One Earth Solar Farm

Volume 7.0: Other Documents [EN010159]

Outline Export Cable Route Construction Method Statement

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1. Outline Export Cable Route Construction Method Statement

1.1 Introduction

1.1.1 One Earth Solar Farm Ltd (hereafter referred to as the 'Applicant') has prepared this Outline Export Cable Route Construction Method Statement ('oCMS') in relation to an application for a Development Consent Order (DCO) for the construction, operation and maintenance, and decommissioning of the One Earth Solar Farm (hereafter referred to as the 'Proposed Development'). The terminology used in this document is defined in the **Glossary of Terms and Abbreviations [EN010159/APP/7.17].**

1.1.2 The Proposed Development comprises the construction, operation and maintenance, and decommissioning of a solar photo-voltaic (PV) array electricity generating facility. The project includes solar PV panels, Battery Energy Storage Systems (BESS), onsite substations and associated grid connection infrastructure which will allow for the generation and export of electricity to the proposed National Grid High Marnham Substation. The Applicant has secured a connection agreement with National Grid which will allow export and import of up to 740 megawatts (MW) of electricity to the National Grid High Marnham Substation. The Proposed Development will be located within the Order Limits.

1.1.3 This oCMS relates to a 7.5km long cable corridor for the installation of a 400kV underground electrical export cable to connect the Proposed Development to the proposed National Grid High Marnham substation.

1.1.4 A description of the Proposed Development is presented in **ES, Volume 1, Chapter 5: Description of the Proposed Development [EN010159/APP/6.5].**

1.2 Purpose

1.2.1 The purpose of this oCMS is to provide details of how the grid connection corridor is likely to be constructed

1.2.2 The components described in this oCMS comprise:

- Grid connection cable;
- Modifications to High Marnham substation; and
- Access points and haul route during construction.

Grid Connection Cable

1.2.3 The 740MW of electricity generated by the Proposed Development will be exported to the National Grid Electricity Transmission (NGET) via a 400kV circuit

from the proposed new substations (connected from the east substation to the west substation) to a 400kV NGET substation adjacent to the new High Marnham 400kV Substation.

1.2.4 The total length of the cable route grid connection corridor is approximately 7.5km for the 400kV cable. The grid connection corridor will be within the Order Limits. **Figure 1.1** shows the site layout plan with the proposed cable route, highlighting the proposed substation locations.

1.2.5 The proposed new substations for the Proposed Development are:

- East substation located east of the River Trent; and
- West substation located west of the River Trent.

