste storage;
- Road access;
- Vehicle parking;
- Gate facility to control access and egress, as well as providing security;
- Wheel wash prior to exiting;
- Temporary power, either via connection to existing electricity supply or from diesel generator;
- Temporary surface water management;
- IT/telecommunication connection;
- Secure bunded area for fuel storage and chemicals, and generators; and
- Signage and lighting.

6.4.4 Temporary Working Areas

In addition to the landfall, cable route and substation construction compounds, temporary working areas will be established, as shown in **Figure 6.1**, for the construction of the new 220kV towers and decommissioning of existing 220kV towers, as well as the flood embankment improvement works.

The temporary working areas will accommodate some or all of the following, depending on the working area in question:

- Welfare facilities;
- Stores;
- Material storage;
- Construction waste storage;
- Road access;
- Vehicle parking;
- Wheel wash prior to exiting;
- Designated wash-down areas when working in areas of invasive species;
- Temporary power, either via connection to existing electricity supply or from diesel generator;
- Secure bunded area for fuel storage and chemicals, and generators; and
- Signage and lighting.

6.5 Construction Methods

6.5.1 Pre-Construction Activity

Pre-Construction Survey

The following pre-construction confirmatory surveys will be completed at all temporary construction compounds and working areas, as required:

- Pre-construction confirmatory habitat or species surveys specified as part of the biodiversity mitigation measures;
- Confirmatory ground investigations;
- Up to date utility survey check (desktop and site based);
- Topographic survey;
- Access route condition survey; and
- Pre-construction, photographic site condition survey.

Landowner and Neighbour Notifications

Prior to commencing any works, the Developer will inform the appointed landowner agents and the landowners about the activities, specific works, and the construction schedule. The neighbours, in the vicinity of the works, will be contacted and advised of the type of work being undertaken and the expected dates and durations.

All landowners will be contacted prior to access being required on their lands and a date of commencement for the works will be provided to the landowner before any work begins.

Pre-Construction Documentation

Prior to commencement of site work, the appointed Contractor(s) will produce detailed construction method statements, work programmes and risk assessments. These documents will provide details on:

- Pre-construction surveys;
- Site enabling works for temporary compounds and working areas, cable route and substation sites;
- Landfall and Transition Joint Bay construction;
- Cable corridor construction;
- Joint bay construction;
- Cable installation;
- Cable route crossings;
- Joint bay and substation permanent access roads;
- Substation platform construction;
- Substation perimeter fencing erection;
- Substation drainage installation;
- Substation earthing and ducting installation;
- Substation foundation construction;
- Substation building construction and fit-out;
- Substation electrical fit-out;
- Substation site finishes and surfacing;
- Access route works for connection to transmission network;
- Tower foundation construction for connection to transmission network;
- Tower structure construction for connection to transmission network;
- OHL stringing for connection to transmission network;
- Existing tower and string decommissioning; and
- Reinstatement.

These method statements will detail how the Contractor plans to implement the design. They will also take into account site investigations, third party requirements, and the mitigation measures outlined in the various sections of the EIAR and CEMP (**Appendix 6.1**).

The method statements produced by the Contractor(s) will be agreed with the Developer, who will ensure the method statement has taken account of any mitigations or actions identified within this EIAR, including compliance with the CEMP (**Appendix 6.1**).

6.5.2 HDD at Landfall

Owing to the steep coastal cliffs in the vicinity of the landfall, HDD will be used to bring the offshore export cables ashore, under the R750, before connecting to the onshore cables.

HDD is a trenchless cable installation technique whereby a hole is drilled under a feature so that the cable installation avoids disturbance of the cliffs and any sensitive habitats in the area.

There will be two HDD bores at the landfall and each HDD bore and duct will contain one cable circuit.

6.5.2.1 Pre-Construction Activity

The pre-construction activities are described in **Section 6.5.1** above.

6.5.2.2 Site Enabling Works

In preparation of commencing construction of the landfall, site enabling works, such as that listed below, will be undertaken.

<u>Site Entrances and Access Tracks</u>

Existing field entrance gates may be replaced with new lockable galvanised double width field gates and posts. To facilitate safe vehicular access and egress, and where required, gates will be set back from the existing entrance.

The existing field entrance will either be temporarily finished with an unbound crushed stone surface, or where required to facilitate safe vehicular access and egress, a bituminous bound bellmouth will be provided up to the edge of the public road. The public road will be kept free of debris by use of a road sweeper and/or on-site wheel wash, as required.

The access track to the compounds will require stripping of topsoil, typically 300mm deep, and then placing of up to a maximum of 600mm of imported clean natural stone, such as SRW Type A to Clause 801 (Transport Infrastructure Ireland, Specification for Roads Works Series 800, Road Pavements) on top of a geotextile separation membrane. Alternatively, a temporary plastic or metal roadway could be used.

There are various plastic or metal access track products available, these generally comprise panels, 3m x 3m, laid directly on top of existing level or levelled ground. A hiab type delivery vehicle can be used to lay the panels, overlapping and linking to form a contiguous access track.

Temporary construction signage will be erected on the R750 public road, in accordance with the Traffic Signs Manual (DTTS, 2019).

Setting Out

The site boundaries will be set out using Global Positioning System (GPS) or total station equipment and temporary hoarding, fencing, signage etc. will be erected, as required, to delineate the extent of the site, prevent unauthorised access and protect the surrounding environment.

If the up-to-date pre-construction utility survey check work identifies existing utilities crossing the site, these will be detected on site using an appropriate technique and equipment, such as Cable Avoidance Tool (CAT) / Ground Penetrating Radar (GPR) equipment, and the location clearly set out prior to any site clearance and excavations, so they can be safely exposed, worked around or diverted.

Clearing the Works Area

The topsoil will be stripped and temporarily stored separately at a designated excavated material storage area for re-use in the reinstatement works.

The excavated material storage area will be at least 50m from any watercourse and material side slopes will be commensurate with the type of material, to ensure slope stability and prevent erosion. The stockpile will be surrounded in silt fencing to protect the surrounding environment.

Existing field entrances to be used for the landfall site will be cleared of vegetation, where required to achieve sight lines as shown in the planning drawings. Vegetation clearance at the site entrances will also help improve turning radii for larger vehicles. All vegetation clearance, where appropriate, will be done outside the bird breeding season (March to August).

Diversion of Field Drains

Any existing field drainage present crossing the landfall site will be temporarily diverted or facilities put in place to over-pump to settlement ponds prior to discharge of treated water into the existing surface water drainage system.

Field drains will be reinstated on completion of the works or new drainage installed to match the drainage characteristics of the ground prior to development. The landowner will be consulted on the proposed drainage provisions prior to any installation.

Existing Utilities

Any area to be excavated will be subject to utilities searches and CAT scanning.

Services, if any, subject to utilities searches and investigation during design, will be exposed using intrinsically safe excavation methods i.e. vacuum or hand excavation. Subject to design requirements and in agreement with the relevant service owner/operator, appropriate protection methods (such as steel plating, concrete slab etc.) will be installed.

Compound Construction

The construction method for each temporary construction compound will be as described below:

A. The temporary site access will be constructed;

B. The compound areas will be fenced and secured;

C. If required, the underlying soil material will be excavated and stockpiled separately, then profiled and surrounded in silt fencing. The underlying soil material will only be excavated to create a level platform area. In the case of the landfall, rock breaking may be required;

D. If the underlying soil material is suitable, it will be used to create a level platform and so reduce the need for stockpiling and import of granular stone material;

E. Geotextile and/or geogrid material will be placed on the platform area to improve the ground and to facilitate the subsequent removal of any imported granular material after construction;

F. Imported granular stone material will be placed and compacted in layers to create a level platform area, typically up to 600mm thick; and

G. Stores and offices will be set-up, parking areas, laydown areas and pedestrian walkways etc. will be created.

On completion of the works, the area of the temporary construction compounds will be decommissioned in reverse order. The temporary cable construction compound will be reinstated to its original use. The HDD compound form part of the biodiversity enhancement planting scheme post construction.

6.5.2.3 HDD Set-up

The Contractor will excavate an entry pit to allow the HDD drilling rig to commence drilling at an appropriate cable burial depth. The entry pit will be used to bring the offshore export cable from the HDD duct to the Transition Joint Bay. This may require introduction of sheet piling.

The Contractor will either mobilise to site a containerised ‘mud lab/recycling plant’ or construct a temporary ‘mud pit/lagoon’. The mud recycling plant or mud pit/lagoon will facilitate the recycling of drilling fluid by removing drill cuttings thus reducing the total water demand.

There are different arrangements for mud recycling plant, which depends on several factors including ground conditions, detailed design of the HDD and the Contractor’s drilling equipment.

A mud recycling plant is typically 2m wide x 6m long x 4m high and will typically comprise pumps with desander and desilter modules.

The desander is used as a primary mud cleaner for drilling applications by separating coarse and medium mixed sands from the mud via a pump tank and a shaker module. The mud then passes through a riser pipe to the lower deck of the shaker for screening. After primary screening, the mud falls into a pump tank below, from there the mud is pumped by a centrifugal pump to a hydrocyclone. The underflow from the hydrocyclones is discharged on to the top deck of the shaker for dewatering, the overflow flows into the pump tank where some is recycled, and some is passed to clean the mud discharge pump for transfer to the next stage of mud treatment or reuse.

The desilter module works in a similar way to the desander module, however, it is fitted with different screens to capture the finer material.

The screened material will be contained in-situ and removed by dump truck or tank, to an appropriately permitted/licenced disposal site.

A temporary ‘mud pit’ area may also be used to settle the returning cuttings from drilling mud. Settling of the cuttings from the mud may take one to two days before it is removed off site by a dump truck or tanker, to an appropriately licenced disposal site.

The mud pit will be appropriately sized and lined to prevent leakage or overtopping due to rain. Typical dimensions of a mud pit are 12m long x 15m wide x 2m deep. The mud pit, if required, will either be formed at existing ground level using an impermeable geomembrane ‘liner’ material and earth bunds or will be an excavation, lined with an impermeable geomembrane below existing ground level.

Spoil management has been included in the CEMP (See **Appendix 6.1**) and will be further developed by the Contractor. This spoil management sets out how volumes of material in and out of the area are managed. The CEMP also sets out how site rainfall volumes are managed, to ensure the volume of the mud pit does not ‘overtop’ to the surrounding land. This will be achieved by monitoring weather conditions, the daily monitoring of the mud pit by the Contractor to prevent overtopping, and measures such as pumping to secure containment will be used where required to prevent overtopping.

Anchoring of HDD Rigs

During the drilling of a pilot hole, reaming out and installation of HDD duct pipe, a HDD rig can exert a considerable pushing and pullback force. This force is generally 30 tonnes but can potentially be up to 300 tonnes. The rig will therefore need to be anchored to the ground and this is usually achieved by either anchoring directly to rock by drilling or, where this is not possible, driving a line of sheet piles to provide an anchoring point.

If superficial deposits still do not provide adequate anchoring support from sheet piles, one anchor block of reinforced concrete will be required to secure each rig during the works.

An anchor block typically consists of a mesh reinforced concrete block of approximate plan dimensions 4.5m x 4m and thickness of c. 1.50m, which will be constructed onsite.

Final details are dependent on specific HDD plant and ground conditions, which will be determined at detailed design stage, by the Contractor. However, the scale and characteristics of the construction works are considered to be the expected worst case for the purposes of assessment.

6.5.2.4 Landfall HDD Works

In the case of a landfall constructed by HDD, considering geological features, water depths, mechanical properties of cables and ducts, the bore would extend to a point at a suitable distance offshore, usually several hundred metres. A pipe is inserted into the drilled hole which is then used as a duct into which the cables are installed. Sufficient space is required behind the HDD bore to string out the HDD pipe to enable a direct feed into the boreholes.

Installation of lengths of cables in HDD ducts can be limited by the maximum pulling tension of the cable and this will vary depending upon the cable mass, conductor cross-section, conductor material and, for the submarine cables, the design of the cable armouring. Also, the length of cable that can be delivered to the HDD location is another limiting factor. Initial consideration of feasible construction methods has indicated the cable will be pulled onshore from a vessel as described below.

A HDD rig will be required for the landfall HDD works. Within the landfall HDD compound, the typical space required for a HDD rig entry set-up is up to 50m x 50m (within the wider HDD compound), providing room for the drilling rig, bentonite pumping plant and drill sections. **Figure 6.11** shows a typical HDD drill rig and **Figure 6.20** illustrates the stages in a typical HDD duct installation at a road and water crossing, similar to the landfall HDD.

Figure 6.11: Photo of Typical HDD Drill Rig at Landfall

The HDD works comprise the following main stages:

A. A pilot hole of approximately 311mm diameter will be drilled from onshore to offshore;

B. Once the pilot hole has been completed, the reaming process will commence, increasing the diameter of the pilot hole to accommodate the safe installation of HDD duct. The reaming process will continue back and forth for a number of passes to achieve a bore diameter of approximately 1118mm. During the drilling procedure, drilling mud is continuously pumped to the drill head to act as a lubricant. Solids are removed from the returning mud via the mud recycling plant, and the spoil is transported off site or via the mud pit to settle before being removed;

C. A Jack-up vessel or dredger will be used at the reception pit, ‘punch out’ location in the seabed;

D. An approximate 30m x 8m wide reception pit will be created at the reception point in the seabed. This is achieved using a combination of air lift and long reach excavators;

E. The last forward HDD reamer will punch through the seabed at the reception pit;

F. The HDD reamer will then be disconnected from the drill pipe and recovered by divers;

G. The high-density Polyethylene (HDPE) liner pipe (duct) will be pre-assembled offsite and then floated in, connected to the drill pipe, and pulled onshore from the offshore end through the pre-drilled bore into position;

H. Steps A – G are then repeated for the other 220kV offshore export cable;

I. Trenches are then excavated from the HDD entry points to the Transition Joint Bay and ducts installed and backfilled;

J. HDD construction equipment and plant will then be demobilised from site;

K. The ducts will then be checked to make sure they are clear for cable pull-in and messenger wires will be installed; and

L. Cables will then be installed in the ducts by pulling onshore through the ducts from the offshore delivery vessel to the Transition Joint Bays.

The maximum duct and associated bore diameter are based on an offshore export cable with outside diameter (OD) of up to 266mm.

Using the current industry standard for the HDD duct diameter of 2.5 times the cable OD, a minimum 665mm internal diameter duct will be required, meaning a standard HDPE Standard Dimension Ratio 11 duct of nominal 800mm diameter will be provided.

This is the envisaged maximum duct diameter, however, this may be subject to change in accordance with industry standards and good practice for duct sizing.

The duct installation mitigates the risk of any gravel or sediments being pulled into the duct during the cable installation phase damaging the cable. Other appropriate controls will be employed to mitigate risk of damage to cables during installation such as positive water pressure with outflow of water from the HDD duct during cable pulling, coupled with a series of roller brushes at the duct entry point.

The drilling of the pilot bore may be performed by a specialist subcontractor, working for the HDD Contractor, using wireline gyroscopic sensor-guiding techniques to set the profile of the drill, providing ‘real time’ three-dimensional location tracking with an accuracy of typically plus or minus one to two metres, horizontally.

Once commenced, the HDD drilling activities are expected to operate continuously over a 24-hour period until each bore is complete. Consequently, lighting will be provided to provide a safe working area. Directional lighting will be employed to minimise light spill onto adjacent areas and the lighting will be configured to meet health and safety requirements.

Drilling may be carried out simultaneously (for both circuits) to accelerate the works programme.

The HDD will require a drilling fluid to cool and lubricate the drill head. Typically, bentonite is used, which comprises 95% water and 5% bentonite clay which is a non-toxic, natural substance. The bentonite effectively seals the bore maintaining a closed system throughout the drill. The bentonite drilling fluid is circulated down through the drill rods and back up the outside the rods in the annulus of the borehole.

While the bentonite drilling fluid is non-toxic and can be commonly used in farming practices, if sufficient quantity enters a watercourse it can potentially settle on the bottom, smothering benthic flora and affecting faunal feeding and breeding sites. In saltwater environments, the smothering effect is less problematic because seawater degrades the bentonite fluid, causing it to flocculate and allowing faster dispersal. Every endeavour will be made to avoid a breakout or frac-out (loss of drilling fluid to the surface) and it will be managed quickly if one occurs.

The drilling Contractor will develop a location specific HDD frac-out contingency plan, detailing measures to be taken to reduce the risk of bentonite breakout and measures to be taken for the protection of sensitive ecological receptors, should a breakout occur.

A typical procedure for managing a breakout or frac-out on land would include:

- Stop drilling immediately;
- Contain the bentonite by constructing a bund e.g. using sandbags;
- Recover the bentonite from the bund by pumping to a suitable container or back to the entry pit for recycling;
- If necessary, inert and non-toxic lost circulation material (mica) will be pumped into the bore profile, which will swell and plug any fissures;
- The area will be monitored closely to determine if the breakout has been sealed; and
- Check and monitor mud volumes and pressures as the works recommence.

A typical procedure for managing a breakout or frac-out under water would include:

- Stop drilling immediately;
- Pump lost circulation material (mica), which will swell and plug any fissures;
- Check and monitor mud volumes and pressures as the works recommence; and
- Repeat process as necessary until the breakout has been sealed.

Any bentonite will be managed and removed by the specialist drilling Contractor on completion of the operation. Water will be brought to site in tankers (to make up drilling fluid) for lubrication of the bore and to provide the requisite volumes of water to the compound. The water used will be non-saline and non-potable water. For each of the two HDD bores and with an average initial demand of around $10m^3/hr$, the total volume of water required is estimated to be up to $450m^3$, assuming full drilling fluid returns are maintained.

On completion of the operation the drill fluid will be disposed of or recovered at an appropriately licensed facility.

6.5.2.5 Transition Joint Bay

The onshore cables, which will be to a different specification to the offshore export cables, will be joined at the Transition Joint Bays which will be located below ground level in the HDD compound, at Johnstown North. The location will depend on the Contractor’s selection of HDD location, based on the options outlined in **Figure 6.2** and **Figure 6.3.**

The Transition Joint Bays will comprise a buried concrete chamber, typically 20m long x 5m wide. One chamber will be required for each circuit. The chambers will be constructed within an excavated pit, approximately 2.5m deep. The sides of the excavations for the Transition Joint Bays will be profiled to a safe angle of repose or safely shored using trench support or sheet piling. The transition bay walls will be constructed using reinforced concrete and the floor of each will be concrete lined to provide a flat, clean working environment. The Transition Joint Bays may be constructed prior to the HDD works in order to minimise construction delays and reduce the length of time for the offshore export cable pull in works.

The offshore and onshore cables must be joined together in a controlled environment, requiring a purpose designed shed or tent to be placed temporarily on top of each Transition Joint Bay chamber. These will be removed once the onshore cables have been joined with the offshore cables.

The chambers will have removable lids and following construction and commissioning, the lids will be installed, and the void below the lids backfilled and ground reinstated above. Surplus excavated material will be reused in the general reinstatement of the site.

Adjacent to each Transition Joint Bay there will be an earth link box. Earth link boxes are used at cable joints and terminations to provide easy access for cable testing and fault location purposes. Earth link boxes will require a number of surface level access covers placed in the vicinity of its associated Transition Joint Bay.

The area around the Transition Joint Bays will be backfilled with the excavated material upon completion of the jointing works, but permanent access will be required to the earth link boxes during the operational lifetime of the proposed development for maintenance purposes. In addition to the earth link boxes, there will be a requirement for a separate small communications chamber that will house jointing of the fibre optic cables.

After installation and reinstatement of the onshore Transition Joint Bays, the only visible above ground equipment will be manhole covers to allow access to the earth link boxes and communication chambers. There will be four manhole covers which, where possible, will be positioned close to field boundaries.

The access track to the Transition Joint Bays for construction will be maintained for permanent access during the operation phase.

6.5.2.6 Landfall Cable Installation

Following the completion of the duct installation, the cable for each circuit will be pulled through the ducts to join with the onshore cable at the Transition Joint Bays.

A ground level platform will be constructed at each Transition Joint Bay for the cable pull-in winch. The winch will be anchored using kentledge blocks, sheet piles or rock anchors. **Figure 6.12** is a photograph of a typical cable pull-in winch.

Figure 6.12: Photograph of typical onshore cable pull-in winch

Prior to pulling, the cable ducts will be tested to ensure the cable can be pulled through without any obstructions.

The cable laying vessel will be positioned offshore in sufficiently deep water. The cable end will be lowered from the vessel and floated (see **Figure 6.13** below which shows a typical cable float in progress) to the location of the HDD reception pit ‘punch out’ location. Divers will then connect the winch line to the cable and the shore winch will then begin pulling the cable through the duct. Pull-in will cease when the cable end reaches the onshore Transition Joint Bays. The offshore export cable beyond the HDD exit will then be lowered to the seabed for burial later, e.g. using a mechanical trenching, ploughing or jetting machine.

Figure 6.13: Typical cable float in progress

6.5.2.7 Reinstatement

Following completion of the HDD and jointing activities, all cabling and jointing infrastructure will be below ground.

The only visible structures at the landfall will be two small manhole covers for each circuit and small cable marker posts, which will indicate the location of the underground circuits. There will also be a permanent access track of approximately 4.5m to allow access to the Transition Joint Bays.

6.5.2.8 Biodiversity Enhancement Planting

In additional to the access track and four manhole covers at the HDD compound at Johnstown North, a biodiversity enhancement planting scheme is proposed, to ensure that there is no net-loss of habitat as a result of the proposed development.

The total biodiversity enhancement area will be 16,000m^2 and include a mixture of native woodland species in a main woodland planting area and perimeter edge mix. Some open areas will be left unplanted to form small glades as the woodland matures. Further information can be found in **Chapter 12** *Biodiversity*.

A rabbit proof fence will be provided to protect trees during early establishment. Weed control should not be necessary in Years 1 or 2, however in Year 3, some hand weeding may be required. A 5-year aftercare programme will be implemented. Any plants which die, are removed or become seriously damaged or diseased within a period of five years from the completion of the development shall be replaced within the next planting season.

6.5.3 Onshore Cable from Landfall to 220kV Substation

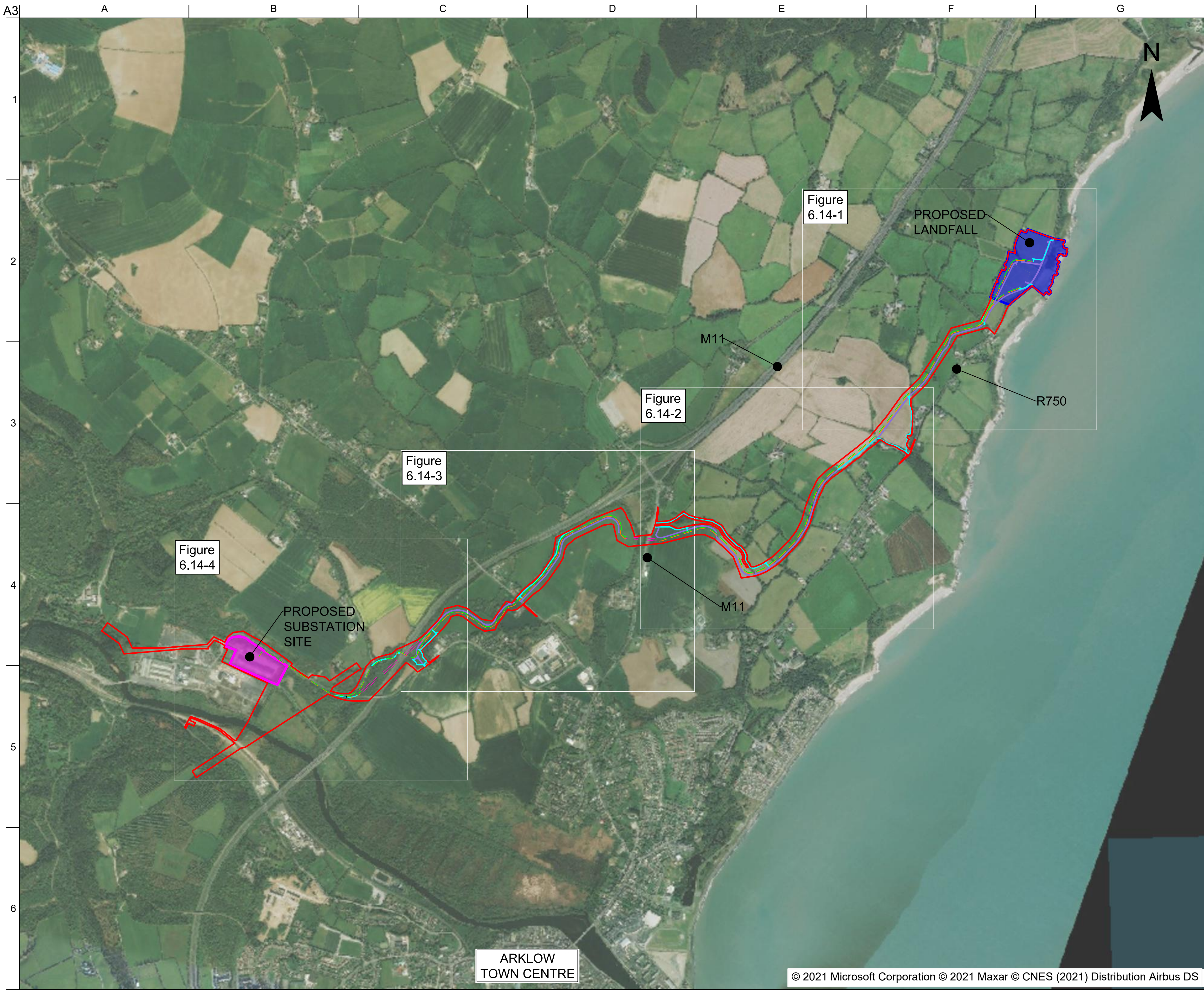
Connection to the proposed onshore 220kV substation at Shelton Abbey will be made by two 220kV high voltage alternating current (HVAC) circuits with associated fibre optic communication and earth cables, laid underground from the landfall location at Johnstown North.

Each of the two circuits comprise of three power cables plus two fibre optic cables. In total there are six power cables plus four fibre optic cables and two earth cables.

The proposed cable route is shown in **Figure 6.14**.

Sequence of Works

Due to the linear nature of the cable route, the stage of work may differ at different locations, however they will all follow the sequence of works outlined below.



Do not scale

LEGEND:

- PROPOSED LANDFALL
- PROPOSED SUBSTATION SITE
- RED LINE BOUNDARY
- PROPOSED CIRCUIT 1
- PROPOSED CIRCUIT 2
- M11 / R772 HDD CROSSING
- RED LINE BOUNDARY
- PROPOSED PERMANENT JOINT BAY ACCESS TRACK
- PROPOSED TEMPORARY HAUL ROAD

D1	16.02.21	SB	EO'G	MW
Rev	Date	By	Chkd	Appd

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Client
Sure Partners Limited

Project Title
Arklow Bank Wind Park
Phase 2
Onshore Grid Infrastructure

Drawing Title
Proposed Cable Route
Keyplan

Scale at A3 1:20,000

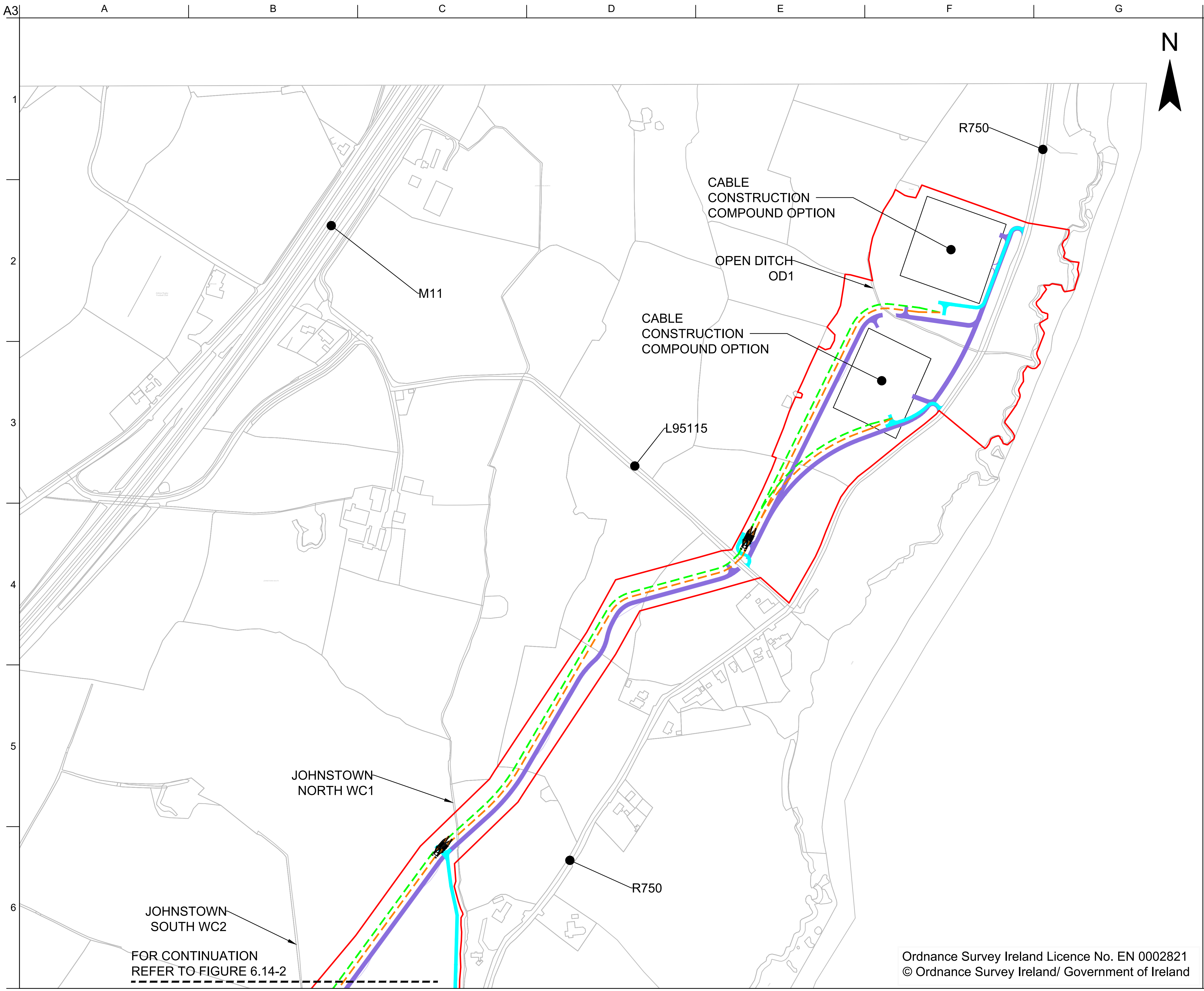
Role Civil

Suitability For Information

Arup Job No 271715-00

Rev D1

Name
Figure 6.14



LEGEND:

- PROPOSED CIRCUIT 1
- PROPOSED CIRCUIT 2
- M11 HDD CROSSING OPTION
- RED LINE BOUNDARY
- PROPOSED PERMANENT JOINT BAY ACCESS TRACK
- PROPOSED TEMPORARY HAUL ROAD
- INDICATIVE PROPOSED STAGGERED JOINT BAY (TREFOIL)
- INDICATIVE PROPOSED PARALLEL JOINT BAY (FLAT FORMATION)

Rev	Date	By	Chkd	Appd
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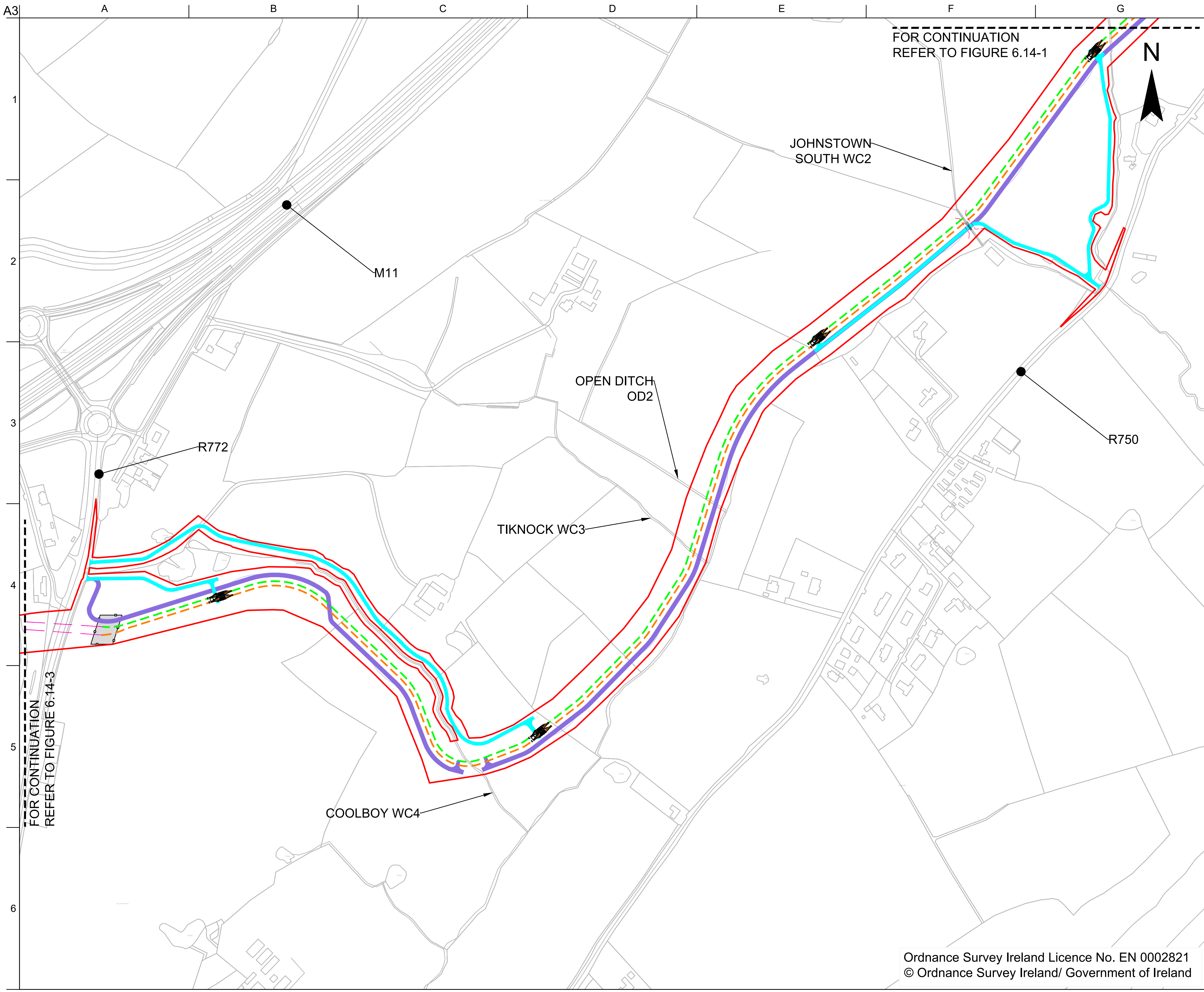
Proposed Cable Route
Sheet 1 of 4

Scale at A3: 1:5,000
Role: Civil
Suitability: For Information
Arup Job No: **271715-00**
Rev: **D1**
Name: **Figure 6.14-1**



LEGEND:

- PROPOSED CIRCUIT 1
- PROPOSED CIRCUIT 2
- M11 & R772 HDD CROSSING OPTION
- RED LINE BOUNDARY
- PROPOSED PERMANENT JOINT BAY ACCESS TRACK
- PROPOSED TEMPORARY HAUL ROAD
- INDICATIVE PROPOSED STAGGERED JOINT BAY (TREFOIL)
- INDICATIVE PROPOSED PARALLEL JOINT BAY (FLAT FORMATION)
- PROPOSED PERMANENT CULVERT

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Drawing Title
Proposed Cable Route
Sheet 2 of 4

Scale at A3: 1:5,000

Role: Civil

Suitability: For Information

Arup Job No: 271715-00

Rev: D1

Name
Figure 6.14-2

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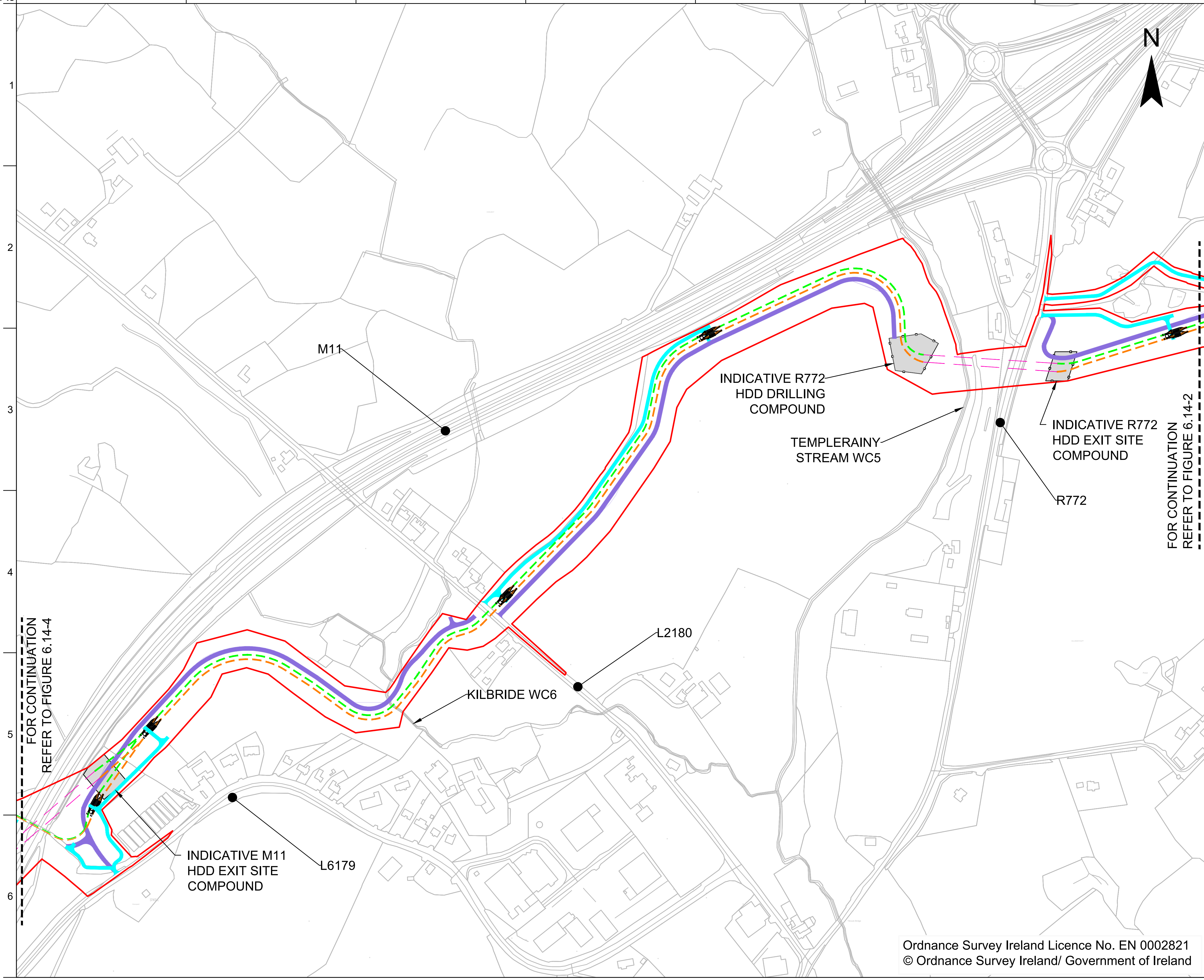

LEGEND:

- PROPOSED CIRCUIT 1
- PROPOSED CIRCUIT 2
- M11 & R772 HDD CROSSING OPTION
- RED LINE BOUNDARY
- PROPOSED PERMANENT JOINT BAY ACCESS TRACK
- PROPOSED TEMPORARY HAUL ROAD
- INDICATIVE PROPOSED STAGGERED JOINT BAY (TREFOIL)
- INDICATIVE PROPOSED PARALLEL JOINT BAY (FLAT FORMATION)

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Proposed Cable Route
Sheet 3 of 4