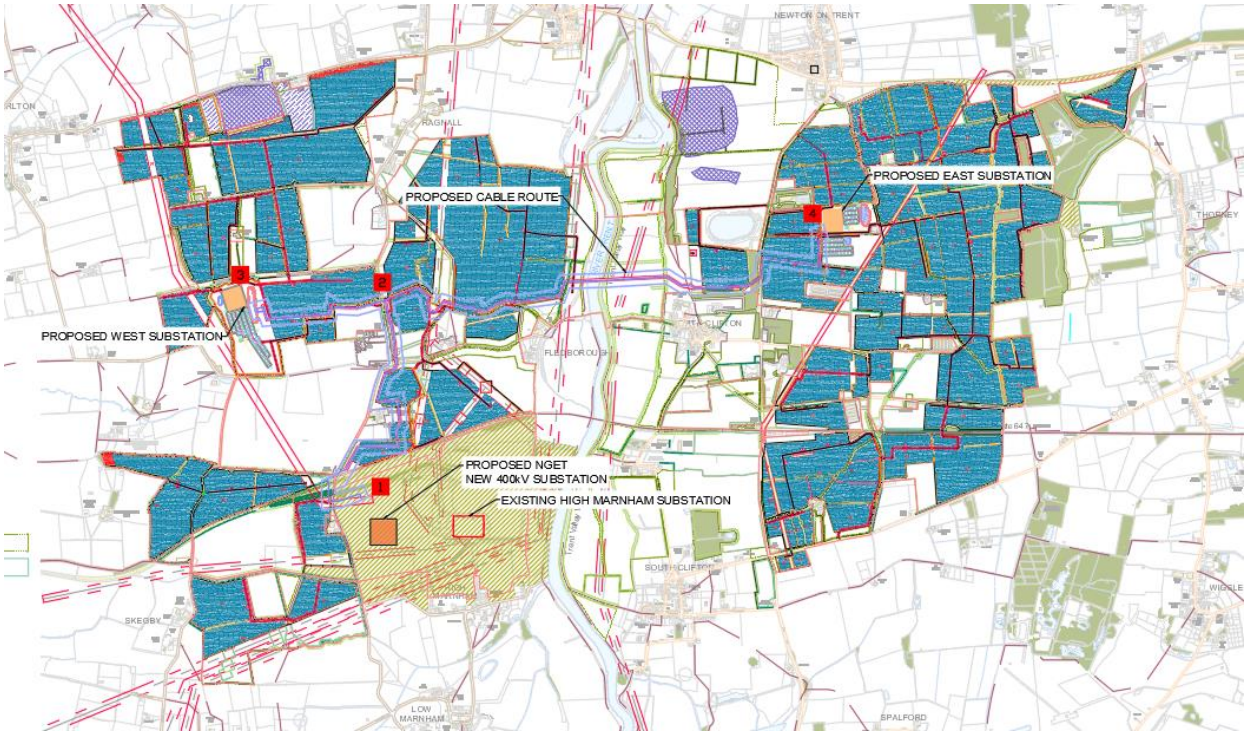


Figure 1.1: Site layout plan showing cable route and substations with numbers to represent different sections of the route

1.2.6 The grid connection corridor crosses a range of existing infrastructure such as the A1133 road, other minor roads, Public Rights of Ways (PRoWs), woodlands, a disused railway, Overhead Electricity Transmission Lines (OHTLs), the River Trent and drainage ditches. A list of major crossings is provided in **Table 1.1**.

1.2.7 The grid connection corridor has been divided into three distinct sections to detail the crossings, these are shown in **Figure 1.1** and referenced in **Table 1.1**:

- Section 1 – 2: From new High Marnham 400kV Substation to the junction of the connection corridor from the East to the West substation;

- Section 2 – 3: From the junction of the connection corridor from the East to the West substation to the proposed West substation (W); and
- Section 2 – 4: From the junction of the connection corridor from the East to the West substation to the proposed East substation (E).

Table 1.1: Crossings encountered along the grid connection corridor

Section of the proposed cable route	Crossing Type	Approximate distance along centre line from High Marnham 400kV Substation
Section 1 – 2		
1	Fledborough Road	0.25 km
2	Tree belt	0.35 km
3	Woodland	0.45 km
4	Dismantled railway/ Sustrans Route 647	0.50 km
5	Fledborough Road	0.50 km
6	Hedgerow	1.05 km
7	Tree belt / hedgerow	1.30 km
8	Tree belt / drainage ditch	1.80 km
9	Hollow Gate Lane road	1.80 km
10	Tree belt / drainage ditch	1.85 km
11	Hedgerow / tree belt	2.05 km
Section 2 – 3		
1	Main Street road	2.30 km
2	Hedgerow / drainage ditch	2.70 km
Section 2 – 4		
1	OHTL	2.80 km
2	Fledborough Beck watercourse	2.85 km
3	Public right of way	2.90 km
4	OHTL / tree belt	3.90 km
5	Public right of way	4.00 km
6	River Trent	4.05 km
7	Trent Valley Way	4.20 km
8	OHTL	4.30 km

Section of the proposed cable route	Crossing Type	Approximate distance along centre line from High Marnham 400kV Substation
9	Sewer Dyke watercourse	4.60 km
10	Public right of way	4.80 km
11	Public right of way / Amblerod Plantation woodland	5.30 km
12	A1133 Collingham Road	5.35 km
13	Tree belt	5.35 km
14	Hedgerow	6.15 km
15	Hedgerow	6.20 km

Construction Methods

1.2.8 All cabling to be installed as part of the Proposed Development will be laid below ground. The construction method for installation of the export cable route will typically be open cut trench and trenchless methods in some locations.

1.2.9 In the first instance, the open cut trench method will be used, however, the use of any trenchless method will be dependent on the type of crossing. When open cut trenching is not possible, a trenchless method will be used to minimise the disruption and impact on various crossing points, such as roads, railways, paths, existing infrastructure and environmentally protected areas.