Scale at A3: 1:5,000

Role: Civil

Suitability: For Information

Arup Job No: **271715-00**

Rev: **D1**

Name: **Figure 6.14-3**

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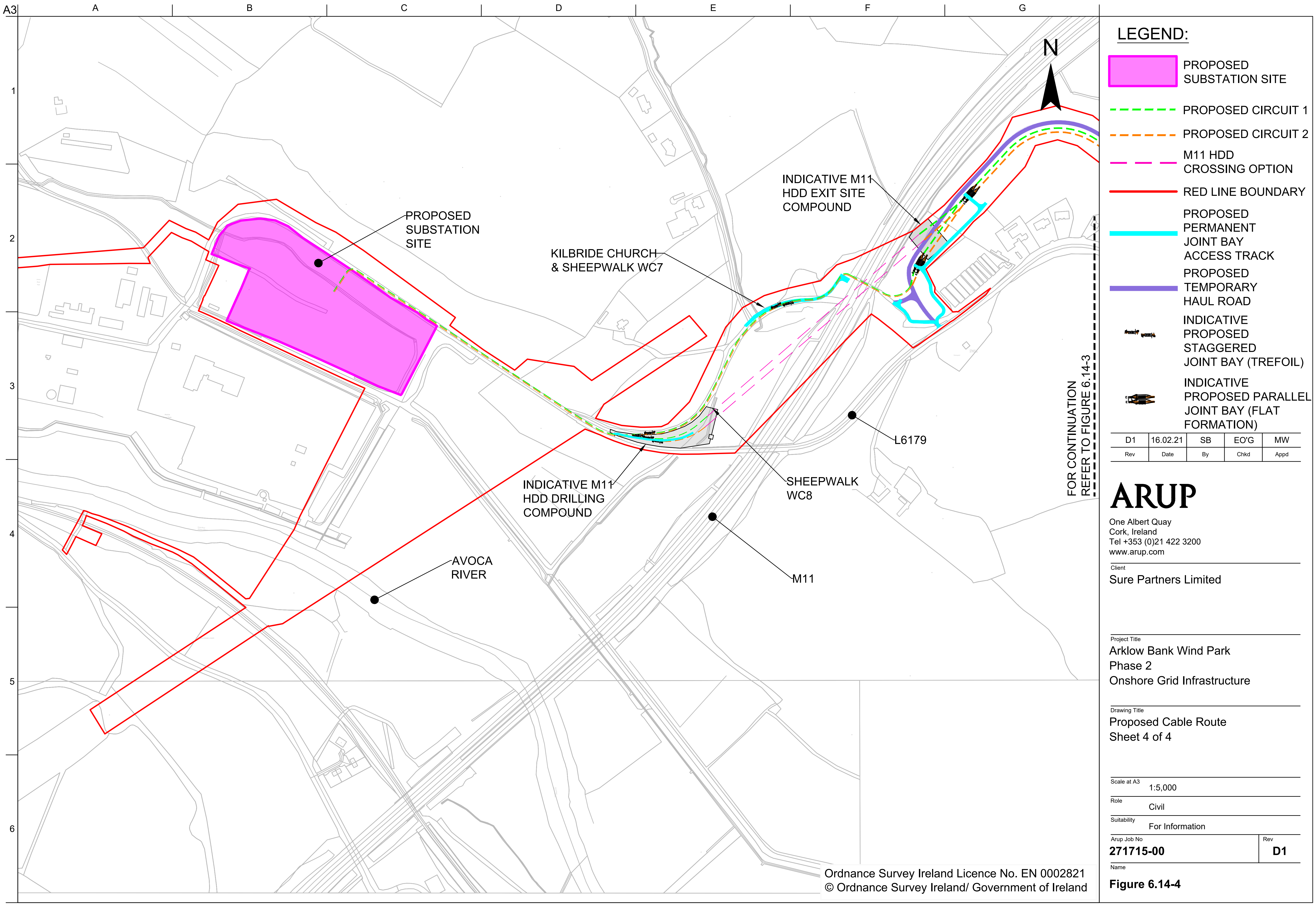

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Drawing Title
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Sheet 4 of 4

Scale at A3: 1:5,000
Role: Civil
Suitability: For Information
Arup Job No: 271715-00
Rev: D1

Name
Figure 6.14-4

Do not scale

6.5.3.1 Pre-Construction Activity

The pre-construction activities are as described in **Section 6.5.1** above.

6.5.3.2 Site Enabling Works

Prior to commencement of construction of the cable route, site enabling works, listed below, will be undertaken.

Setting Out

The cable route works will be set out using GPS or total station equipment and temporary hoarding, fencing, signage etc. will be erected, as required, to delineate the extent of the works area to provide a safe working area, prevent unauthorised access and protect the surrounding environment.

If the up-to-date pre-construction utility survey check work identifies existing utilities crossing the site, these will be detected on site using an appropriate technique and equipment (such as CAT/GPR equipment) and the location clearly set out prior to any site clearance and excavations, so they can be safely exposed, worked around or diverted.

Clearing the Works Area

Once the cable route and associated works area has been set out, clearing of the works area will begin. This will include removal of fences and cutting back of trees and vegetation, outside of the bird breeding season. To maintain field and other boundaries, throughout the works and prior to full reinstatement, the line of the hedge/fencing will be marked and temporarily fenced as appropriate.

Temporary access routes to the cable route may also result in loss of localised vegetation. Again, this vegetation will be reinstated, on completion.

Any non-native and invasive species recorded near works areas will be managed in accordance with the Invasive Species Management Plan in the CEMP, which is included in **Appendix 6.1**.

Diversion of Field Drains

Where existing drainage is present along the cable route, whether in open ditch or buried field drains, these will be temporarily diverted, or facilities put in place to over-pump to the temporary surface water drainage system.

Field drains will be fully reinstated on completion of the works or new drainage installed to match the drainage characteristics of the ground prior to development. The landowner will be consulted on the proposed drainage provisions prior to any installation.

Diversion of Any Existing Utilities

If existing utilities need to be diverted, this will be undertaken, either by the Contractor or by the utility owner in accordance with the relevant codes and standards and following agreement with the relevant authorities.

Any potable water supplies affected by the works, will be reinstated as soon as is feasible, or an alternative supply provided on a temporary basis until the permanent supply can be reinstated. Where access to drinking troughs for animals is severed by the works, an alternative supply will be provided for the duration of the works.

Erection of Temporary Guarding Positions

Where the cable route passes beneath existing overhead services, suitable fencing and guarding will be installed in accordance with good practice.

Temporary Access Points

Access points to the temporary cable construction corridor are presented in **Figure 6.1**.

Where temporary access is required to a point on the cable route other than provided directly from a public road, this will be defined, signed, and if necessary upgraded. These access track locations will be contained within the red line boundary and will comprise crushed stone and be approximately 4.5m wide. Crushed stone will be delivered to site by 20t tipping truck, then spread and profiled using an appropriately-sized tracked excavator or grader and then rolled and compacted using an appropriately sized vibrating roller.

Sections of temporary access tracks will be maintained for permanent access to joint bay locations. Appropriate drainage measures will be designed and constructed along these access tracks to maintain existing drainage regime.

Where required and to facilitate safe vehicular access and egress, a bituminous bound bell-mouth will be provided up to the edge of the public road.

6.5.3.3 Standard Cable Corridor

For the majority of the length of the cable corridor, an open cut trench method will be used to construct the two 220kV cable circuits.

Corridor Principle

A temporary cable construction corridor, typically 30m wide, will be established. As shown in **Figure 6.15**, the temporary construction corridor will provide space as follows:

- c. 1.25m temporary fencing and drainage
- c. 4.75m for stockpiling of segregated excavated material (topsoil and subsoil)
- c. 1.5m safe buffer zone
- c. 1.825m trench for circuit one
- c. 4.0m median
- c. 1.825m trench for circuit two
- c. 2m safe working zone
- c. 3m working zone / duct laydown area

- c. 5.5m haul road
- c. 2.5m excavated material stockpiling between 20m long passing bays typically @ 100m centres
- c. 1.25m temporary fencing and drainage

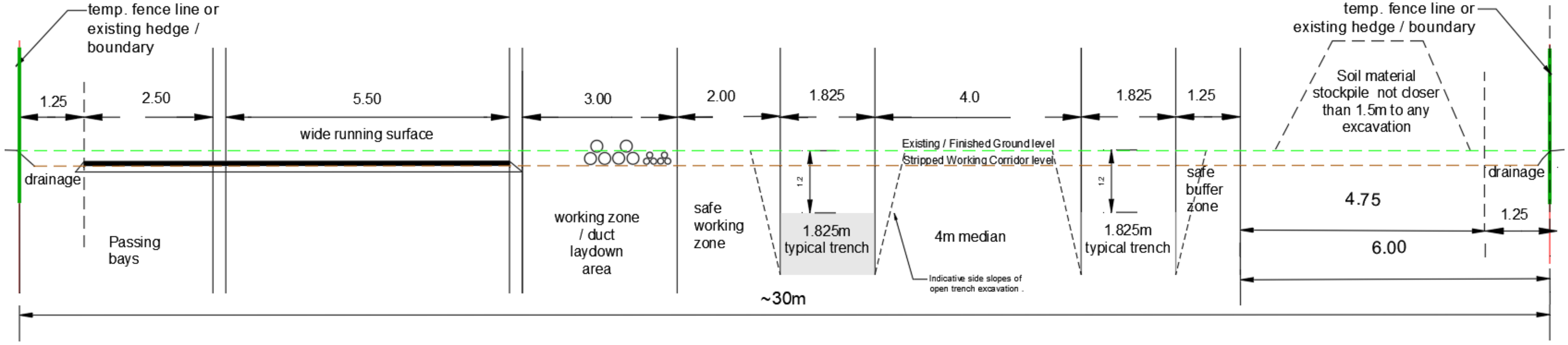


Figure 6.15: Temporary Cable Construction Corridor

Methodology

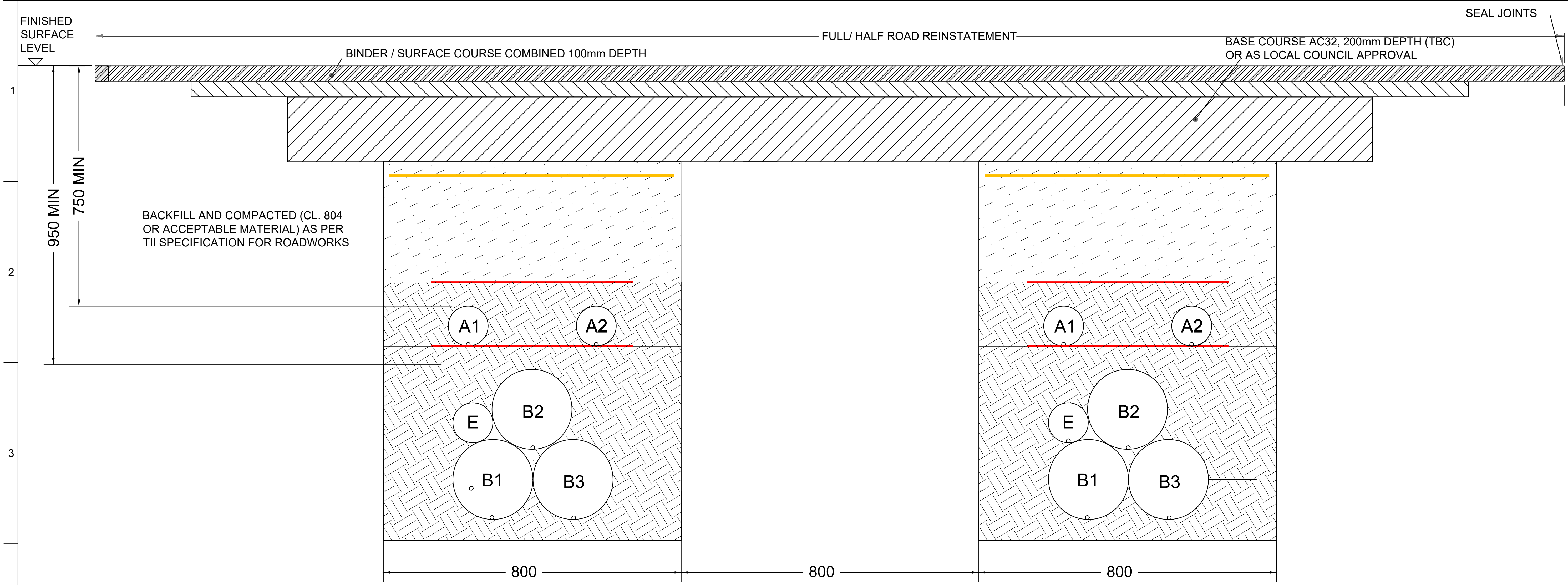
The following methodology will be used to construct the temporary cable construction corridor, with enabling works having been undertaken as outlined previously in **Section 6.5.3.2.**

The methodology will depend on the nature of the existing ground use. Where the existing ground is private land, such as agricultural:

- The proposed surface water management measures will be employed as required, in accordance with the measures set out in the CEMP, see **Appendix 6.1**;
- The haul road will be constructed by placing geotextile (and geogrid if required) material on to the existing ground;
- Imported granular stone will then be placed and compacted in layers as per the detailed design to create a typical make-up of 300-600mm thickness (depending on underlying ground conditions);
- The cable circuit 1 trench and cable circuit 2 trench will be excavated to the required depth, or further if required to reach a suitable bearing stratum;
- Excavated material will be side cast from the point of excavation and profiled. Topsoil and subsoil will be in separate stockpiles. The material will be kept a sufficient distance from the edge of the excavation for stability of the trench wall. Silt fences will be installed on the downslope side;
- The bedding material will be placed along with the cable ducts in trefoil or flat formation as required by the design;
- The remainder of the trench will be backfilled, with warning tapes or boards installed as per the detailed design; and
- The ducts will be cleaned of any debris and water by a series of brushes and rubber discs, usually pulled through as a ‘train’.

Circuit Trench

The circuit trench detail (trefoil and flat) is described in **Chapter 5** *Description of Development* and illustrated in **Figure 6.16** and **Figure 6.17** below.



TYPICAL ON ROAD CROSS SECTION INDICATING TRENCH FOR 220KV CIRCUIT TREFOIL

SCALE NTS

A= 125mm O.D. HDPE DUCT FOR COMMUNICATIONS, SDR=17.6
B= 250mm O.D. HDPE DUCT FOR HV CABLE, SDR=21
E= 125mm O.D. HDPE DUCT FOR EARTH CONTINUITY CONDUCTOR, SDR=17.6

RED MARKER STRIP
YELLOW MARKER WARNING TAPE
EXISTING SERVICE MARKER STRIP
6mm GALVANISED STEEL PLATE

RAPID HARDENING WET CONCRETE C25/30
CBGM B (CL. 822). COMPACTED TO CL 813.10
BACKFILL COMPACTED (CL. 802 OR ACCEPTABLE MATERIAL)
TOP SPOIL
ACCEPTABLE REINSTATEMENT MATERIAL

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.

D1	17.02.21	SB	EO'G	MW
Rev	Date	By	Chkd	Appd

ARUP
One Albert Quay
Cork, Ireland
Tel +353 (0)21 422 3200
www.arup.com

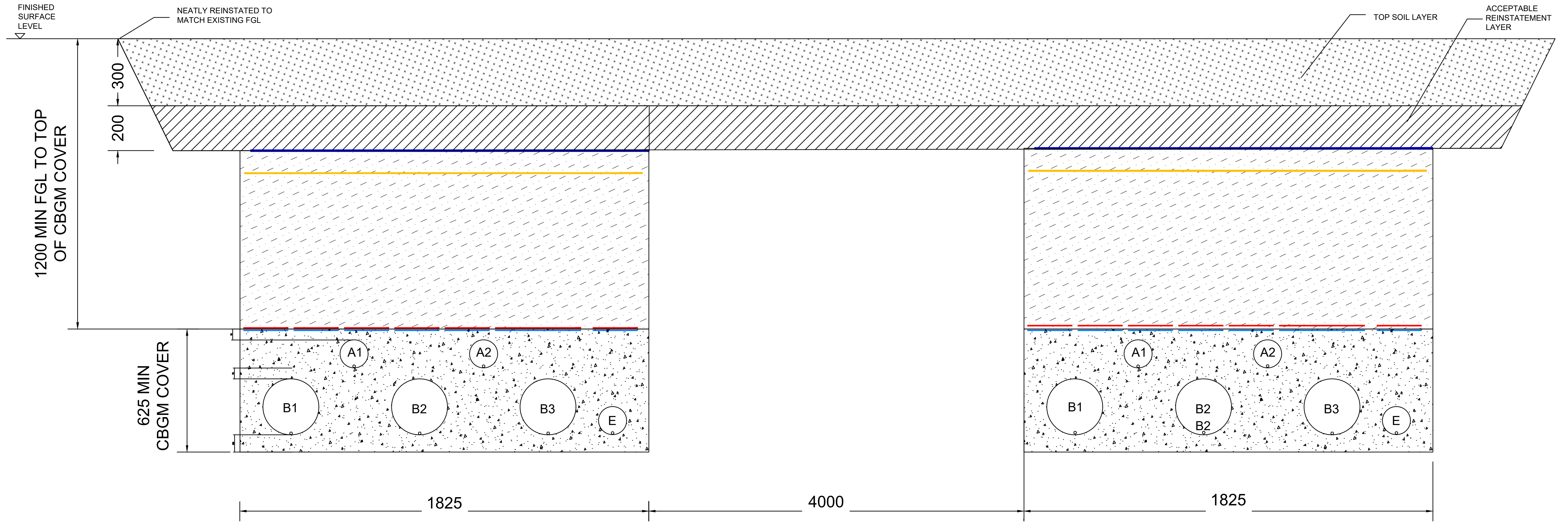
Project Title: Arklow Bank Wind Park Phase 2 Onshore Grid Infrastructure

Client: Sure Partners Limited

Drawing Title: Trench Cross Section Trefoil Arrangement

Scale at A3: NTS
Role: Civil
Suitability: For Information
Arup Job No: 271715-00
Rev: P1
Name: Figure 6.16

Do not scale



TYPICAL OFF ROAD CROSS SECTION INDICATING TRENCH FOR 220KV CIRCUIT FLAT FORMATION

SCALE NTS

A= 125mm O.D. HDPE DUCT FOR COMMUNICATIONS, SDR=17.6
B= 250mm O.D. HDPE DUCT FOR HV CABLE, SDR=21
E= 125mm O.D. HDPE DUCT FOR EARTH CONTINUITY CONDUCTOR, SDR=17.6

- RED MARKER STRIP
- YELLOW MARKER WARNING TAPE
- EXISTING SERVICE MARKER STRIP
- 6mm GALVANISED STEEL PLATE

- RAPID HARDENING WET CONCRETE C25/30
- CBGM B (CL. 822). COMPACTED TO CL 813.10
- BACKFILL COMPACTED (CL. 802 OR ACCEPTABLE MATERIAL)
- TOP SPOIL
- ACCEPTABLE REINSTATEMENT MATERIAL

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.

Rev	Date	By	Chkd	Appd
D1	17.02.21	SB	EO'G	MW

ARUP

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Project Title: Arklow Bank Wind Park Phase 2 Onshore Grid Infrastructure

Client: Sure Partners Limited

Drawing Title: Trench Cross Section Flat Arrangement

Scale at A3: NTS

Role: Civil

Suitability: For Information

Arup Job No: **271715-00**

Rev: **P1**

Name: **Figure 6.17**

Duct Installation

Ducts will typically be delivered to site in c. 6m sections. Where the route changes direction, care will be taken to ensure that local over-bending of the ducts will not occur at the connections.

Alternatively, pre-formed bends will be used at tighter changes in direction. Pre-formed bends will be avoided, if possible, as they increase the pulling force on cables during installation and so reduce the length of a cable that can be installed.

Due to the way push-fit ducts are connected, with a considerable length of interference (i.e. the 'male' part is inserted at approximately 300mm to ensure adequate sealing of the duct joints), the ducts will be installed in a continuous process. Trying to insert ducts in gaps in the route e.g. at road crossings, requires a considerable length of duct to be lifted in order to provide the spare length to accommodate the interference, and there is a risk of disturbing good duct connections at either side of the gap.

For this reason, it is essential that the whole of each cable section will be available and accessible before duct installation commences, and that one crew works from one end to the other. Multiple crews working on the same section is not practicable and will not be carried out.

The push-fit joints are designed to present minimum interference to the cable when pulled in one direction through the joint, from the 'male' end of one duct into the 'female' part of the next duct. Therefore, the installation of the cables will be planned before the ducts are installed, to ensure that the orientation suits the proposed pulls.

Cables can be pulled in the opposite direction, but additional scuffing of the cable over-sheath, and increased pulling tensions, could occur.

A nylon rope will be left in each section of duct to enable cleaning equipment to be pulled into the duct. The ducts will then be sealed.

Duct Quality Check

The cable ducts will be installed in such a manner to ensure the cables can be pulled into them without damage. Some scuffing of the cable over-sheath is to be expected during any cable installation. The purpose of this over-sheath is to provide mechanical protection to the metallic sheath and the cable core.

The pulling tension will be recorded to allow:

- Validation of the assumptions regarding coefficients of friction between the bond wire and the unlubricated duct; and
- Validation of increases in pulling tension, compared with calculated values, can indicate local obstructions, ovality (caused by ducts being crushed during installation) or deviations from the designed route.