Open Cut Trenching

1.2.10 The open cut trenching method can install cables via direct burying or ducting.

1.2.11 The direct buried method typically requires longer sections (up to 500m) of trenching to be exposed at a time to allow for the cable to be rolled/laid into the trench before backfilling.

1.2.12 Ducting of cables utilises shorter sections of exposed trenching at a time where the ducts are typically installed and backfilled in 20-40m sections, which is substantially shorter than the sections required for direct burying. Following this, the cables are installed by being pulled through the ducts. It is anticipated that ducting will be the preferred method for the Proposed Development due to shorter sections of trench being exposed at a time.

1.2.13 For the open cut trench sections of the grid connection route, a typical working width corridor of 40m is anticipated. This area will include the open cut trench for laying of the 400kV cables (direct burying or ducting), temporary haul road (for vehicles, plant and access to joint bays), temporary drainage ditch and a laydown area for the storage of topsoil following excavation of the cable trench.

1.2.14 The temporary haul road will be a maximum of 5m wide for typical straight sections and temporary track matting will be used where required. Turning bays and passing places will be provided in appropriate locations, and exceed 5m in width.

1.2.15 An example showing the cross-section of a typical 400kV open cut cable trench is shown in **Appendix A**, with an indicative maximum width of 1100mm and depth of 1400mm.

1.2.16 Topsoil and subsoil will be stored in separate bunds to avoid mixing. Guidance on indicative stripping depths states 300mm for topsoil and 700mm for subsoil removal. However, soil horizons should be stripped on site according to their individual compositions. The building and storage of soil storage bunds should follow the guidance provided in Sheets B and C of *The Institute of Quarrying Good Practice Guide for Handling Soils in Mineral Workings*[1].

1.2.17 The use of open cut trenching under OHTLs should follow 'Avoiding danger from overhead power lines Guidance Note GS6[2] to maintain safe distances and heights during OHTLs crossing construction. Implementation of goalpost-controlled crossing points will be required for plant movements under the OHTLs.

Trenchless Crossings

1.2.18 There are different viable trenchless methods that can be used for the export cable installation and these are discussed in more detail in **Section 1.4.18, 1.4.19** and **1.4.21** below. The selection of a trenchless method will be dependent on the type of crossing, alignment, required length of crossing, ground conditions and depth. The method will be appropriately selected on a crossing-by-crossing basis and will likely be one of the following:

- Horizontal Directional Drilling (HDD);
- Tunnel Boring Machine (TBM) Tunnelling:
  - Microtunnelling/Pipe Jacking; and
  - Conventional Tunnelling Method (CTM).

1.2.19 An example of an indicative cross-section of a trenchless crossing is shown in **Appendix B**.

1.2.20 Trenchless crossings require launch and reception pits, which will be sited outside the avoidance areas mentioned in **Section 1.2.21**. An illustrative example

[1] GOOD PRACTICE GUIDE FOR HANDLING SOILS In Mineral Workings [Internet]. Chilwell, Nottingham: The Institute of Quarrying ; 2021 [cited 4AD Dec]. Available from: https://885685.fs1.hubspotusercontent-na1.net/hubfs/885685/Soils%20Guidance/IQ%20Soil%20Guidance%20full%20document%20including%20all%20practitioner%20advice%20updated%20May%202022.pdf

[2] Avoiding danger from overhead power lines [Internet]. www.hse.gov.uk. Available from: https://www.hse.gov.uk/pubns/gs6.htm

of a 25m x 20m launch pit working area layout for a 400kV connection is included in **Appendix C**.

Open Trench Avoidance Areas

1.2.21 The exact locations of the start and end points of the different construction methods (open cut trench and trenchless) for the 7.5km export cable route will be determined at detailed design stage. Therefore, the approach to the Environmental Impact Assessment (EIA) is to commit to 'Open Trench Avoidance Areas' where the method will be likely be trenchless.

1.2.22 Open Trench Avoidance Areas where a trenchless crossing method will likely be used are identified in **Appendix D**. The associated launch and reception pits will be located outside of the Open Trench Avoidance Areas to minimise impacts in these areas where trenchless is confirmed as appropriate.

1.2.23 Note that whilst there will likely be no open cut trench or launch/reception pits in the Open Trench Avoidance Areas, parts of the haul road will cross a number of Open Trench Avoidance Areas.