6.5.3.4 Joint Bays

The joints between two circuits will be made at a joint bay after two lengths of circuit have been winched into position in the duct.

The locations of joint bays along the cable route are indicated in **Chapter 5** *Description of Development*.

Methodology

The following methodology will be used in installing a joint bay on a cable route (30m corridor):

- The area of the joint bay will be excavated down to a suitable bearing stratum, with the sides of the excavation either battered or shored.
- If necessary, ground water will be pumped out and discharged downslope via suitable surface water management means.
- The reinforced concrete base slab will be constructed, followed by the reinforced concrete walls. Alternatively, precast U-channel sections may be used and lifted into place using appropriately sized excavator or crane.
- The required number and orientation of duct penetrations will be formed in the walls.
- The perimeter of the excavation will be backfilled as much as possible once duct penetrations are sealed with a non-shrinking material, or fully if the cable trench is already installed on either side.
- Ancillary items including the link box and communications chamber will be installed adjacent to the joint bay.
- The pull-in locations on either side of the joint bay will be prepared to support the cable pulling equipment and the cable drum.

The joint bay may be constructed in advance of the cable trench on either side.

6.5.3.5 Cable Installation

Methodology

The following methodology will be used in installing a cable, or pulling into a duct:

- Cable drums will be located on low loader vehicles unless the installation dictates that it needs to be transferred to drum stands due to limited space.
- The cable pulling will be undertaken using the pulling equipment located on a hardstand area adjacent to the joint bay.
- A suitable length of spare cable will be coiled at either end to undertake the joining process.
- A temporary shelter will be placed over the joint bay to provide a safe and clean environment for an engineer to work in while connecting the two cable ends. This shelter could be a modified shipping container.

Figure 6.18 is a photograph of a typical shelter.

- The joint will be made as per the cable manufacturer's instructions (See **Figure 6.19**).
- The temporary shelter will be removed.
- The joint box will be backfilled with clean sand, with red cable marker tape above the cables.
- A reinforced concrete slab will be placed over the top of the joint box before yellow cable markers are installed as part of the remaining backfilling and final reinstatement
- The cable will be tested and commissioned.

The cable will be energised on completion of the full length between the onshore 220kV substation and the offshore substation, and connection of the onshore 220kV substation to the National Electricity Transmission Network (NETN).

Figure 6.18: Typical Joint Bay Shelter

Figure 6.19: Typical Jointing Process

6.5.3.6 Reinstatement

The cable corridor will be fully reinstated following the completion of works along the cable route.

Farmland will be reinstated to its original condition. Prior to the replacement of the topsoil, the subsoil will be ripped to below the depth of compaction, if possible, and levelled, and any roots, stones, shale and rock will be removed. Topsoil will be replaced, and additional topsoil provided, if required. Grassland will be reseeded, in consultation with the landowner.

On completion of the works all temporary buildings, fences, roadways, surplus materials debris, and materials not naturally belonging on the land will be removed. The access tracks to the joint bays will be retained.

Where loss of hedgerows occurs due to the cable route crossing them, the hedgerow will be replanted with shallow-rooted, native species to provide new growth, with stock-proof fencing installed to maintain the boundary until the growth matures. To protect the cable, there will be restrictions on the reinstatement of treelines over the cable trenches. Suitable alternative planting will be provided instead, at these locations.

Where habitat cannot be reinstated, biodiversity enhancement planting will be provided at the landfall to ensure that there is no net-loss of habitat as a result of the proposed development. Further detail on this is provided in **Chapter 12** *Biodiversity*.

On completion of the construction works and energisation of the project, the permanent wayleave will be 15m. Future access to the joint bays for annual inspection will be maintained via the construction of approximately 4.5m wide permanent access tracks to each joint bay location (See **Chapter 5** *Description of Development*).

6.5.3.7 Road and Utility Crossings

Where the cable crosses another utility or feature, the crossing will be undertaken based on the following methodologies.

Road Crossings – Open Cut Trench

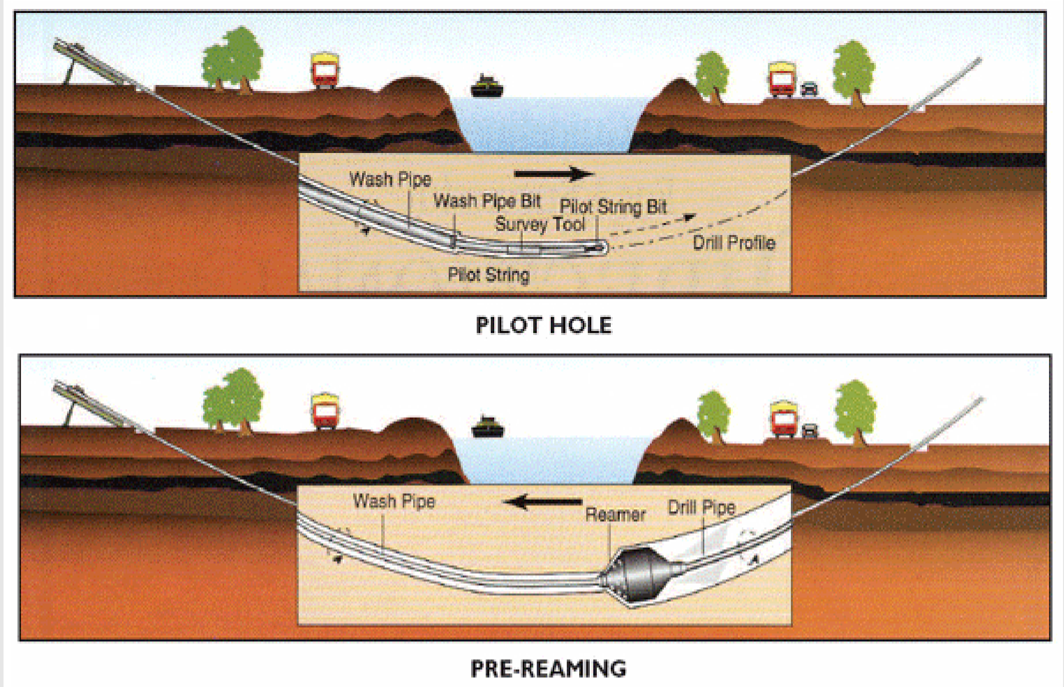
The cable route crosses a number of public roads as shown in **Figure 6.14**, as well as some private access roads.

Where the works cross existing farm tracks or farm roadways, obstruction will be minimised while the work is underway, and arrangements will be made for the safe passage of persons, farm machinery and livestock across the working width, as required by the landowner.

The circuit trench detail will remain as per the standard cable corridor circuit trench, however the backfill material may be changed to mass concrete. To undertake the crossing of a public road, a temporary traffic management plan will be produced, agreed with the road authority and be implemented. If possible, traffic flow will be maintained by use of temporary traffic signals, however if the road width is insufficient, or on private lanes, the road will be closed and an appropriate diversion put in place.

R772 Road Crossing - Horizontal Directional Drill

HDD will be used to cross the R772, the adjoining Templerainy watercourse and a gas pipeline beside the R772, as shown in the typical HDD schematic in **Figure 6.20.**



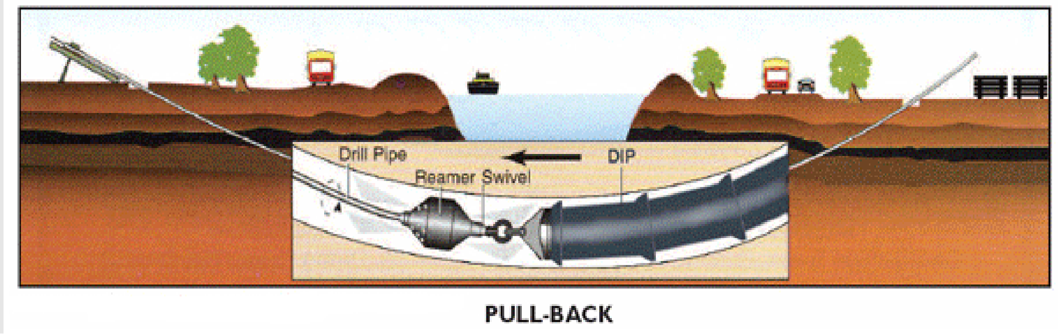


Figure 6.20: Typical HDD Schematic

A smaller HDD-rig (**Figure 6.21**) than that proposed for the landfall HDD is likely to be used for the R772 road and Templerainy watercourse crossing.

The exact equipment to be used will be subject to the Contractor’s available equipment and the detailed design. However, the scale and characteristics of the construction works described below are considered to be the worst case for the purposes of assessment.

The HDD for the R772 and Templerainy watercourse crossing will be approximately 200m long with an anticipated maximum depth of approximately 20m.

The typical space required for the smaller HDD rig entry set up is up to 20m x 25m, providing room for the drilling rig, bentonite pumping plant and drill sections, as shown in **Figure 6.6**.

The typical space requirement for the exit compound is similar to the entry compound and provides space for the construction of the HDD drill reception pit, storage of the HDD pipe and welding equipment during the pipe fabrication process including the plant and welfare facilities.

Figure 6.21: Indicative HDD Rig for Road and Watercourse Crossings

For the R772 road and Templerainy watercourse crossing, the maximum expected outer diameter of each HDD bore will be c. 900mm.

The operation of the smaller HDD rigs will be similar to that described above for the landfall (**Section 6.5.2.4**). The smaller HDD rig will utilise a comparatively smaller volume of drilling fluid which will be in a self-contained small mobile vessel. The smaller HDD rig will also have smaller ancillary equipment on a small footprint with setup significantly quicker than the static equipment used by a larger HDD rig.

Drilling mud and water management in relation to the R772 road and Templerainy watercourse crossing will be similar to that described for the landfall HDD. For each of the two R772 HDD bores and with an average initial demand of around $10m^3$/hr, the total volume of water required is estimated to be up to $200m^3$, assuming full drilling fluid returns are maintained. On completion of the operation the drill fluid will be disposed of or recovered at an appropriately licensed facility.

M11 Road Crossing - Horizontal Directional Drill or Existing Underpass

Two options are being considered to cross the M11 motorway as shown in **Figure 6.14**. One option is a HDD, as described above for the landfall HDD except, the HDD length to cross the M11 (including Sheepwalk watercourse) will be approximately 500m, with an approximate depth of 25m (See **Figure 6.7**).

This option will require felling up to approximately $4000m^2$ of immature woodland on the west side of the M11 to facilitate the HDD work, follow-on cable route and safe access.

Once tree felling and site clearance works are complete and subject to the ground conditions encountered, the M11 HDD crossing option will require an over-pumping arrangement similar to that described for open cut cable trench watercourse crossings in **Section 6.5.3.8**. which will be over a length of approximately 50m of the Sheepwalk watercourse.

The temporary HDD working area (c. $550m^2$) will be excavated west of the Sheepwalk watercourse up to approximately 8m below existing ground level to achieve the minimum vertical HDD bend radius of 500m and a provide approximate 2m cover, to the HDD bore profile below the Sheepwalk watercourse.

An adjoining c. $1500m^2$ area for temporary access track and hardstand construction will be excavated and graded from ground level to the HDD working area level.

The sides of the M11 HDD working, access and hardstand area excavations may be temporarily shored up using sheet piling or other appropriate supports (timber; sandbags, gabion baskets etc.) to minimise the extent of the excavation and earthworks.

Excavated material will be temporarily stored locally at temporary HDD exit compound for re-use in the works, and topsoil will be stored separate from subsoil.

Imported crushed stone typically 300mm – 600mm thick will be placed to form a stable platform for the temporary HDD working area and access track.

Appropriate temporary drainage will be installed in and around the working area and the perimeter of the excavations, as required.

For each of the two M11 HDD bores and with an average initial demand of around $10m^3$/hr, the total volume of water required is estimated to be up to $450m^3$, assuming full drilling fluid returns are maintained. On completion of the operation the drill fluid will be disposed of or recovered at an appropriately licensed facility. The other option for the onshore cables to cross the M11 is via an existing underpass, comprising a concrete box-culvert.

The underpass was installed when the M11 was originally constructed to allow the landowner to move cattle between fields severed by the motorway construction. The concrete box-culvert aperture is approximately 40m long, 3m wide and 3m high.

The two 220kV circuits will either be in flat or in trefoil formation in the underpass. In both instances, the cables will be ducted and concrete encased for both security and cable protection reasons. **Figure 6.22** illustrates the flat formation option for installing the cable in the box culvert under the M11.

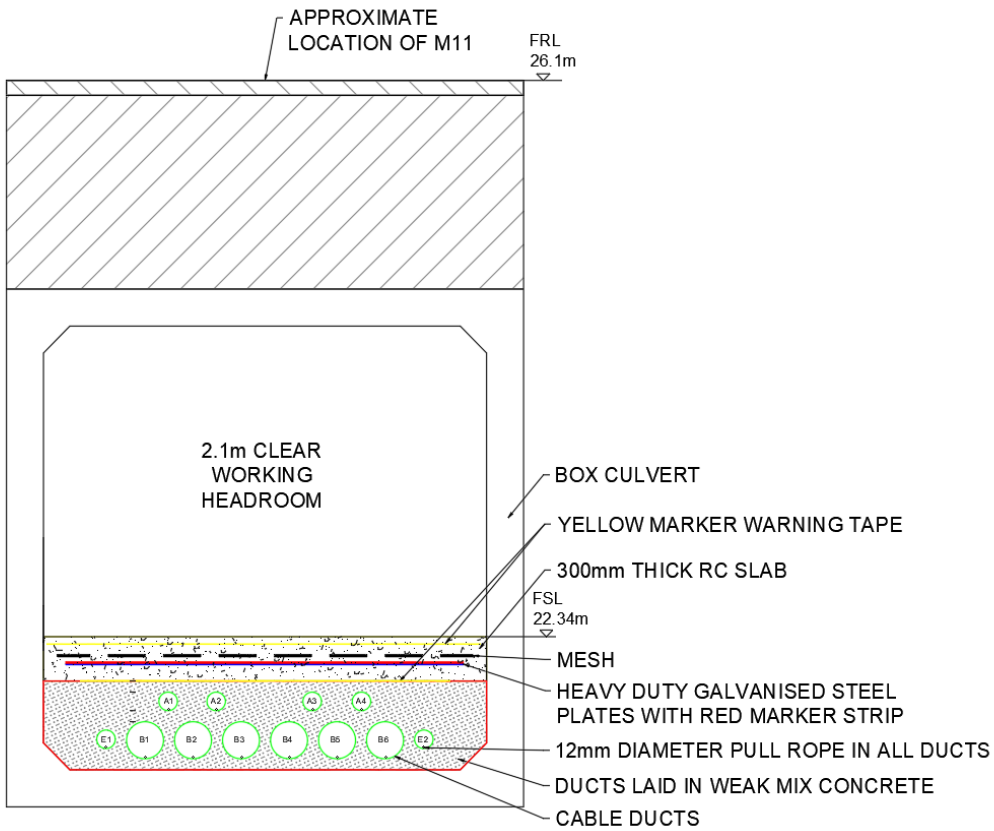


Figure 6.22: Typical Option (flat formation) for Installing cable in Box Culvert in M11 Underpass

The underpass, if used for the cable installation, will no longer be suitable for pedestrian and vehicular access and will therefore be used for the sole purpose of the proposed development.

Ongoing consultation with the asset owner, Transport Infrastructure Ireland (TII) is underway to finalise design details prior to works commencing.

Gas Pipeline Crossing

The cable corridor crosses a 4bar 180mm HDPE Gas Networks Ireland pipeline along Forest Road. This pipeline is generally approximately 1m below ground level. It is 2.5m below ground level where it crosses the M11.

This pipeline will be crossed by either open cut trench or as part of the M11 HDD crossing. Where the crossing of the gas pipeline is achieved by use of an open cut trench, this will be undertaken by hand digging. Protective timbers will be strapped around the gas pipeline as it is exposed, such that the timber will provide support and protection to the short length of exposed gas pipeline. The cable trench will be deeper than a standard cable trench to allow the ducts to be installed under the gas pipeline. The protective/supporting timbers will be removed as the cable trench is backfilled carefully by hand.

If crossed by the M11 HDD crossing, the methodology will be similar to the crossing of gas pipeline at the R772 and Templerainy watercourse as described above.

The crossing methodologies will be in accordance with the GNI Safety Advice for Working in the Vicinity of Gas Pipelines (2016).

6.5.3.8 Watercourse Crossings

Along the cable route, a number of watercourses will be crossed by open cut to facilitate cable trench installation. Watercourse crossings are also required for temporary vehicular access along the cable route during the construction phase to minimise traffic on public roads.

The location of all watercourse crossings is shown in **Figure 6.14** and typical crossing types shown in **Figure 6.23** and **Figure 6.24**.

A schedule of both HDD and open cut watercourse crossings is provided in **Table 6.6** below:

Table 6.6: Watercourse Crossings

Ref	Watercourse Name	Crossing Type	Crossing Method
OD1	Unnamed – Open Ditch	Cable Trench + Haul Road	Potential temporary over-pumping Potential bottomless culvert due to topography
WC1	Johnstown North	Cable Trench + Haul Road	Potential temporary over-pumping Potential bottomless culvert due to topography.
WC2	Johnstown South	Cable Trench + Permanent access to joint bay /Haul Road	Potential temporary over-pumping Existing vehicular crossing to be upgraded using

Ref	Watercourse Name	Crossing Type	Crossing Method
			minimum 900mm diameter culvert pipe
OD2	Unnamed - Open Ditch	Cable Trench + Haul Road	Potential temporary over-pumping Potential bottomless culvert due to topography
WC3	Ticknock	Cable Trench + Haul Road	Potential temporary over-pumping Potential bottomless culvert due to topography
WC4	Coolboy	Cable Trench	Potential temporary over-pumping
WC5	Templerainy	HDD	Trenchless technique. Refer to Section 6.5.3.7
WC6	Kilbride	Cable Trench + Haul Road	Potential temporary over-pumping Potential bottomless culvert due to topography Seasonal working required due to fish stock value
WC7	Sheepwalk + Kilbride Church	Cable Trench	Potential temporary over-pumping
WC8	Alternative crossing method for Sheepwalk	HDD	Trenchless technique with temporary over-pumping. Refer to Section 6.5.3.7

All applicable watercourse crossings will be designed and agreed in consultation with the Office for Public Works (OPW) prior to commencement of watercourse crossings, and in accordance with Section 50 of the Arterial Drainage Act 1945, as amended.

The following general principles for each of the different *Type* and *Method* of crossing will be adhered to, as described in **Section 6.5.3.8.1** and **Section 6.5.3.8.2**.

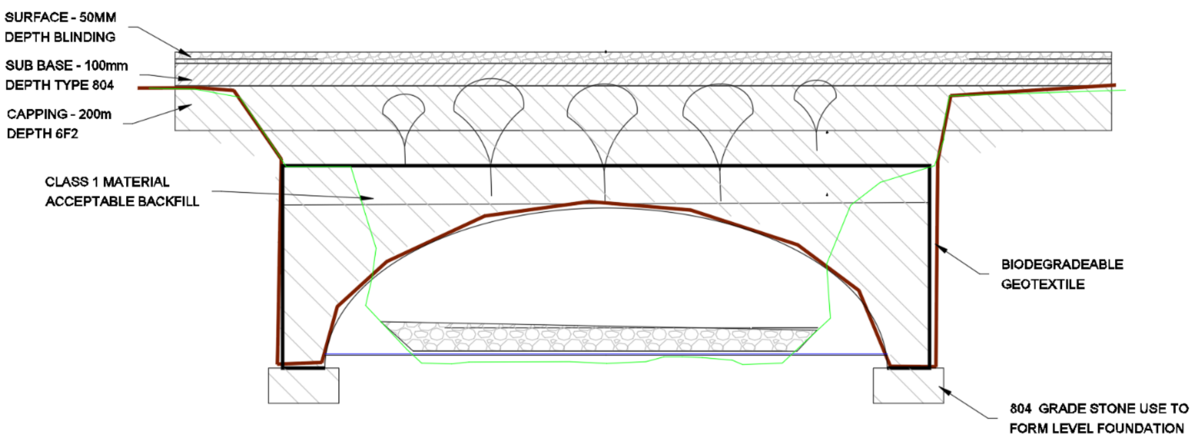


Figure 6.23: Typical Temporary Watercourse Crossing Detail

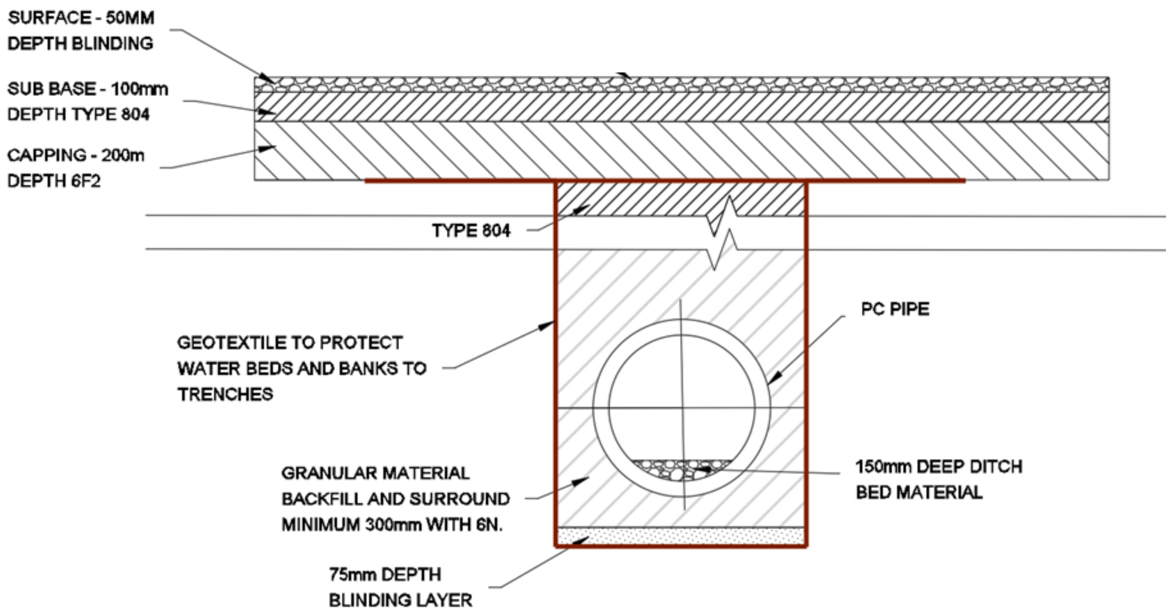


Figure 6.24: Typical Permanent Watercourse Crossing Detail

6.5.3.8.1 Watercourse Crossing Types

Cable Trench Watercourse Crossing Type

Before any watercourse cable installation work commences and to allow these works to take place, water flows will first be controlled to maintain free flow, this will either be achieved using temporary damming and an over-pumping method or alternatively, using a flume pipe method, with the invert of the pipe typically 100mm below the invert of the existing stream bed, to replicate the natural flow.

Haul Road and Joint Bay Access Track Watercourse Crossing Type

Before the construction of any haul road or permanent joint bay access track over a watercourse and to allow these works to take place, water flow will first be controlled and maintained using a culvert/flume pipe method, with the invert of the pipes installed typically 100mm below the invert of the existing stream bed, to replicate natural free flow.

Temporary bridge structure or bottomless culverts are methods that may be used in instances of steep topography or if required to minimise impact to a watercourse and allow safe passage of plant, equipment and materials.

HDD Crossing Type

Further details of these crossings can be found in **Section 6.5.3.7** Road and Utility Crossings.

6.5.3.8.2 Typical Watercourse Crossing Methodologies

Over-pump Watercourse Crossing Methodology

If temporary damming and over-pumping methodology is adopted, soil filled sandbags will be used to create a seal and dam both the upstream and downstream sides of the watercourse crossing. Then appropriately sized pumps will be located adjacent to the watercourse crossing and an intake pipe will be lowered into the dammed upstream side of the crossing and a discharge pipe to the downstream side of the crossing.

The pump will take all the flow from upstream side of the crossing point. The discharge hose will be directed through a filtering medium to limit siltation or bed disturbance, before being released to the downstream side.

Culvert/Flume Pipe Watercourse Crossing Methodology

In this method, the water flow will be diverted into a culvert or flume pipe to the side of the watercourse. The culvert/flume pipe watercourse crossing will be prepared by stripping the topsoil from the banks and areas adjacent to the river at the crossing point and storing it separately within the working area, at a safe distance away from the watercourse. The bank material and a selection of vegetation will be stored for replacement, after the cable ducts have been laid. A flume pipe bridge will be installed to one side of the watercourse channel. The culvert/flume pipe will be long enough to extend below the haul road to allow safe passage of plant and materials along the cable route.

Suitably sized culvert/flume pipe will be installed at the crossing point. The invert of the culvert/flume pipe will be typically 100mm below the existing watercourse invert, to replicate natural free flow through the channel. The culvert/flume pipe will extend on the upstream and downstream sides of the crossing point for a suitable distance. The culvert/flume pipe will then be bedded and packed or surrounded with soil filled sandbags to create a seal or dam across the watercourse, to prevent scouring and to divert the water flow into the flume pipe. The flume pipe will take all the flow to the downstream side of the crossing point and the ducts will be installed beneath the dry watercourse channel.

Cable Trench Watercourse Installation Method

Once the flume pipe or dam and over-pump method has been installed and sandbags are securely in place, the construction of the cable trench can proceed by excavating through the bed of the watercourse. In the case of the Johnstown North and Johnstown South watercourse crossings, ground investigations indicate a small amount of rock excavation may be required to achieve the required trench depth. The excavated stream bed material will be stored within the working width separately from the bank material. Trench supports may be used to facilitate safe excavation and dewatering of the excavation area will be carried out if required.

Prefabricated cable duct sections will then be installed in the trench and checked to ensure that a minimum cover, typically 1.6m below the top of watercourse bed and the top of the cable ducts. Thicker walled ducts may be used. In some circumstances the ducts may be further protected by installing at a greater depth.

The ducts will be surrounded with concrete and galvanised steel plates with red marker strip fixed to the top of the concrete. Final reinstatement will use the stored river-bed materials with reinforcement mesh included along with yellow marker warning tape.

Bridge or Bottomless Culvert Watercourse Crossing Methodology

Where a temporary bridge structure or bottomless culvert crossing is used for vehicular access along the temporary haul road or permanent Joint Bay access track, the ground adjacent to the watercourse will be stripped of topsoil and stored away from the watercourse for re-use in the reinstatement works. The exposed ground will be levelled before installing the crossing and constructing the haul road over.

An excavator or mobile crane will be used to place the temporary bridge or bottomless culvert.

Kilbride Watercourse Crossing Methodology

To minimise impact to the Kilbride Watercourse crossing and maintain water quality for the aquatic environment, all works within the watercourse, including any bank stabilisation work, will be completed between July and September.

Good practice pollution prevention measures, described in **Chapter 10** *Water*, will be installed to avoid any downstream siltation impacts.

Typical Watercourse Crossing Reinstatement Method

The banks of the temporary watercourse crossings will be reformed to their original profile in accordance with both the National Parks and Wildlife Service (NPWS), Inland Fisheries Ireland (IFI) and the landowners' requirements. The bed materials which had been removed for construction will be reinstated to the original profile. The temporary flume pipe, packing and sand-bags will be removed once the bed materials and bank profile are reinstated, ensuring the correct sequencing of substrate reinstatement.

Final bank reinstatement may require further measures to stabilise the banks and prevent erosion. Geotextiles may be used in conjunction with seeding of an appropriate grass mix. Heavier solutions such as the importation of locally sourced large stones or rocks may also be used. Bank stabilisation works will be discussed with the NPWS/IFI to ensure that suitable materials and methodologies are being used. Any bank protection, where it is required, will be adequately keyed into both the bed and banks. The materials and methods employed will be in keeping with the surrounding environment and will comply with any conditions attached to the planning approval.

The management of stockpiles of material in the vicinity of a watercourse will comply with the requirements specified in the CEMP (**Appendix 6.1**).

6.5.4 Onshore 220kV Substation

6.5.4.1 Pre-Construction Activity

The pre-construction activities are described in **Section 6.5.1** above.

6.5.4.2 Site Enabling Works

In preparation for commencing construction of the substation, access routes, towers and stringing, site enabling works, such as that listed below, will be undertaken.

Setting Out

The substation works will be set out using GPS or total station equipment and site perimeter temporary hoarding, fencing, signage etc. will be erected, as required, to delineate the extent of the works area to provide a safe working area, prevent unauthorised access and protect the surrounding environment.

If the up-to-date pre-construction utility survey check work identifies existing utilities crossing the site, these will be detected on site using an appropriate technique and equipment (such as CAT/GPR equipment) and the location clearly set out prior to any site clearance and excavations, so they can be safely exposed, worked around or diverted.

Site Perimeter

The perimeter of the substation site will be secured by temporary hoarding prior to construction works commencing.

The temporary fence will be located outside the perimeter of all permanent works to ensure the site remains secure during construction.

Clearing the Works Area

The works area will be cleared of any material or items not required for the works. This will include removal of fences and clearance of trees and vegetation outside of the bird breeding season.

Diversion of Any Existing Utilities

At present no utility diversions are required.

If following pre-construction surveys any existing utilities are identified as needing to be diverted, these works will be undertaken either by the Contractor or by the utility owner in accordance with the relevant codes and standards and following agreement with the relevant authorities.

Existing 110kV poles are located within the site, these will remain in-situ and appropriate guarding for working around electrical overhead lines and poles will be erected for both health and safety of personnel but also to protect the electrical infrastructure from damage and disruption.

6.5.4.3 Site Access

Initial access to the substation site will be via the existing access road to the Avoca River Business Park. For that purpose:

- All plant movements will be controlled by a qualified supervisor; works will be zoned by barriers ensuring segregation.
- Temporary signage will be installed at intervals (speed limits, passing places, overhead services, etc). Warning "goal posts" will be provided where overhead services cross the route.
- An additional entrance junction will be constructed for the transmission compound.
- An additional entrance junction will be constructed for the connection compound. The existing entrance will also be maintained to provide access to the connection compound during operation.

To avoid re-work, construction of the new site entrances, including the associated existing Avoca River Business Park access road tie-in works, will be undertaken once the platform and permanent drainage works in the vicinity are complete.

6.5.4.4 Permanent Site Entrance Works

Permanent entrance construction works includes:

- Each of the new proposed connection and transmission compound entrance junctions will be constructed using an appropriate material, typically placed using an excavator and suitably compacted using a vibrating roller.
- All entrances junction will tie-in to the existing Avoca River Business Park access road levels and provide safe sightlines.
- Where required, entrance junction works will be carried out under temporary traffic management (lane closure under traffic signal control), located along the Avoca River Business Park access road.
- Road embankments required for the site entrance junctions will be profiled using an excavator, to provide an appropriate safe angle of repose.
- Drainage will be installed to maintain the existing drainage regime along the Avoca River Park Business Park access road and prevent surface water runoff from the Avoca River Business Park road flowing into the substation site.
- A kerb raft will be constructed with in-situ concrete, and precast concrete kerbs and backing will be installed. Mechanical lifting will be used to lift and place the kerbs.
- Surfacing to roads will be bituminous e.g. asphalt. The equipment used will include an asphalt paving machine, ride-on rollers, floor saw, and planers.
- The surface course will be placed prior to handover to the client on completion of construction, when use of the road for site construction traffic has finished.
- On completion of the final road surface, road markings will be applied to the road surface by a competent Contractor.

- Permanent signage will be installed in and around the site entrances to safely direct drivers to their destination, using weather resistant metal poles, embedded within an in-situ concrete foundation for stability.
- Permanent signage will be installed, prior to the removal of temporary traffic management.
- Permanent entrance gates will be installed to ensure access control.
- Entrance gates will be set back an appropriate distance from the edge of the existing road to allow vehicles to safely access and egress the site.

6.5.4.5 Platform

A level platform of c. 4 hectares in area, on which the substation will be constructed, will be created by bulk filling to bring site levels up to a maximum level of 3.8mOD to provide flood protection in accordance with the Flood Risk Assessment, provide suitable capping to the made ground and facilitate the buried services for the proposed development.

The earthworks to create the substation platform, including those works required for the remediation strategy (capping) will be as follows:

- Most of the substation site is paved with asphalt. This existing asphalt paving will be removed in phases and will be replaced with granular fill as soon as possible to protect the material below and prevent the generation of any windblown dust;
- An area along the northern boundary of the substation site will be excavated to achieve the final platform level;
- Where required, the made ground will be locally excavated for the shallow cable basements and footings of the external electrical infrastructure;
- The made ground will be compacted and levelled to form an even working platform;
- A geotextile will be placed over the entire area;
- Suitably graded imported material will be delivered to site by lorry and stockpiled for use in the substation works. All stockpiles will be adequately protected from erosion as outlined in the CEMP;
- As and when required, delivery lorries, prior to exiting the site and joining the surfaced road, will pass through a wheel wash to remove loose mud and debris from the vehicle;
- A gas drainage layer of appropriately graded granular material will be laid initially with a minimum thickness of 0.3m. The gas collection layer will terminate at a gas venting trench along the site perimeter;
- A geosynthetic clay liner (GCL) which will form a suitable hydraulic barrier, will then be laid by a specialist Contractor. The thickness of this layer is negligible. It is not necessary for the GCL to extend beneath buildings and larger impermeable foundations such as for the transformers. The GCL will be suitable for the proposed use of the site including for traffic movements;

- A granular material drainage layer of 0.3 - 0.5m thickness or a geosynthetic drainage medium having a minimum hydraulic conductivity of $1x10^{-4}$m/s will then be placed on top of the GCL;
- This drainage layer will have perforated filtration pipes which collect the percolated rainfall and route this to the storm water collection system;
- Finally, a finishing layer of varying thickness, comprising appropriately graded fill material, will be placed to raise the site to the maximum platform level of 3.8mOD;
- The composition of the finishing layer will vary across the site based on the requirements at each particular location. It will comprise a granular material to form the piling platform and sub-base layer to any structures. Outside of the building and road footprints, this layer will be topped off with a minimum compacted thickness of 200mm of crushed stone fill material to finished site levels;
- To mitigate the environmental exposure risk to construction workers, dust generation and dermal exposure during site construction works will be controlled by appropriate dust control measures e.g. water sprays and appropriate personal protective equipment (PPE);
- Where required by the detailed design, geotextile or geogrid materials will be used to increase strength of the platform
- The imported material will be placed using excavator and dump trucks, then levelled using a dozer or grader to the required thickness.
- The material will then be compacted by roller in layer thickness defined by the detailed design.
- The surface of the final layer will be graded to avoid ponding of water and to direct surface flow to the site drainage.
- Any made ground, excavated in the course of installing underground services and footings, which is not suitable for reuse on site, or surplus to requirements, will be stockpiled, tested and classified for recovery or disposal. Refer to **Chapter 16** *Resource and Waste Management* for further information.

Figure 6.25 provides a graphic representation of the capping design.

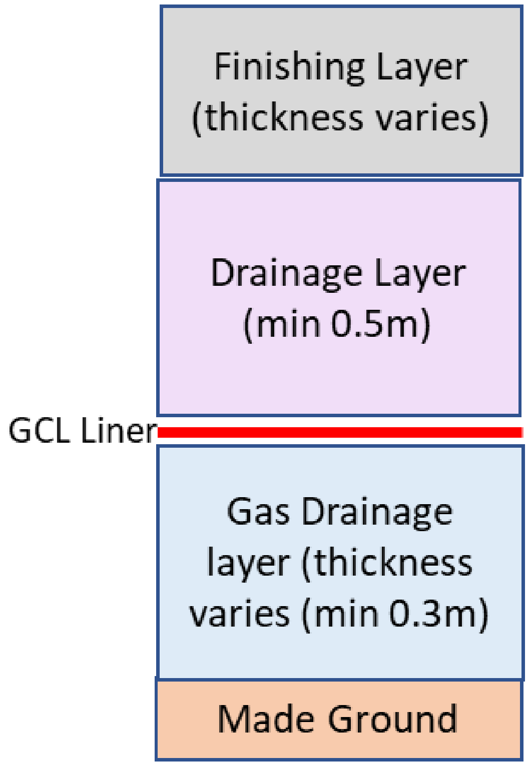


Figure 6.25: Substation Site Remediation Strategy (not to scale)

6.5.4.6 Site Perimeter Fencing

The permanent fencing will be installed following completion of earthworks.

Methodology

The fence will be erected using the following method:

- Marking the line of the fence and then positions of the fence posts.
- Drilling or excavating holes using an excavator with suitable attachment of the fence holes to a depth required to ensure stability of the fence.
- Placing the fence posts and infilling the hole with concrete from a concrete skip attached to an excavator or direct from the concrete delivery lorry if access is available.
- Placing or pouring a concrete cill below the line of the fence.
- Placing fence rails and support members between the fence posts.
- Installing and connecting appropriate earthing.

6.5.4.7 Substation Site Drainage

To control surface water runoff from the site during construction, temporary drainage will be installed in accordance with the CEMP.

The permanent drainage will then be installed after the GCL has been installed during platform construction as described in **Section 6.5.4.5**.

Temporary Drainage

- Measures will be provided to ensure only appropriately treated/clean surface water run-off is discharged from site during construction, which may include settlement ponds/silt interceptors. These will be subject to daily inspection to ensure they remain adequate and effective. The treated discharge will be to the same outfall location as the existing permanent drainage.

Maintenance of Existing Drainage

Carrier Drains, Filter Drains, Manholes

- Maintenance work on the existing drainage network and attenuation pond may be required. This is expected to include de-siltation of existing channels and the attenuation pond and will either be completed by an excavator or hydro-vac. The silt will be removed from site as required, to an appropriately licenced disposal facility.
- Other maintenance work such as water jet cleaning of existing drainage culvert pipes to remove any blockages or debris, replacement of damaged culvert pipes using equivalent size twin walled HDPE or precast concrete pipes and the shoring up of culvert pipe headwalls may also be required.
- Excavation will typically be by an appropriately sized 360° tracked excavator, typically 13 to 25 tonnes. The excavator or a mobile crane may be used to lower and install drainage pipes into trenches and the excavator will be used to backfill material over pipes, as necessary to provide sufficient cover protection.
- Safe access and egress into excavations will be maintained with appropriate edge protection.

Permanent Site Drainage

Storm Water Drainage, Road Gullies

- Below ground drainage will be installed prior to construction of the building superstructure/roof drainage. Final connection will be made when down pipes are installed to ensure accurate positioning.
- Road gullies, filter drains and associated connections will be installed during road construction, prior to trimming sub-base, and surfacing. Gullies will be finished once the binder course has been installed.
- Appropriately sized hydrocarbon interceptors will be installed at strategic locations along the proposed surface water drainage network to prevent any hydrocarbons from leaving the site of the proposed substation.
- The efficiency of the existing pumping arrangement used to control the discharge of surface water to the Avoca River will be confirmed. If found not to meet the minimum requirements of the Flood Risk Assessment, then it will be replaced. The pump will first be safely disconnected from existing infrastructure before an excavator or crane is used to lift out and remove the existing pump, and an appropriate replacement is installed in reverse sequence to the removal.

The old pump will be recycled or disposed of at an appropriately licensed facility.

- On the northern side of the flood defence embankment, a hydrobrake will be installed to the existing attenuation pond outfall, limiting the existing gravity fed outfall to a maximum greenfield discharge rate of the existing facilities and planned developments within Avoca River Business Park. A mix of hand and machine excavating will be used to locate the existing outfall pipe before installation of the hydrobrake to control the gravity fed outflow. In accordance with the manufacturer's instructions, the hydrobrake (and exposed pipe) will then be backfilled, using the excavated material.

6.5.4.8 Substation Flood Defences

In addition to determining a minimum substation platform level, the Flood Risk Assessment confirmed the existing Avoca River Business Park flood defences require improvement works to protect the substation buildings and associated ancillary external equipment, from a mid-range future scenario 1 in 1000 return period event.

The substation site flood defence improvement works will comprise localised raising of the existing flood defence embankment level for a length of up to 75m (See **Figure 6.26**).

In accordance with the Flood Risk Assessment Report, the level of flood defence embankment needs to be at least 6.5mOD. Whilst most of the existing embankment is 6.5mOD or above, one section of approximately 75m in length, to the west of the substation site, will be raised by up to 0.7m, where at its lowest point the embankment was found to be approximately 5.8mOD.

This may be achieved by driving a sheet pile through the centre of the embankment and shoring either side with appropriate earth material, placed and compacted to a stable angle of repose and subsequently finished with rock armour, as protection to prevent scouring and erosion.

Alternatively, the embankment could be raised with an appropriate impermeable or cohesive material, placed and compacted by excavator at a stable angle of repose and, if required, finished with rock armour, to prevent scouring and erosion.

Up to approximately 160m of temporary drainage and an access track will be constructed from the Avoca River Business Park along the northern side of the existing embankment.

The access track will be typically 5m wide, comprising crushed stone over laid onto geotextile membrane to assist with removal.

If required, the access track will be used as a piling platform and may necessitate an additional 3m to be added to the width over the length of embankment to be piled, to facilitate safe access and egress around the piling rig.