Modifications to High Marnham Substation

1.2.24 The grid connection corridor will connect the Proposed Development to the National Grid (NG) point of connection, which is into a proposed NGET substation adjacent to the existing High Marnham substation.

1.2.25 The NGET are building a new substation adjacent to the existing High Marnham substation as part of the great grid upgrade strengthening works. It will consist of new transmission lines connecting it to Beverley in the north and Brinsworth in the west.

1.2.26 The export cable's point of connection to the NG is expected to connect into NGET's proposed new NGET substation at High Marnham from the northern side.

1.2.27 The location of the substations relevant to the Proposed Development can be seen in the **Works Plan [EN010159/APP/2.3]** with the NGET's proposed substation at High Marnham shown to the southwest of the Site.

Access Points

1.2.28 Access to and egress from the land within the grid connection corridor will be provided through the same access track junctions designed for solar access, as shown in the **Streets, rights of way, and access plans [EN010159/APP/2.4]**.

1.3 Equipment

1.3.1 Equipment required for cable installation consists of at a minimum:

Open Cut Trench

- Excavators anticipated to be delivered on an articulated lorry;
- Low loader lorries for delivery of cable drums;
- Tractors and other smaller vehicles to transport materials within the cable route;
- Trench protection e.g. temporary shoring, benching, sheet piling, or timber supports, dewatering/pumping equipment; and
- Suitably sized concrete lorries for delivering concrete to create the joint bays.

Trenchless Crossings

Launch Pits:

- Suitably sized low loader lorry for delivery/pick up of the directional drill rig;
- Low loader lorries for delivery of cable drums;
- Flatbed lorries for delivering temporary trackway;
- Telehandler anticipated to be delivered on an articulated lorry;
- Excavator anticipated to be delivered and picked up with the telehandler;
- Suitably sized concrete lorries for delivering concrete to create the joint bays;
- Light Vehicles;
- Beavertail lorry and gallon tank with rod boxes;
- HDD rig;
- Tractor and tanker;
- Vehicle with gallon mixing tanks; and
- Mud mixing tank unit.

Reception Pits:

- Excavator anticipated to be delivered and picked up with the telehandler;
- Suitably sized lorries for delivering the concrete to create the joint bays;
- Suitably sized low loader lorries for delivery of cable;
- Flatbed lorries for delivering temporary trackway;

- Telehandler anticipated to be delivered on an articulated lorry; and
- Flatbed lorry for the delivery of sand.

1.4 Construction

Site and Construction Compounds

1.4.1 Construction and restoration activities will include:

- The establishment of mobilisation areas and haul roads;
- Temporary construction compounds and site access points;
- Site preparation including fencing;
- Establish satellite construction compounds if required;
- Stripping of topsoil in sections;
- Trenching in sections;
- Appropriate storage and capping of soil;
- Appropriate construction drainage with dewatering and pumping where necessary (for trenching and trenchless works primarily);
- Sectionalised approach of duct installation (if ducted);
- Excavation and installation of joint bay pits;
- Cable joint installation;
- Cable pulling (if ducted);
- Implementation of trenchless crossings for watercourses and infrastructure (including roads and rail);
- Testing and commissioning;
- Demobilisation of construction compounds; and
- Site reinstatement and habitat creation.

1.4.2 Establishment of the main site compound preliminary activities are setting up the contractor's compound and offices. This also includes cabins, stores, welfare and car parking facilities.

1.4.3 There may also be other smaller mobile welfare units established along the route. **Appendix E** shows a typical satellite compound and Appendix F shows a typical construction compound detail.

1.4.4 Locations of these compounds will be confirmed at a later design stage but will be within Works Area 6B on the **Works Plan [EN010159/APP/2.3]**.

1.4.5 In addition, at the grid connection corridor access locations, there will be temporary construction lay-down areas which are typically up to 50m x 50m that will be used to support the cable installations. The laydown area footprint will take into consideration topography, drainage, and any heritage and environmental constraints.

1.4.6 The laydown areas will allow construction vehicles to turn off public roads and park safely. Activities at the laydown areas will include receipt of deliveries, unloading, provision of welfare, and storage of plant and construction materials. The areas will likely include portacabins, welfare and power generators, and will be secured using Heras fencing and security cameras. In the construction phase, parking will be available at these locations for the workforce. Upon completion of construction, the laydown areas will be removed and the land reinstated.