A temporary materials storage area, within 20m of the embankment, will be used to facilitate the embankment improvement works.

The Contractor will take all steps reasonably practical to avoid damage to the vegetation and ground that is not part of the permanent work through use separation layers such as geotextile material and load spreaders such as bog mats.

Stands of the non-native invasive species Japanese knotweed and Himalayan Knotweed were recorded growing along the flood defence embankment, in the vicinity of the improvement works. The preferred management option is chemical treatment and further information is provided in **Chapter 12** *Biodiversity*. An Invasive Species Management Plan is included in the CEMP (**Appendix 6.1**). Any works in the area of the embankment will be undertaken in compliance with the Invasive Species Management Plan.

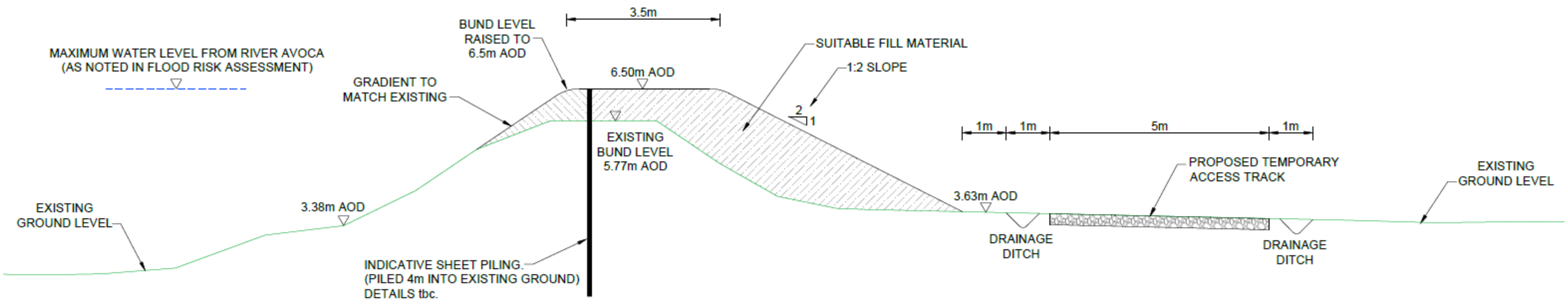


Figure 6.26: Proposed Flood Defence Embankment Improvement Works – Indicative Cross Section

6.5.4.9 Ducts, Troughs and Earthing Grid

Earthing Grid

The substation will have an earthing grid installed typically 600mm below platform level. The methodology for the earthing grid installation is as follows:

- The earthing grid will be progressed in conjunction with drainage/ducts/ troughs and foundations to ensure it is progressed safely and efficiently. As far as possible open excavations will be avoided, and the excavations will be backfilled the same day.
- Open excavations will be suitably protected, if required.
- An excavator will be used to place the earthing grid. If required, imported selected backfill material may also be used to achieve necessary equipment specific earthing ratings..

Ducts and Troughs

Electric and fibre optic cables will be installed in ducts and troughs to provide linkage between different elements of the electrical equipment. The ducts and troughs will be installed as follows:

- A tracked excavator will be used.
- The sequence of installation will be carefully planned with the drainage and foundations installation to ensure that it can be carried out safely and efficiently.
- Ducts and chambers will be installed in shallow excavations. As far as possible, open excavations will be avoided and the excavations will be backfilled the same day. Any open excavations will be protected by barriers.
- Excavations for cable troughs will be benched to avoid the need for additional ground support. The base of the excavation will be prepared typically with mass concrete. Precast concrete trough units will be placed using mechanical lifting, using a tracked excavator. The excavations will be backfilled as soon as possible. Precast covers will be placed progressively to avoid a fall hazard of open troughs. Whenever covers are removed or omitted, edge protection/barriers will be provided.

6.5.4.10 Substation Site Foundations and Slabs

The proposed substation layout consists of various buildings, equipment, towers, roads and hardstanding areas which each require appropriate foundations to support the structural loads and ensure the functionality of the substation site.

The substation will have various reinforced concrete foundations to provide support to buildings and external electrical equipment. The foundations for the buildings and heavier equipment will be supported on displacement piles such as precast driven piles, to transfer loads to a suitable bearing stratum below.

In addition, due to the presence of soft silt / peat layers below the made ground as described in **Chapter 9** *Land and Soils*, the site requires soil improvement piling such as vibro concrete columns.

Driven precast piles, typically 275mm x 275mm or 325mm x 325mm, with a pile length in the order of 12m to 14m are expected to be suitable to support buildings and external electrical equipment.

For soil improvement, approximately 12m long vibro concrete columns will be installed in a triangular or square grid pattern with 2m to 3m spacing.

All piling will be carried out following the placement of the deeper granular gas drainage layer which will serve as a piling mat.

The equipment to be used will include a tracked excavator, mobile crane/crawler crane/tower crane/pedestrian tower crane, piling rigs and concrete pumps. The different concrete works will be undertaken as described below.

Piling

- The displacement piles (such as precast concrete type) will be transported to site, close to the installation position.
- Specialist piling rigs will undertake the installation of the piles to the design depth, which will vary by location and items being supported.
- Hydraulic crushers/mounted excavators will be used to trim the top of the piles and the final trim will be completed using hand-held breakers. This is to allow the top of the pile to be embedded within the reinforced concrete base of the foundation.
- Ground improvement piling (i.e. Vibro concrete columns) will be implemented using a vibrating poker which penetrates the soil by a combination of self-weight, vibrations and air/water jetting and is a relatively quiet installation process. During this process concrete is pumped to create the concrete column.

Excavation and Blinding

- All excavations will be barriered and fenced.
- Excavations will be undertaken by appropriately sized excavator – typically 20 or 25 tonnes for larger structures, and 13 tonnes for smaller structures. Excavations will be benched or battered, and if required temporary stairs will be provided for safe access into excavations. To prevent degradation, formation levels will not be left exposed in poor weather. Blinding concrete will be placed as the excavation progresses over several days, or a protective surcharge will be left for final trim.
- Blinding will be placed using a machine bucket, or crane and skip, or by concrete pump.
- If required, a sheet piled ground support system or other similar trench support system will be used to reduce the extent of excavation or provide support to provide safe space to work for operatives.

The excavation support will be lifted into position by a suitable sized excavator or crane, with installation by a suitable attachment for an excavator or from specialist installation equipment.

Steel Fixing

- Where possible steel reinforcement cages will be prefabricated at ground level and lifted into position by a suitably sized excavator or crane.
- Where fixed in situ, reinforcement will be lifted onto the blinding in bundles and then distributed by operatives tying the reinforcement cage together.
- Reinforcement will be fixed progressively across the blinding, using tying wire and hand tools. Strips of rubber matting will be placed to provide safe access to reduce trip hazard on reinforcement mats. Protection will be provided to starter bars and any projecting steel.

Shuttering and Preparation for Pour

- Prior to erection, shuttering panels (which will be assembled into the formwork, into which the concrete will be placed) will be inspected to ensure they are clean and free from damage. Shutter oil, used to prevent the concrete sticking to the shuttering, will be applied by brush, roller or spraying.
- The panels will be placed using mechanical lift assistance. Kickers and bolt hanging jigs etc. will be completed in timber and plywood.
- Cast-in bolts and ducts will be installed during shutter erection.
- Prior to placement of concrete, the shuttering will be checked, and debris will be blown out or removed by hand.

Placement, Compaction, Finishing and Curing of Concrete

- Concrete will be placed by crane and skip, or by concrete pump, working progressively across the pour in layers, to ensure the working front is kept “live”.
- Concrete will be compacted using portable vibrating poker units.
- Unformed surfaces will be tamped off to the required level, before being floated to the required finish. Some slabs may require a power float finish.
- The finished concrete will be covered to aid curing, typically with polythene covers or sprayed with curing membranes. Protection from rain or cold may be required in adverse weather.
- The covers and protection will remain in place until the concrete has “set” and the temperature of the concrete has reduced to a suitable level. This could be up to 72 hours depending on the dimensions of the volume poured.

Striking Formwork, Finishing Works

- The sequence for striking (removing) formwork will be planned, and temporary propping for stability will be provided.

- Formwork will be stuck when the concrete is sufficiently cured and has gained sufficient strength.
- On striking formwork, defects and tie holes will be made good, and any rubbing up/finishing will be carried out.
- Surface treatments (if any) to surfaces will be applied
- The space between the excavation and the cured concrete will be backfilled as soon as possible.

6.5.4.11 Substation Steel Superstructure Erection, Wall Cladding, Roof Installation, Gutters and Rainwater Pipes

The superstructure of the substation buildings will be structural steel. The structural steel will be erected, once the foundations have been completed. The wall and roof metal cladding will be fixed, making the buildings weather-tight, when the structural steel frames are in place.

Structural Steel Erection

- Equipment to be used will include: 200 or 250 tonne crawler cranes, 120 or 160 tonne mobile cranes and mobile elevated work platforms for access.
- The sequence of operations will be carefully planned, ensuring that the structures are built progressively to maintain access, and ensuring temporary stability. Temporary bracing may be required to ensure stability.
- Large span roof trusses will be assembled at ground level in two parts, which will be connected by an “air splice” to avoid tandem lifts.

Wall Cladding and Roof installation

- Equipment to be used will include mobile cranes, mobile elevated work platform access, scissor lifts, scaffold and tower access, fall arrest netting.
- The sequence of operations will be carefully planned to ensure the installation is progressed safely and efficiently.

Floor Screeds and Finishes

- Floor Screeds and finishes will comprise a pumped floor screed and specialist concrete floor paints.

Internal Walls and Partitions

- Once the building envelope is water-tight, internal walls will be constructed using a metal stud partition system.
- Plywood pattresses will be installed where items are to be fixed to the walls.
- Appropriate fire rating for walls and ceilings will be achieved by use of cement board, cement blocks and/or concrete. Structural steelwork will be treated with an appropriate coating such as intumescent paint, to achieve the require fire rating.

- All walls will be painted.
- First and second fix joinery will be installed.
- Electrical equipment and instrumentation will be installed.
- A specialist subcontractor will install fire stopping which will undergo a very stringent monitoring system.
- Rooms will be fitted with required fixtures and fittings.

6.5.4.12 Substation Electrical Fit Out

Once external foundations are constructed or buildings are weather-tight, the electrical fit out will be undertaken.

The electrical fit out includes the following:

- Delivery and installation of all high voltage equipment, communication mast and lightning arrestor masts.
- Wiring and cabling of all high voltage equipment and protection and control cabinets.
- Commissioning of all newly installed equipment

6.5.4.13 Substation Site Finishes and Surfacing

When site construction traffic is no longer a risk to finished surfaces and prior to the completion of the development, road surfacing (access roads to substation platforms) will be completed, permanent site signage will be erected, unpaved areas within the substation will be surfaced with stone chippings.

Road Surfacing

- Top surface of the bituminous binder layer will be thoroughly cleaned, and tack coat will be applied to the binder layer, prior to placing the surface course by the surfacing Contractor.
- Surface course material will be delivered by lorry, placed using asphalt paving plant and then be compacted by roller.

Lining and Signage

- Road markings will be applied as soon as possible after the surface course has been placed.
- Permanent Road Signage will be installed, fixed either to fences or buildings, or mounted on galvanised steel poles, which are embedded in a concrete mass footing in the ground.

Substation Surfacing “chippings”

- The sub-base will be placed as structures are completed and backfilled.
- When areas are no longer subject to site traffic, the sub-base will be trimmed and sub-station surfacing – chippings – will be placed and compacted.

6.5.5 Connection to the National Electricity Transmission Network (NETN)

The proposed double circuit angle towers required for the connection to the NETN will be constructed as galvanised steel lattice towers, which are the standard type used for the construction of double circuit 220kV overhead lines in Ireland.

Figure 6.27 shows the working areas relating to the construction of the NETN connection.

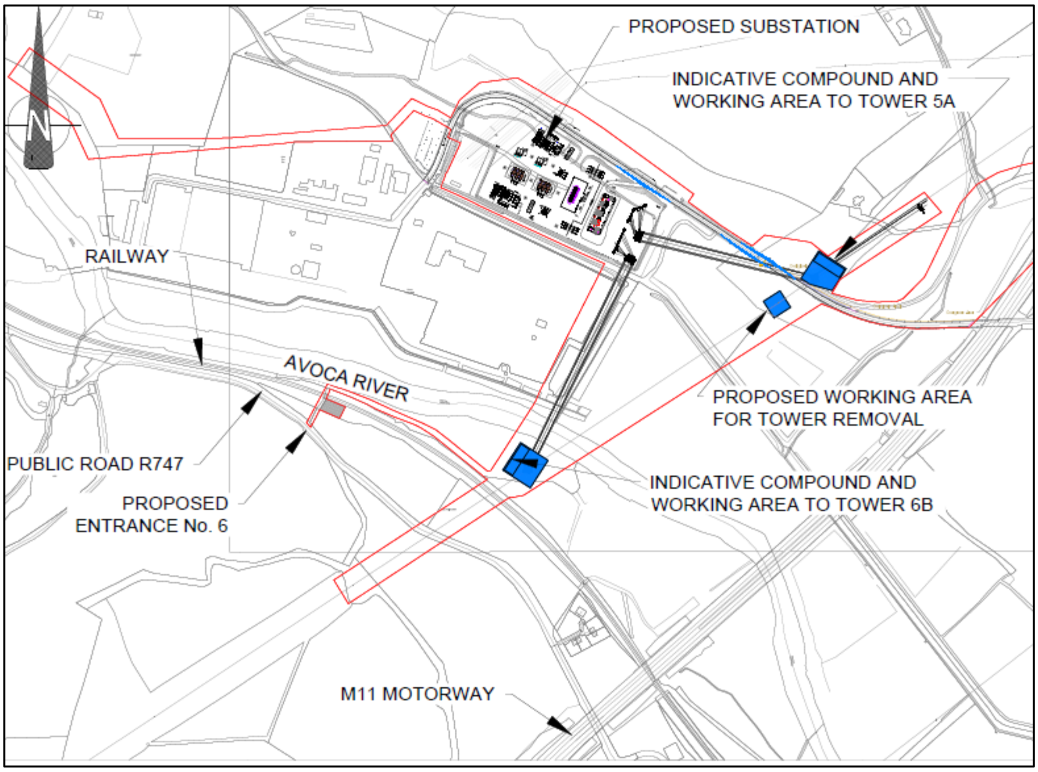


Figure 6.27: NETN Connection Working Areas

6.5.5.1 Pre-Construction Activity

The pre-construction activities are described in **Section 6.5.1** above.

Outage Scheduling

The works involve the permanent diversion of a short length of the existing 220kV overhead line between Arklow substation and Lodgewood substation. To facilitate this diversion, EirGrid will grant a pre-scheduled, defined duration, outage of the overhead line. This outage will be planned by EirGrid to ensure grid stability is maintained. The bases of the two new towers will likely be constructed while the overhead line is live.

6.5.5.2 Site Enabling Works

In preparation for commencing construction of access routes, towers and stringing, site enabling works, such as that listed below, will be undertaken.

Clearing the Works Area

This will include removal of fences, cutting back of trees and vegetation. These works will be undertaken outside of the March to August bird breeding season.

All vegetation adjacent to the overhead line, which has the potential to fall onto the overhead line, will be cut or trimmed to ensure safety clearances. The extent of trimming will depend on distance from the proposed overhead line and will involve a scalloping or profiling effect which will minimise the effect on vegetation.

For the purposes of assessment (reasonable worst case), a corridor (twice the height of the maximum trees/vegetation plus the width of the line – which for a standard 220kV line is twice the tree height + 16m) will be cleared. This is to ensure that trees cannot fall onto the overhead conductors or towers.

As a minimum, tree clearances will be in accordance with the requirements of Table 5.4.4 of Irish NNA EN 50341-3-11:2001. The extent of vegetation clearance will be location specific and subject to survey in advance of construction together with a final check immediately prior to works commencing.

There will be a loss of localised vegetation to the tower sites including tree, shrub and hedge removal to allow for the construction of towers for supporting the overhead lines.

Provision of temporary access routes to the towers may also result in loss of localised vegetation.

A corridor of 4m width directly under the overhead lines and support structures must be kept totally clear for maintenance access. Directly outside the permanent 4m corridor, trees/vegetation will be reinstated once the works have been completed. However the trees/vegetation will be kept to a maximum height of 3m above ground level. This 3m maximum height requirement applies along the full corridor.

A competent Contractor will undertake the cutting of trees to ensure required safety clearances are maintained.

Levelling of the Tower Foundation Area

The towers are designed such that a difference in ground level can be accommodated from one side of the tower to the other, hence minimising the extent of local disturbance.

For a difference in ground level across the foundation of less than 1m, this will be dealt with by locally re-grading of the ground profile.

For a difference in level of greater than 1m, leg extenders will be used between the tower foundation stub and the tower body on the lower side. The elevation of the top of the tower will not increase.

On completion of the tower and OHL work, the ground level around the excavated area will be assimilated into existing landscape contours as much as is feasible, avoiding sharp changes of gradients within the constraints of the working area and achieving the objective of minimising land use impacts.

Diversion of Field Drains

Where existing drainage is present at the location of a tower foundation, typically this drainage will be removed from the tower foundation construction area. New drainage trenches will be dug to bypass the tower foundations on one or as many sides of the foundations as required, or alternatively a number of drains will be replaced by a larger single drain, which bisects the tower foundation.

Delineation of Any On-site Working Area

Temporary fencing, goal post/restricted height barrier arrangements and warning signs will be erected as required to provide a safe working area for operatives, landowners and third parties.

Diversion of Any Existing Utilities

No diversion of utilities is anticipated. However, if existing utilities need to be diverted, this will be undertaken in accordance with the utility standards, either by the Contractor or by the utility owner.

Erection of Temporary Guarding Positions

Where the overhead line is to be strung over roads and railway tracks, temporary protective structures will be erected prior to the commencement of stringing. These temporary structures will be in the form of suitable guard poles.

The protective structures will be positioned on both sides of a crossing and will be temporary in nature, for the duration of the stringing operation. They will help to minimise disruption to road and rail users.

6.5.5.3 Temporary Access Routes to Working Areas

Temporary access routes, capable of accommodating construction plant, construction materials and personnel, are required for the construction of each tower, the installation of the overhead line and the setting up of temporary guarding positions.

Temporary access routes for the proposed development are indicated in **Figure 6.1** and are described below.

Access routes for these activities will minimise disruption and use existing access routes and points as far as possible:

Tower 5A Access

- Access to the Tower 5A working area will be from the existing Avoca River Business Park access road using an existing field entrance and via a new access track, approximately 100m long and 4.5m wide.
- Overhead line installation (stringing) equipment will be accessed from the working area, the Avoca River Business Park access road and adjacent lands using a 4 x 4 and/or a low ground pressure excavator to minimise any disruption. Consideration will be given to the manual pulling out of the new conductor as this may speed up the operation and reduce the requirement of stringing equipment.
- Access to guarding activities: The guarding positions will be accessed from the working area, the Avoca River Business Park access road and adjacent lands. This will be by 4 x 4 vehicle and/or a low ground pressure excavator to minimise any disruption. Two trips will be required from the working area, one for erection, and one for disassembly.

Tower 6B Access

- Access to the Tower 6B working area will be from the R747 (Vale Road) on the west side of the M11 motorway:
    - An access route is available via an existing gated access track to the north west of the existing Arklow to Lodgewood 220kV OHL. The track continues for approximately 350m before reaching the Working Area. This route requires traversing beneath a rail bridge for Arklow to Gorey railway line and is suitable for 4 x 4s and other low sided vehicles, plant and pedestrians.
    - A mobile crane may be used to lift other equipment and materials, which would be unsuitable for the proposed Tower 6B access route, over the Arklow to Gorey railway line (in consultation with Irish Rail) to the existing access track. To minimise disruption to rail services, any such lifting over the Arklow to Gorey railway will likely occur at night.
- The working area is adjacent to the new proposed tower location and existing access track, and to the existing adjacent tower, which is to be decommissioned and removed.
- Overhead line (stringing) equipment will be accessed from the working area and adjacent lands using 4 x 4 and/or a low ground pressure excavator to minimise any disruption.
- The guarding positions will be accessed from the working area and adjacent lands. This will be by 4 x 4 vehicle and/or a low ground pressure excavator to minimise any disruption. Two trips will be required from the working area, one for erection, and one for disassembly.

Where a crane is required to lift other plant, equipment or materials over railway infrastructure, temporary laydown areas will be required to be cleared of vegetation and crushed stone will be laid onto geosynthetic reinforcing material to form a temporary crane hardstand if required.

The maximum hardstand dimensions for the mobile crane hard stand are expected to be c. 30m x 20m. The hardstand will be formed by removing the topsoil and subsoil to create a level sub-base for the platform. Separate stockpiles of vegetated topsoil and subsoil materials will be created adjacent to the cleared area. The crushed stone will be placed, using a tracked excavator. The crushed stone will then be compacted using a roller.

Alternatively (if the weather and the Contractor's equipment allow) and if the task specific lifting plan and ground conditions permit, crane outrigger plates will be sufficient to disperse loads, and a crushed stone hardstand will not be required.

Vehicular Access Route

A range of construction types for access routes are available, which include:

- Use of existing surfaced roads or farm tracks
- Use of existing farm tracks, with improvements if required by track condition
- Installation of temporary metal or plastic roadway panels (such as Trakway)
- Installation of temporary stone track, with geotextile and geogrid as required
- Use of low ground bearing pressure vehicles across original ground

While all of these potential access route options have been assessed in the EIAR, the method used for each route will be selected at construction stage, in consultation with the Contractor. Weather conditions during the period of works may also influence the decision.

Tower 6 Access

Access to the Tower 6 working area will be via the existing Avoca River Business Park access road using an existing field entrance. Access to the tower will be via an existing track (see **Figure 6.1**) with some vegetation clearance required directly adjacent to the tower.

As the tower is located on EPA licensed land, to minimise disruption, the access route will be used in its current state with the addition of temporary metal or plastic roadway panels if required. Temporary traffic management may be required on the L6179 Kilbride Road to accommodate crane access to the tower from the road.

6.5.5.4 Foundations for New 220kV Towers

Methodology

The following methodology will be used by the Contractor to install each new 220kV tower foundation:

- Location of the foundations will be checked for underground services such as cables, water pipes etc.;
- A working area of approximately 50m x 50m will prepared and secured following the same methodology as for the landfall temporary compounds, described in **Section 6.5.2.2** above;

- The foundation excavation will be set out and pegged;
- This may require excavation of existing ditches or field drains to allow clear pegging of each individual leg footing for excavation;
- Foundations will be constructed;
- The foundations will consist of a reinforced concrete block at each tower leg, which will be founded on a suitable bearing stratum and of sufficient size to anchor the tower in position. Depth can range from 2m to 3.5m, with plan size ranging from 2m x 2m to 9m x 9m;
- Where a standard foundation is not suitable, the foundation could be:
    - Larger foundation in the case of weak soils;
    - Pile foundations in the case of large depth to suitable bearing stratum; or
    - Reduced foundation in the case of shallow rock.
- Each of the tower stubs (lower part of tower leg, of which there will be four in total) will be embedded into or connected to the foundation;
- A template frame will be used to correctly position and orientate the tower stubs relative to each other;
- For a standard foundation, for each of the four tower stubs an excavation will be undertaken using a tracked excavator to reach a suitable bearing stratum at the required formation level;
- The depth of excavation will be checked by the on-site foreman;
- If groundwater is present in the excavation, it will be pumped out prior to any concrete being poured into the foundation. The water will be discharged at the surface a suitable distance downhill from the excavation. If suspended solids are present in the groundwater, a system such as a settlement pond, proprietary Siltbuster or other technique will be used to filter the groundwater before discharge;
- Concrete trucks will bring the required volume of concrete to site, and, depending on site topography and ground condition, the concrete will be transferred to the excavation by:
    - Lorry;
    - Wheeled dumper;
    - Tracked excavator with concrete skip; and / or
    - Concrete pump.
- In areas of poor ground or high water table, it may be necessary to use temporary works such as sheet piles to support the excavation walls;
- After this, the remaining part of the foundation, the concrete shear block or neck will be formed using shuttering;
- During each pour, the concrete will be vibrated thoroughly using a vibrating poker. In the event that sheet piles are used, these will be removed (pulled) at this stage. Care will be taken not to damage the base members of the tower. The shear block shuttering will be removed at this stage;

- The tower foundations will be backfilled one leg at a time with the excavated material. The backfill will be placed and compacted in layers. All dimensions will be checked following the backfilling process. If the excavated material is deemed unsuitable for backfilling, imported fill material will be used and also compacted in layers. When the base construction crew leave site, they will remove all surplus materials from the site including all unused excavated fill;
- Once the concrete in the tower base is completed and fully set (usually after at least seven days) it will be ready to receive the tower body sections, which will be assembled in an area near the foundation site ready to be lifted and bolted into place;

Construction Equipment Required

The following construction equipment will be required to construct the tower foundations.

- 4 x 4 vehicle;
- Concrete placing and finishing equipment;
- Tractor and trailer;
- Water pump;
- Wheeled dumper or track dumper (typically 6 to 8 tonnes);
- Timber/steel or other shuttering boxes;
- 360˚ tracked excavator (typically 13 tonne and 22 tonne for rock breaking);
- Transit van;
- Chains, vibrating pokers and other small tools;
- Survey equipment; and
- Concrete delivery lorry travelling from suitable nearby concrete production facility.

Duration of Works and Crew Size

The duration of the foundation works is expected to be 10 days. However, if the foundation is non-standard the duration will be up to 15 days. The crew size will be four to six workers.

6.5.5.5 Erection of Tower Body

Methodology

To erect the tower body, which is the above ground element of the tower, the following methodology will be used:

- The pre-cut, drilled and protected steel sections and bolts will be delivered to the tower location by flat-bed lorry or, if necessary, by helicopter;

- Portions of the tower body will be preassembled from the steel sections and bolted together at a location beside the foundation. Portion sizes will be dictated by weight and method of lifting;
- Assembled tower portions will be lifted into position and bolted together; and
- The assembled tower portions would normally be lifted into place using a suitably sized crane if the ground is suitable. Alternatively, a derrick/gin pole and winch/tractor will be used to lift the semi-assembled portions of tower into place, or if necessary, a helicopter where access is particularly constrained.

Construction Equipment Required

The following construction equipment will be used to construct a tower body.

- 4 x 4 vehicle;
- Winch/hoist;
- Tractor and trailer;
- Mobile crane (size depends on weight of lift, along with vertical and horizontal distance of the lift);
- Derrick/gin pole and winch/tractor or possibly a helicopter;
- Teleporter;
- Transit van; and
- Chains and other small tools.

Duration of Works and Crew Size

The expected duration of the tower body erection works will be five days. However, adverse wind condition or electric storms may cause delay. The crew size will be seven workers.

6.5.5.6 Overhead Line Stringing

Methodology

Stringing of overhead lines refers to the installation of phase conductors and earth wires on the supporting tower structures.

The conductor installation will follow a staged process of:

- Erecting temporary guards such as guard poles at obstacles including roads and railways;
- Pulling of a pilot line (nylon rope), which is normally carried by hand into the stringing wheels, across the gap between the towers to be connected. A drone or boat will be used to carry the pilot line across the Avoca River (no works are required for landing/berthing of drone or boat);
- Using the pilot line to pull a heavier pilot line (steel rope) across the gap;

- Using the heavier pilot line and specifically designed “puller – tensioner” machines to pull the conductors from the drum stands into position;
- One end of the conductor, which has just been pulled into position, is terminated on the appropriate tension fittings and insulator assemblies;
- The other end of the conductor is then placed in temporary clamps called “come-alongs” which take the conductor tension; and
- The conductor is then cut from the puller-tensioner and the conductor is sagged using a chain hoist.

Consideration will be given to pulling out the conductor manually, however the main advantages with this method are:

- The conductor is protected from surface damage; and
- Major obstacles such as road and rail crossings can be completed without the need for major disruption.

Where a string crosses a main road, and the extent of guarding structure required becomes excessive, catenary stringing can be used as an alternative protection method. Catenary stringing is a secondary safety support system, such that if the conductor or pilot line breaks it can only fall a short distance determined by the catenary design.

The catenary support system consists of a high strength, low elasticity rope, which once installed hangs above the profile of the wire being strung and provides support via a series of roller wheels. The method to deploy the catenary system is:

- The catenary rope is anchored to a tower or ground anchor at one side;
- A series of rollers are placed on the previously installed pilot line, with the catenary rope attached to these rollers at defined spacings. As the catenary rope has less tension than the pilot line, it hangs below it;
- The spacing of the rollers is calculated so that the sag in the un-tensioned catenary rope does not enter the exclusion zone of the obstruction or feature below;
- The free end of the catenary rope is attached to a robot, which is hanging on the pilot line;
- The robot travels across the pilot line to the next stringing support point, pulling the catenary rope behind it, with the roller units supporting the catenary rope;
- The free end of the catenary rope is removed from the robot and fixed to the next tower or ground anchor;
- The catenary rope is tensioned. In doing so, the catenary rope is pulled into a profile that now positions it above the pilot line. As the roller wheels are double wheels, the 180^0 reversal of orientation means the bottom wheel becomes the top wheel;
- The tensioned and anchored catenary rope is now supporting the pilot line via the series of rollers hanging from the catenary rope;

- The previously calculated spacing of the rollers is also checked so that if the pilot line or conductor wire were to fail during deployment, the sag would be minimal and so avoid conflict with the obstruction or feature below;
- The heavier pilot line and then conductor wire are pulled across as previously described, with catenary system providing temporary support and maintaining the exclusion area; and
- Once the conductor wire is installed and fixed in position, the catenary system is removed in reverse order to the previous steps.

In accordance with standard installation practice, for stringing of the overhead line between the existing Tower 5 and the new Tower 5A and also between the existing Tower 8 and the new Tower 6B, the following will be the sequence of works:

- The new double circuit angle towers, except for the bases which will have been constructed earlier, will be erected while the Arklow to Lodgewood 220kV OHL is switched out. Each of the existing OHL conductors will still be in place between the existing towers. Care will be taken when assembling the new towers not to damage the OHL conductors or shield wire;
- Come-along clamps/slings and chain hoists will be used to transfer each OHL conductor across to the correct tower arm on the new tower while the conductor is slipped from its fixing on the old towers. Once in place and the correct sag has been obtained, the conductor will be fixed to its respective fixing point on the tower arm via insulators. This will be repeated for each of the OHL conductors and the shield wire.

Construction Equipment Required

The following equipment will be during line stringing.

- 4 x 4 vehicles;
- Puller – tensioners;
- Mobile aerial platform;
- Teleporters;
- Drum stands;
- Drum carriers;
- Stringing wheels;
- Conductor drums;
- Compressor & head;
- Transit vans;
- Chains, hoists/winch, slings and other small tools; and
- Conflict guarding.

<u>Duration of Works and Crew Size</u>

The average duration of stringing works is typically one week per straight. This figure is approximately the same for all straights, regardless of length, as the most time-consuming aspect is the movement and setup of the stringing equipment. Stringing crews are typically quite large and could have as many as 15 workers.

The process is shown in **Figure 6.28.**

Figure 6.28: Typical Setup for Overhead Line Stringing (Source: SPL)

6.5.5.7 Decommissioning of Existing Structures

The decommissioning of the existing Towers 6 and 7 will be completed by ESB Networks in line with the ESB's standard policy and procedures.

For the OHL conductors and towers that are to be decommissioned, the following stages will occur:

- De-stringing will be carried out as the reverse process of overhead line stringing operations. Winch and tensioner positions will be established to reel in the conductors.
- Decommissioned conductors will be taken to an appropriately licensed facility for recycling or reuse.
- Towers will generally be dismantled in sections.
- The tower steel will be bundled on site and removed by tractor and trailer and sent for recycling.

- Insulator strings will be taken for disposal at an appropriately licensed waste facility.
- The foundations of the existing Tower 6 within the licensed landfill will be left in situ to avoid any disturbance of lands within this area.
- The existing Tower 7 foundations (which is outside the existing licensed area) will be broken down to a depth of approximately 1m below ground level and the stubs cut off. Waste material will be segregated on site and will be removed from site using a permitted waste carrier for recycling or disposal at a licensed site. The ground will then be reinstated and landscaped to match the surrounding ground.

6.5.5.8 Reinstatement

Once all works are complete, the access route and the working areas around the towers and overhead line stringing areas will be reinstated as close as possible to their original condition.

This work will be carried out by a specialised agricultural Contractor and will be carried out in accordance with the relevant good practice and in consultation with the individual landowner.

6.6 Commissioning Activities

Commissioning of all electrical equipment will be required to confirm the operational readiness of the equipment and to demonstrate the equipment meets the functional and operational specifications.

The overall commissioning duration for all elements of the proposed development will be approximately 6 months.

6.6.1 Landfall

The landfall circuits will be commissioned in accordance with the relevant industry standards and specifications. Equipment for this may be required to be transported via a low loader vehicle due to the size of the testing equipment. The test equipment will be placed in the landfall HDD compound.

6.6.2 Connection from Landfall to the Onshore 220kV Substation

The onshore export circuits will be commissioned in accordance with the relevant industry standards and specifications.

Testing will be completed at each joint bay.

High voltage and partial discharge testing will be required at the substation and the landfall. Equipment for this may be required to be transported via a low loader vehicle due to the size of the testing equipment. The test equipment will be placed within the substation construction compound.

6.6.3 Onshore 220kV Substation

The onshore 220kV substation will be commissioned in accordance with the relevant industry standards and specifications.

Commissioning of the substation will involve the following activities:

- Pre-commissioning;
- Sub-system testing;
- HV energisation; and
- Performance testing.

Each piece of auxiliary equipment, STATCOMs, including 33kV switchgear and transformer, harmonic filters, voltage regulation devices, house transformer, and diesel generators will be commissioned separately and in accordance with the respective industry standard and specification.

The connection compound and transmission compound will include 220kV GIS switchgear, control and protection panels, LV distribution equipment, batteries and UPS supplies. Again, all elements will be commissioned separately and in accordance with the respective industry standard and specification.

The onshore 220kV substation will be pre-commissioned by the Developer. The final steps of commissioning including HV energisation will be undertaken between the Developer and ESB Networks, in their role as Transmission Asset Owner, and in coordination with EirGrid as Transmission System Operator.

6.6.4 Connection from Substation to Transmission Network

The Developer will pre-commission the overhead line loop-in connection from the existing overhead line to the transmission compound.

The pre-commissioning will involve impedance testing of the overhead line. Test equipment required for this is lightweight and portable in nature.

Once pre-commissioned, ESB Networks will fully commission the new overhead line loop-in connection in accordance with standard ESB Networks' policies and procedures.

6.7 Delivery Routes

Access to the construction compounds and working areas will be from the local and regional road network (See **Figure 6.1**).

Delivery routes for equipment and materials including cable drums will be determined upon selection of supplier, which will determine their manufacturing location. With the M11 in close proximity to the site, equipment and materials will be easily transported to site via the public road network by standard road vehicles.

Transport and delivery routes are addressed further in **Chapter 13** *Traffic and Transportation*.

6.8 Site Management

6.8.1 Employment

The project is anticipated to provided employment to approximately 165 people during the construction phase.

A breakdown of the number of workers on site for the landfall, cable route, substation and NETN connection during the construction phase is presented in **Table 6.7**.

Table 6.7: Estimate of workforce required for the various stage of installation

Project Stage	Estimated No. of People
Landfall Construction	10
Landfall Decommissioning	4
Cable route civil works	50
Cable installation and jointing	40
Cable testing and commissioning	15
Reinstatement	5
Substation earthworks, services installation, and erection of buildings and equipment, fit out and finishes	Up to 30
Substation Electrical Fit-Out	30
NETN Connection – Foundation Works	6
NETN Connection – Tower Installation	7
NETN Connection – Stringing of OHL	15
HDD M11 Crossing	10
HDD R772 Crossing	10

There is some overlap in terms of workforce numbers in the table above, as some personnel will (programme dependent) be involved in more than one of the stages.

Decommissioning of the landfall, cable and substation, at the end of the operational life of the proposed development, would take place over a c. 6 month duration.

Table 6.8: Estimate of workforce required for decommissioning

Project Stage	Estimated No. of People
Landfall	4
Cable route	4
Substation	Up to 25

6.8.2 Working Hours

The timing of construction activities, core working hours and the rate of progress of construction works are a balance between efficiency of construction and minimising nuisance and significant effects.

The normal construction working hours for the proposed development will be 7am – 7pm: Monday to Saturday. These hours correspond to the current construction programme.

The permissible noise levels are detailed in **Chapter 11** *Noise and Vibration* where 'daytime' noise limits are defined as 7am to 7pm, and lower permissible noise levels are stipulated outside these hours.

All rock breaking/fracturing activities, pile driving and breaking out of existing concrete will be undertaken during normal working hours. The removal of waste material off site by road and regular deliveries to site will, where appropriate, be generally confined to outside of peak traffic hours.

Subject to further construction planning and resourcing, certain activities may occur 24-hours a day, 7-days a week for the duration and this has been taken as a worst case for the purpose of the assessment of impacts in this EIAR.

Deliveries to site will, where appropriate, be generally confined to outside of peak traffic hours to minimise the disruption to other road users, with all such traffic movements carried out under the conditions of the relevant permits from An Garda Síochána.

It is expected that the HDD works will operate 24 hours per day, seven days per week. Commissioning and pre-commissioning may also take place 24 hours per day, seven days per week.

In order to undertake the works on Tower 6B as described in **Section 6.5.5.3**, equipment will need to be lifted across the Arklow to Gorey railway line. Night-time working will take place for this activity for Health and Safety and Irish Rail compliance purposes.

It may be necessary, due, for example, to weather constraints, specialist subcontractor availability or the nature of the activity, to undertake certain other activities outside of the normal construction working hours. Any other construction outside of the normal construction working hours will be agreed in advance with Wicklow County Council. The scheduling of such works will have regard to nearby sensitive receptors, who will be notified in advance.

6.8.3 Hoarding and Fencing

A site boundary in the form of temporary hoarding will be established around each of the temporary construction compounds with hoarding or fencing used around each of the working areas. These will be established before any significant construction activity commences, as these construction sites can be a unsafe environment for those that have not received the proper training and are unfamiliar with construction operations.

For the temporary construction compounds (HDD, substation and temporary cable construction compounds), the hoarding will be generally be a minimum 2m high in order to provide a secure boundary to prevent unauthorised access and delineate the works. The site hoarding will also perform an important function in relation to minimising nuisance and effects including:

- Noise emissions (by providing a buffer);
- Visual impact (by screening the working areas, plant and equipment); and
- Dust minimisation (by providing a buffer).

The hoarding/fencing will be typical of that used at most construction sites. Mounting posts will be erected by using a mini-digger and the posts will be set in concrete.

Other working areas and site access routes will typically use a mix of fencing and other appropriate safety barriers, as these types can be more readily re-configured and re-used between working areas as the construction activities progress.

6.8.4 Services and Site Lighting

Temporary site services will be installed in parallel with the rearrangement and diversion of existing utilities, where relevant. Ecocabins will be used to promote the most efficient use of resources for the temporary construction facilities for the proposed development.

Electricity

Where possible, the working areas will be powered by existing mains supplies, but if not available, via a diesel generator, where power is required. Typically, one 20,000 litre tanker for the delivery of diesel to the site compounds will be required each week.

Drinking Water

Potable water will be supplied from Irish Water mains where available. If not, potable water will be either transported via tanker to site or via large, recyclable bottles. Typically, one delivery each week will be required for the provision of potable water.

Grey Water

Grey water for non-drinking purposes (construction and toilets) will be sourced via rainfall collection or transported via tanker to site.

Wastewater

Wastewater will be collected and stored on site in holding tanks, which will be emptied on a regular basis (typically bi-weekly) by licensed Contractors and disposed of appropriately.

Internet and Telephone

Connection to the internet (which will also provide telephone services) will be via satellite or microwave dish by a specialist third party Contractor.

Lighting

Site lighting will typically be provided by tower mounted temporary portable construction floodlights that will be cowled and angled downwards to minimise spillage to surrounding properties.

Wheel wash

Where a wheel wash is installed, this will be located on impermeable surface, and water will be passed through a silt buster or other appropriate surface water management mechanism.

Alternatively, a “dry” wheel wash will be used, which relies on mechanical vibration of the vehicle wheels and chassis to loosen and remove mud and debris.

6.8.5 Deliveries to Site

Deliveries of materials will be planned and programmed to ensure that the materials are delivered only as they are required at the working areas. Storage of material will primarily be at the substation compound or at the temporary cable construction compound, depending on the type of material.

Works requiring multiple vehicle deliveries, such as concrete pours, will be planned so as to ensure there will be no queuing on the public roadways around the working areas.

Deliveries will, where appropriate, be limited to outside of peak traffic hours.