1.4.7 Temporary services to the site cabins and offices will include electrical, communications, water and sewerage facilities.

1.4.8 The temporary site compounds will be erected, maintained and subsequently removed in a manner that will have minimum reasonable impact on the locality and in accordance with the DCO and approved outline management plans.

1.4.9 Appropriate security measures will be in place to reduce the risk of theft of materials outside of working hours (nights, weekends and bank holidays). This is likely to consist of a combination of remotely monitored closed-circuit television (CCTV), temporary secure fencing and patrolling security personnel.

1.4.10 Any cabins or vans present on site will have a weekly housekeeping service.

Prior to Construction

1.4.11 A utility survey will be conducted within the vicinity of proposed excavations to confirm existing utilities in the area which will be avoided during construction.

1.4.12 Appropriate ground investigation will be undertaken in advance of any trenchless crossings to support settlement calculations and ensure that riverbed levels, underground services, roads and railways will not be adversely affected by the works.

1.4.13 Appropriate temporary works to be erected before any works commence at the access/egress points of the access roads to inform members of the public about the works.

1.4.14 Appropriate temporary traffic management to be in place as required during construction works, on private and public roads, and at the site access and egress points. General traffic management may include:

> Traffic cones;

- Traffic signals;
- Temporary signs;
- Temporary lighting;
- Temporary speed restrictions;
- Temporary diversions;
- Temporary height restriction barriers;
- Narrow lanes;
- Lane closures; and
- Partial or full road closures (to be agreed with the relevant authority) with appropriate diversion signing in place).

1.4.15 The land occupied by the works will be identified on site by surveying and installing appropriate pegs and posts, prior to the works commencing.

1.4.16 Any required vegetation clearance across the working area of the construction corridor will be carried out prior to construction.

Overview of Construction Activities

1.4.17 A typical construction sequence for open cut trenching cable installation for direct buried/ducting is to be implemented:

- Appropriate site survey and setting out of route;
- Excavate the trench;
- Trench protection e.g. temporary shoring, benching, sheet piling or timber supports, dewatering/pumping equipment;
- Construct bedding layer - sand or cement bound sand;
- Install ducting onto bedding layer (if ducted);
- Pull cables through the ducts (if ducted);
- Lay the cables in the trench, where not ducted;
- Reinstate the excavated trench using appropriate backfill material, while ensuring stratigraphy of subsoil and topsoil is maintained as outlined within **Outline Soil Management Plan [EN010159/APP/7.10];** and
- Ensure backfill material is compacted effectively around the cables without any air pockets.

1.4.18 A typical Microtunnelling/Pipe Jacking construction method is shown in **Figure 1.2**, which is a potential trenchless option for the cable installation.

- This method is typically used for diameters ranging from 0.3m to 2.4m and is limited to lengths of around 2km.
- Pipe jacking is a similar technique to Microtunnelling but tends to be utilised for larger man-entry diameters.

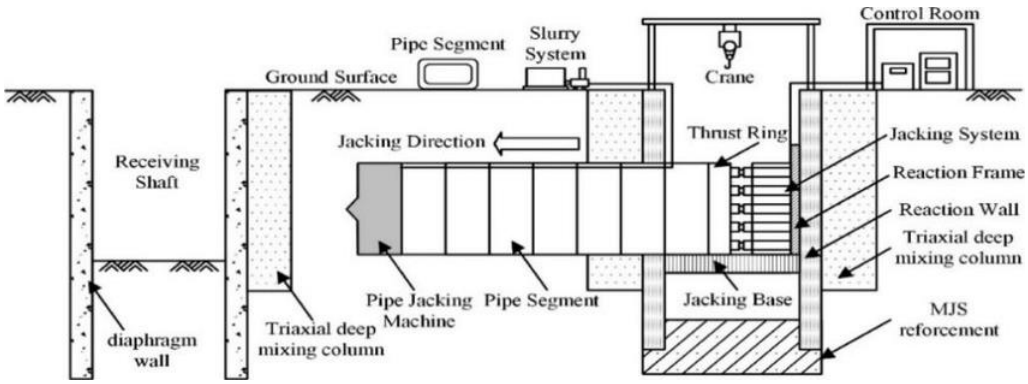


Figure 1.2: Cross-section of a typical pipe jacking construction method [3]

1.4.19 A typical microtunneling construction method is shown in **Figure 1.3**. This is a potential trenchless option for the cable installation.