6.8.6 Security

Security for the works will be provided by a combination of:

- Secured work areas with fencing, with gate man and barrier controlling access to the fenced areas, at the substation site.
- Roving security patrol outside normal working hours
- CCTV

6.8.7 Community Liaison During Construction

The Developer recognises the importance of effective community liaison in order to reduce nuisance to residents and the general public during the works, to ensure public safety and welfare, and to help ensure the smooth running of construction activities. The Developer has prepared a Community Liaison Plan, which is included in the CEMP (See **Appendix 6.1**). The purpose of the plan is to ensure good relations with the community, which will be done by:

- Providing information for the public during the construction phase, (particularly nearby sensitive receptors);
- Providing the correct points of contact and being responsive; and
- Ensuring good housekeeping in all aspects of the operations.

A significant part of the plan is the ‘good neighbour’ policy. Key aspects of this policy include:

- Early implementation of the policy i.e. from the commencement of construction;
- Reduction of nuisance factors;
- Maintaining access to neighbouring premises;
- Clear and concise information; and
- Undertaking timely liaison with stakeholders.

With regard to liaison, the Contractor will be required to comply with the plan and develop it further with additional information, which will include providing the details of how the local community, road users and affected residents will be notified in advance of the scheduling of major works, the temporary traffic diversions and the progress of the construction works.

The Contractor’s additional details will include the following:

- Contractor’s community relations policy;
- Personnel nominated to manage public relations;
- A methodology for processing observations, queries and complaints from the general public, relevant authorities, the media and emergency services; and
- The strategy for project-wide liaison with all relevant parties.

A liaison manager will be responsible for managing such tasks as the following:

- Briefing neighbours on progress and issues as necessary;
- Liaison with Wicklow County Council and emergency services as appropriate;
- Liaison with local Gardaí, particularly in relation to traffic movements and abnormal load permits where necessary; and
- Contact details for the liaison manager will be posted on all construction site notice boards and on any other information or correspondence, which may be distributed from time to time.

6.8.8 Waste Management

A Construction Waste Management Plan (CWMP) has been prepared and is included in the CEMP (See **Appendix 6.1**). The Contractor will further develop this CWMP, prior to construction.

The CWMP addresses:

- Waste Manager
- Waste Types
- Tracking and documentation procedures for waste sent off site.

A significant proportion of the surplus excavated material from the landfall site and cable route will consist of uncontaminated soil, stone and naturally occurring material which may be reused in its natural state within the site. This reuse is certain and as such the material is not deemed to be a waste in accordance with Article 2 of the Waste Framework Directive (2008/98/EC) (EC, 2008) and Section 3 (c) of the Waste Management Act 1996 (as amended). **Chapter 16** *Resource and Waste Management* provides further information.

Off-site re-use options for surplus clean and inert excavated material include reuse as a by-product on other construction sites subject to Article 27 of the European Communities (Waste Directive) Regulations 2011, S.I. No. 126 of 2011 (as substituted by Article 15 of S.I. No. 323/2020 - European Union (Waste Directive) Regulations 2020) notification to the EPA, or recovery at suitable authorised waste facilities i.e. facilities which have been granted a Certificate of Registration, Waste Facility Permit or EPA licensed soil recovery facilities in accordance with the Waste Management Acts 1996-2016.

On the substation site, made ground, excavated in the course of installing footings and underground services, which is not suitable for reuse on site, or surplus to requirements, will be stockpiled, tested and classified for recovery or disposal. Refer to **Chapter 16** *Resource and Waste Management* for further information.

In the unlikely event that asbestos is uncovered, the asbestos containing material will be double-bagged, stored, collected and removed from site by a competent Contractor and disposed of in accordance with the relevant procedures and legislation.

6.9 Materials Management

6.9.1 Excavated Materials

Excavated material as part of the construction works will generally consist of:

- Rock, at the landfall compound;
- Topsoil and subsoil; and
- Made ground.

Natural ground, where it can be shown to fulfil the requirements of the project Earthworks Specification, will be reused within the site. The excavated material will be shown to comply with the requirements of Class 1 or Class 2 general fill as defined in Transport Infrastructure Ireland (TII) publication titled 'Specification for Road Works Series 600 - Earthworks (including Erratum No. 1, dated June 2013)'.

Any excavated contaminated material will be removed and disposed of or recovered at a suitably licensed or permitted site in accordance with the current Irish waste management legislation as described in **Section 6.8.8**.

Table 6.9: Earthworks Balance Table

Earthworks Description	**Volume (m^3)**
Landfall Option 1 (Worst Case – HDD Compound in Southern Field, Cable Construction Compound in Northern Field)	
Volume of material to be reused:	
Topsoil	6,700
Subsurface material (from platform earthworks)	19,000
Volume of material to be disposed of or recovered:	
Topsoil and Subsurface material (from platform earthworks)	0
HDD Bore Material	1,100
Imported crushed stone (for compound bases and 1no. access tracks)	13,500
Cable Route Construction Corridor	
Volume of material to be reused:	
Topsoil	42,000
Subsoil (trench backfill as per typical detail) & joint bay excavation	17,200
Volume of material to be disposed of or recovered:	
Topsoil and Subsurface material (excavation for CL1039 part of trench) & joint bay excavation	0

Earthworks Description	**Volume (m^3)**
Asphalt/pavement build up (remove pavement where cable is laid in road)	900
Haul roads build up along corridor	11,000
Cable Route Access Tracks	
Volume of material to be reused:	
Topsoil	4,500
Volume of material to be disposed of or recovered:	
Imported crushed stone (for access tracks)	0
R772 HDD Platforms	
Volume of material to be reused:	
Topsoil	2,000
Volume of material to be disposed of or recovered:	
Imported crushed stone (for HDD temp. base)	4,000
HDD Bore Material	200
M11 HDD Platforms	
Volume of material to be reused:	
Topsoil	2,400
Subsoil (M11 HDD entry pit and cable trench)*	11,000*
Volume of material to be disposed of or recovered:	
Imported crushed stone (for HDD temp. base)	4,600
HDD Bore Material	500
Substation	
Volume of material to be reused:	

Earthworks Description	**Volume (m^3)**
Subsurface material (from embankment cut excavation)	0
Volume of material to be disposed of or recovered:	
Asphalt/pavement build up (existing pavement on site), embankment cut excavation and local excavation of made ground	12,500
Flood Defence Improvement Works	
Volume of material to be reused:	
Existing embankment material	0
Volume of material to be disposed of or recovered:	
Existing embankment material	300
Imported crushed stone (for working area and access track)	700
Connection to NETN	
Volume of material to be reused:	
Topsoil (tower working areas)	2000
Volume of material to be disposed of or recovered:	
Tower 7B foundation	200
Imported crushed stone (for working areas and access tracks)	1,700

*Material to be transported by Public Road to the HDD Exit Compound for stockpiling.

Transport of material to and from the works areas will be managed in accordance with the construction traffic management measures outlined **Chapter 13** *Traffic and Transportation* and included in the Construction Traffic Management Plan in the CEMP (**Appendix 6.1**), to ensure that there will be no queuing of trucks on public roadways around the works areas.

6.9.2 Construction Materials Requirements

The proposed development will have a requirement for materials imported to the works areas, primarily concrete, crushed stone, road paving materials and steel, for the construction of the substation and crushed stone and PVC ducting for the installation of the cables.

Concrete, sand, crushed stone and steel will be imported to works areas during the construction works, when required. Breakdowns of the volumes of these materials required are presented below:

6.9.2.1 Landfall

Water for HDD

Approximately 450m^3 of water will be utilised for the landfall HDD per bore, brought to site in tankers.

Bentonite for HDD

Approximately 22.5m^3 of bentonite will be utilised for the landfall HDD per bore.

Landfall HDD Materials

High Density Polyethylene (HDPE) HDD duct will require up to 1km of ducting for the two circuits.

Concrete at Transition Joint Bay

Approximately 100m^3 of concrete will be required for the Transition Joint Bay chambers (two in total).

Concrete for Anchor Blocks

Approximately 54m^3 of concrete for anchor blocks, if kentledge is used for the HDD rig.

Steel for Anchor Blocks

Approximately 20 tonnes of steel for anchoring, if sheet piling is used for the HDD rig.

Temporary Construction Compounds (HDD and Cable Construction Compound) and Access Tracks

Approximately 13,500m^3 of crushed stone will be imported for the HDD, cable construction compound and associated access tracks at the landfall.

6.9.2.2 Connection from Landfall to the Onshore 220kV Substation

Concrete Requirements along Cable Route

There will be weak mix concrete (i.e. cement-bound sand (CBS), typically 14:1 sand/cement mix) required for most of the cable route in the cable trench.

A standard concrete pad will be required at the base of each joint-bay. Estimated volumes of concrete required for the cable route are provided below.

- Estimated volume of weak mix concrete for the cable route (two circuits) = 5,000m^3
- Estimated volume of standard concrete per joint-bay = 20m^3
- Assuming 20 joint-bays, estimate volume of standard concrete = 400m^3

Cable Materials

The length of the cable route from the Transition Joint Bays at the landfall to the substation is approximately 6,000m.

This comprises (per circuit) three power cables coming to 18,000m, two fibre optic cables coming to 12,000m and one earthing cable coming to 6,000m. Therefore, for a total of two circuits is 72,000m.

The length of earth conductor for each joint bay is approximately 43m (8m x 2.5m joint-bay with conductor 1m outside joint-bay wall, 1 x communication chamber x link box chamber). Therefore, for 20 joint bays, the length of earth conductor is 860m.

The total length of earth rods for joint bays is 40m (4 x 10m earth rods per joint bay). Therefore, for 20 joint bays, the length of earth rod is 800m.

Cable Installation Materials

High Density Polyethylene (HDPE) HDD duct will require up to 72km of ducting for the two circuits.

Road Construction

The haul route along the cable corridor (within the working corridor), together with the access tracks to the cable corridor will require approximately 17,000m^3 of road construction material.

Road Surfacing – Road reinstatement - Asphalt

The road crossing reinstatement will require c. 2,000m^3 of asphalt.

Water for HDD at R772 and M11 Crossings

Approximately 200m^3 of water will be utilised for the R772 HDD per bore.

Approximately 450m^3 of water will be utilised for the M11 HDD per bore.

In both cases, water will be brought to site in tankers.

Bentonite for HDD at R772 and M11 Crossings

Approximately 10m^3 of bentonite will be utilised for the R772 HDD per bore.

Approximately 22.5m^3 of bentonite will be utilised for the M11 HDD per bore.

R772 and M11 HDD Materials

High Density Polyethylene (HDPE) HDD duct will require up to 400m of ducting for the two circuits at the R772 HDD crossing and 1km of ducting at the M11 HDD crossing.

Temporary Construction Compounds (HDD)

Approximately 9,500m^3 of crushed stone will be imported for the HDD compounds at R772 and M11.

Approximately 380 tonnes of steel for sheet piling will be imported to create access and compound area, if HDD is used as the M11 crossing option.

6.9.2.3 Onshore 220kV Substation

Crushed Stone - Imported Structural Fill

Approximately 70,000m^3 of granular fill will be imported for the substation site.

Concrete in Substation

The substation foundations and the other concrete structures on the site will require c. 6,000m^3 of concrete.

Steel Reinforcement

The reinforced concrete elements in the substation will require approximately 340 tonnes of reinforcing steel.

Structural Steel

The structures on the substation site will require c. 484 tonnes of structural steel.

Steel Cladding

The buildings on the substation site will require approximately 2,600m^2 of roof and wall cladding.

Road Construction – Bituminous Material

The permanent site access tracks and internal roads will require c. 2,200m^3 of bituminous material.

Temporary Construction Compounds

The temporary construction compound for construction of the substation will be situated within the substation site on existing hardstanding, and therefore a separate area will not be required and no additional materials are envisaged to be required.

Flood Improvement Works

Approximately 800m^3 of suitable cohesive structural fill will be imported for the flood improvement works and 700m^3 for working area and access route.

Additional 125 tonnes of steel will be imported for sheet piling.

6.9.2.4 NETN Connection

Crushed Stone and Stone Chippings

Approximately 1,700m^3 of crushed stone structural fill will be imported for the temporary works areas and access route, for the tower construction.

Concrete in the Tower Foundations

The tower foundations and the other concrete structures on the site will require c. 500m^3 of concrete.

Steel Reinforcement

The reinforced concrete elements in the towers will require approximately 35 tonnes of reinforcing steel.

Structural Steel

The towers to facilitate the tie-in will require approximately 60 tonnes of structural steel.

6.10 Safety Management

6.10.1 Health and Safety

The requirements of the Safety, Health and Welfare at Work Act 2005 (Government of Ireland, 2005), the Safety, Health and Welfare at Work (Construction) Regulations, 2013 (Government of Ireland, 2013), as amended, (the "Regulations") and other relevant Irish and EU safety legislation will be complied with at all times during the construction works for the proposed development.

As required by the Regulations, a Health and Safety Plan has been formulated which addresses health and safety issues from the design stages through to completion of the construction and maintenance phases. This plan will be reviewed and updated as required, as the development progresses.

In accordance with the Regulations, a 'Project Supervisor Design Process' has been appointed and a 'Project Supervisor Construction Stage' will be appointed for each construction works package.

The Project Supervisor Construction Stage will assemble the Safety File as the project progresses on site.

The Contractor will be required to ensure all Health and Safety, Fire Safety and security requirements are met.

All construction staff and operatives will be inducted into the security, health and safety and logistic requirements on site prior to commencing work.

All Contractors will be required to progress their works with reasonable skill, care and diligence and to proactively manage the works in a manner most likely to ensure the safety, health and welfare of those carrying out construction works, all other persons in the vicinity of the working areas and interacting stakeholders.

Contractors will also have to ensure that, as a minimum, all aspects of their works and project facilities comply with legislation, good industry practice and all necessary consents.

6.10.2 Traffic Management Plan

A Construction Traffic Management Plan (CTMP) has been prepared and is included in the CEMP. The plan will be further developed by the Contractor, prior to construction and will be agreed with Wicklow County Council.

The Construction Traffic Management Plan minimises the disruption to the public and the road users in the vicinity of the working areas during the construction phase of the works. The plan will include all suitable temporary signage, barriers and hoarding as necessary.

Chapter 13 *Traffic and Transport* provides more information on the issues addressed in the plan.

6.10.3 Environmental Incident and Emergency Response Plan

An Environmental Incident and Emergency Response Plan has been prepared, which will cover all foreseeable risks during the construction stage, including fire, flood, collapse and accidental spills and releases of hazardous substances. The plan will be further developed by the Contractor, prior to construction commencing. In further developing the plan, the Contractor will be required to liaise with the emergency response services. Further information on the emergency response plan is presented in the CEMP, provided in **Appendix 6.1**.

Appropriate site personnel will be trained as first aiders and fire marshals.

6.11 Environmental Management

Every effort will be made to ensure that any significant environmental effects will be avoided, prevented or reduced during the construction phase of the proposed development. The CEMP, provided in **Appendix 6.1**, will be further developed by the appointed Contractors prior to construction commencing.

The CEMP comprises all the construction mitigation measures proposed in the EIAR. The Contractor will include any additional measures imposed as a condition of the planning approval. Implementation of the CEMP will ensure disruption and nuisance will be kept to a minimum.

The CEMP has regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK; Environmental Good Practice on Site Guide, 4th Edition (CIRIA, 2015).

The CEMP is in accordance with relevant legislation and guidance and will be effective for the duration of the construction works. The CEMP will be a live document during the construction phase and will be updated/added to as construction progresses.

6.11.1 General Measures

Steps will be taken to reduce the probability of an incident occurring and to also reduce the magnitude of any incident by a combination of good site environmental management procedures, including additional precautions when operating machinery close to watercourses, soil management, staff training, contingency equipment and emergency plans.

Key measures identified to reduce the risk of pollution, erosion and sedimentation of waterways include:

- Secure oil and chemical storage in over-ground bunded areas, limited to the minimum volume required to serve immediate needs with specified delivery and refuelling areas;
- No refuelling or fuel storage within 50m of waterways and only on a sealed surface;
- Emergency spill kits will be retained onsite at sensitive locations, with portable kits provided to plant and equipment operators;
- Cessation of work and development of measures to contain and/or remove pollutant should an incident be identified;
- Silt traps will be employed and maintained in appropriate locations;
- Temporary interception bunds and drainage ditches will be constructed up slope of excavations to minimise surface runoff ingress and in advance of excavation activities; and
- Excavation and earthworks will be suspended during and immediately following periods of heavy rainfall to minimise sediment generation and soil damage.

6.11.2 Landfall

For the HDD at the landfall, any groundwater or rainwater that collects in the HDD drilling pit will be pumped away. Then it will be discharged onto the adjacent land, not directly into a waterway, and through a filter medium. This will avoid the build-up of silt, as some granular material will, inevitably, be pumped out with the water from the trench. Any bentonite (or similar HDD drilling head lubrication material) will be handled and removed by the drilling Contractor. The volume of bentonite (or similar material) will be determined by the ground conditions encountered and length of HDD. Typically for a land-based HDD rigs the volume of bentonite would be approximately 5m^3 per shift, and for the landfall HDD rig, the volume of bentonite would be approximately 15m^3 per shift.

6.11.3 Connection from Landfall to the Onshore 220kV Substation

The cables will be installed in ducts, so the only section of trench that will be open is that which is being excavated and in which ducts are being installed. Excavated cable trenches will be backfilled as the works progress, as soon as installation is complete, and any cement bound surround material has cured sufficiently.

Any groundwater or rainwater that collects in a trench will be pumped to locations agreed with the landowners and local authorities. Typically, this will be onto adjacent land, not directly into waterways, and through a filter medium, to avoid the build-up of silt, as some granular material will, inevitably, be pumped out with the water. The pump flowrates will match that of the water into the trench, as it must be kept generally free of water. A single pump with a 75mm hose will usually be adequate to deal with rainwater running into a trench. A similar arrangement will apply at joint bays, where a sump will be cast into the concrete base for a pump.

For the R772 and M11 crossings, the control of water collecting in the HDD pits will be as described above, in **Section 6.11.2.**

6.11.4 Onshore 220kV Substation

Steps will be taken to reduce the probability of an incident occurring and to also reduce the magnitude of any incident from a combination of good site environmental management procedures, including additional precautions when operating machinery close to watercourses, soil management, staff training, contingency equipment and emergency plans.

In addition to the measures described above:

- Dust generation and dermal exposure during site construction works, until the made ground is capped, will be controlled by appropriate dust control measures e.g. water sprays and suitable personal protective equipment.
- Where the asphalt layer is being removed, this will occur in phases and the asphalt will be replaced with granular fill as soon as possible to prevent the generation of windblown dust.
- All made ground excavated in the course of installing underground services, which is not suitable for reuse on site, or surplus to requirements, will be stockpiled, tested and classified for recovery or disposal. Refer to **Chapter 16** *Resource and Waste Management* for further information.

It is noted that the Avoca River Business Park's existing flood defences provide protection for the present day 0.1% AEP (annual exceedance probability), which is expected to adequately protect the works during construction.

6.11.5 Connection from Substation to NETN

The precautions to minimise the impacts of the works detailed in **Sections 6.11.1 and 6.11.4** above will be implemented for the construction of the connection to the transmission system.

6.12 Decommissioning Activities

6.12.1 Landfall and Cable Route

As described in **Chapter 5** *Description of the Development*, on cessation of operation, the cables and ducts will be left in place. The above ground structures such as the marker posts will be removed. The works will require a small workforce and will be of short duration. The environmental management measures specified in the CEMP, which are relevant to the decommissioning activities, will be implemented.

6.12.2 Onshore 220kV Substation

As described in **Chapter 5** *Description of the Development*, on cessation of operation, the substation will be decommissioned. The substation will be de-energised, the equipment will be removed, and the buildings and structures will be disassembled or demolished down to ground level. The decommissioning plant required will be similar to that required for the construction phase of the substation. The workforce required will be smaller and the duration of the works will be shorter. The environmental management measures specified in the CEMP, which are relevant to the decommissioning activities, will be implemented.

6.13 References

Construction Industry Research and Information Association (CIRIA) 2015 *Environmental Good Practice on Site Guide. 4th Edition*

GNI (2016) *Safety Advice for Working in the Vicinity of Gas Pipelines*

Government of Ireland (2013) *Safety, Health and Welfare at Work (Construction) Regulations 2013*

Government of Ireland (2005) *Safety, Health and Welfare at Work Act 2005*

EirGrid (February 2016) *Substation Civil and Building Works*

EirGrid 110kV, 220kV and 400kV Underground Cable Functional Specification, General Requirements (March 2020)

EirGrid (January 2019) *110 / 220 / 400 kV Gas Insulated Switchgear (GIS) Connected to the Transmission System*

EirGrid (December 2019) *Earthing and Lightning Protection Function Specification*

Department Transport Tourism Sport (2019) *Traffic Signs Manual*

Transport Infrastructure Ireland (2013) *Specification for Road Works Series 600 - Earthworks (including Erratum No. 1, dated June 2013)'*