1.4.20 A microtunneling rig is set up at the launch location;

- The drill requires the following components: drill bit, drill head and drilling fluid.
- A pilot hole is drilled along a predetermined path with drilling fluid injected to ensure the ground conditions remain cohesive to prevent collapse of the unsupported excavation.
- Once the initial drill bit reaches the exit location, a back reamer is attached to the drill string and pulled back through the borehole to increase the diameter of the hole.
- The pipe duct is then pulled through the excavated borehole. Following this, a winch is used to pull the cables through the ducts.

[3] Wang L, Kong C, Peng F, Zhang B, Deng J, Gu S, et al. Construction of a large-section long pedestrian underpass using pipe jacking in water-filled clay. IOP Conference Series: Materials Science and Engineering. 2020 Jan 1;741(1):012103.

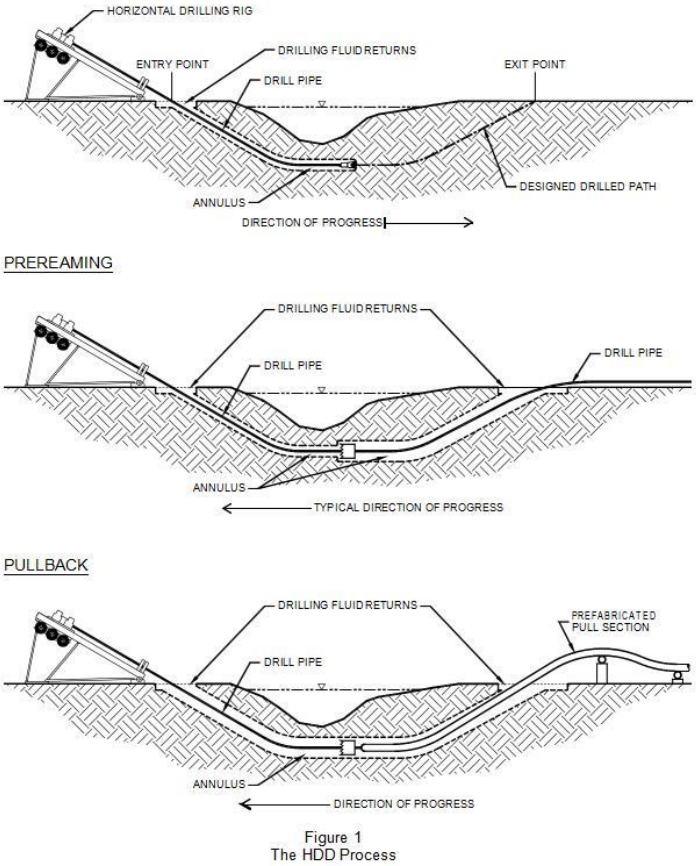


Figure 1.3: Cross-section of typical HDD construction method [4]

1.4.21 A typical CTM construction method is shown in **Figure 1.4**. This is a trenchless method that can be used for cable installation. However, it is typically used for larger diameter tunnels with greater lengths than are expected for the Proposed Development.

> CTM uses a lining formed of precast concrete segments which are interlocked to line the tunnel bore.

> The minimum tunnel diameter is typically 4m and it is most cost effective when the tunnel length is greater than 5km.

[4] Co. E. The Horizontal Directional Drilling Process [Internet]. Xcmghddrig.com. 2019 [cited 2025 Jan 9]. Available from: https://www.xcmghddrig.com/the-horizontal-directional-drilling-process.html

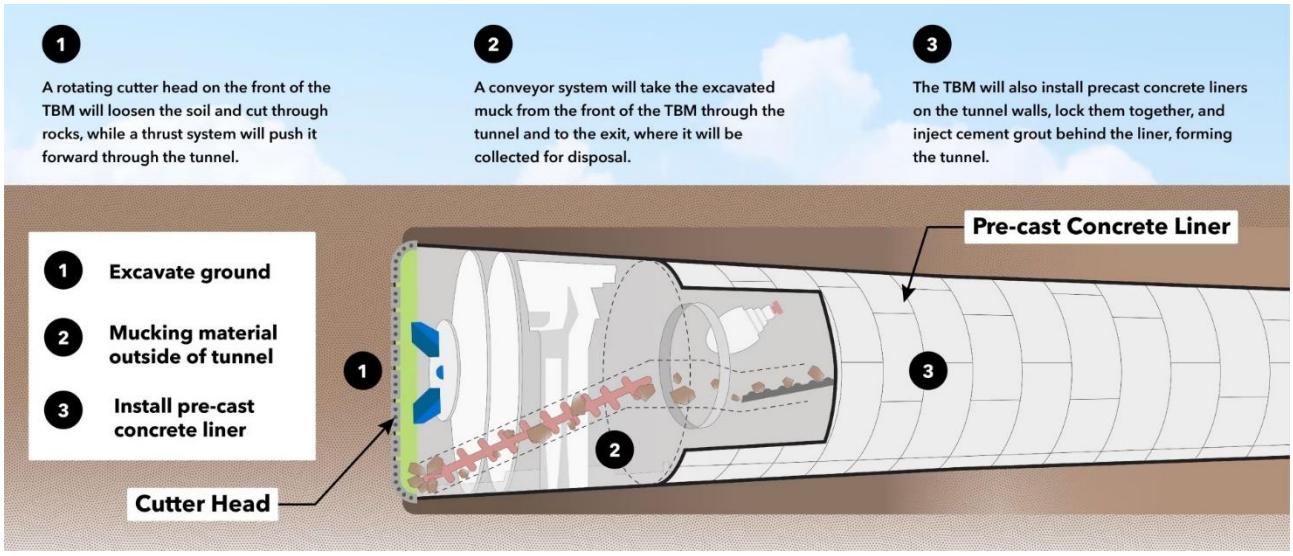


Figure 1.4: Cross-section of typical CTM construction method [5]

1.4.22 A typical joint bay construction sequence is to be implemented. As per National Grid's guidance, underground joint bays will be required every 500m to 1000m. These will be concrete lined and suitably sized to accommodate the cable size and required working area.

1.4.23 The cable installation construction method will implement the following guidance and best practice procedures:

- Under supervision of a banksman, the excavator with toothless bucket will be escorted to excavation position. A banksman will be present throughout machine operations to ensure safe machine movements.
- Following HSG47 Guidance 'Avoiding danger from underground services', the excavator will remove the topsoil/vegetation. The excavator will continue the excavation by removing layer of no more than 75mm of spoil.
- Topsoil and subsoil will be separated and stored either side of the trench and used as backfill material upon restoration of the trench.
- Continual cable avoidance tool (CAT) and Genny (signal generator) scanning of the excavation area will be undertaken at regular intervals as excavation progresses.
- As mentioned in **Section 1.4.11**, a utilities survey will be conducted prior to commencement of any construction works to avoid danger from and damaging underground services. If an unknown service is encountered, stop work and contact the engineer or utility owner immediately.

[5] Tunnel Boring Machines for the Eglinton Crosstown West Extension | Ghella [Internet]. Ghella.it. 2023 [cited 2024 Nov 27]. Available from: https://ghella.it/en/media/news/tunnel-boring-machines-eglinton-crosstown-west-extension

- Dewatering of excavations shall be carried out when required and transferred to appropriate drainage areas.

Spoil

1.4.24 During construction of the grid connection corridor, spoil will be stored temporarily within designated areas adjacent to the cable route and within construction compounds.

1.4.25 Refer to **Sections 1.4.26 and 1.4.27** for further information on the use of spoil on the Site.

Reinstatement of Working Width

1.4.26 Following the completion of works, the Site will be returned to its previous condition. This will comprise of the following activities:

- Backfilling trenches with stored soil;
- Removal of construction machinery and materials from the Site;
- Temporary access tracks and site fencing removed; and
- Where land had previously been vegetated, the re-planting of these areas with grass seed will be needed to satisfy the landowner.
- Adequate aftercare programme as agreed.

1.4.27 Excavated spoil stored on site is expected to be utilised to backfill or reinstate the temporary construction compounds, trench excavations and any temporary access roads to its original condition. Any excess spoil is assumed to be retained on site and reused.

1.4.28 Where seeding is required to restore the land to its original condition, this will occur after backfilling of the trenches and application of topsoil.

Construction Programme

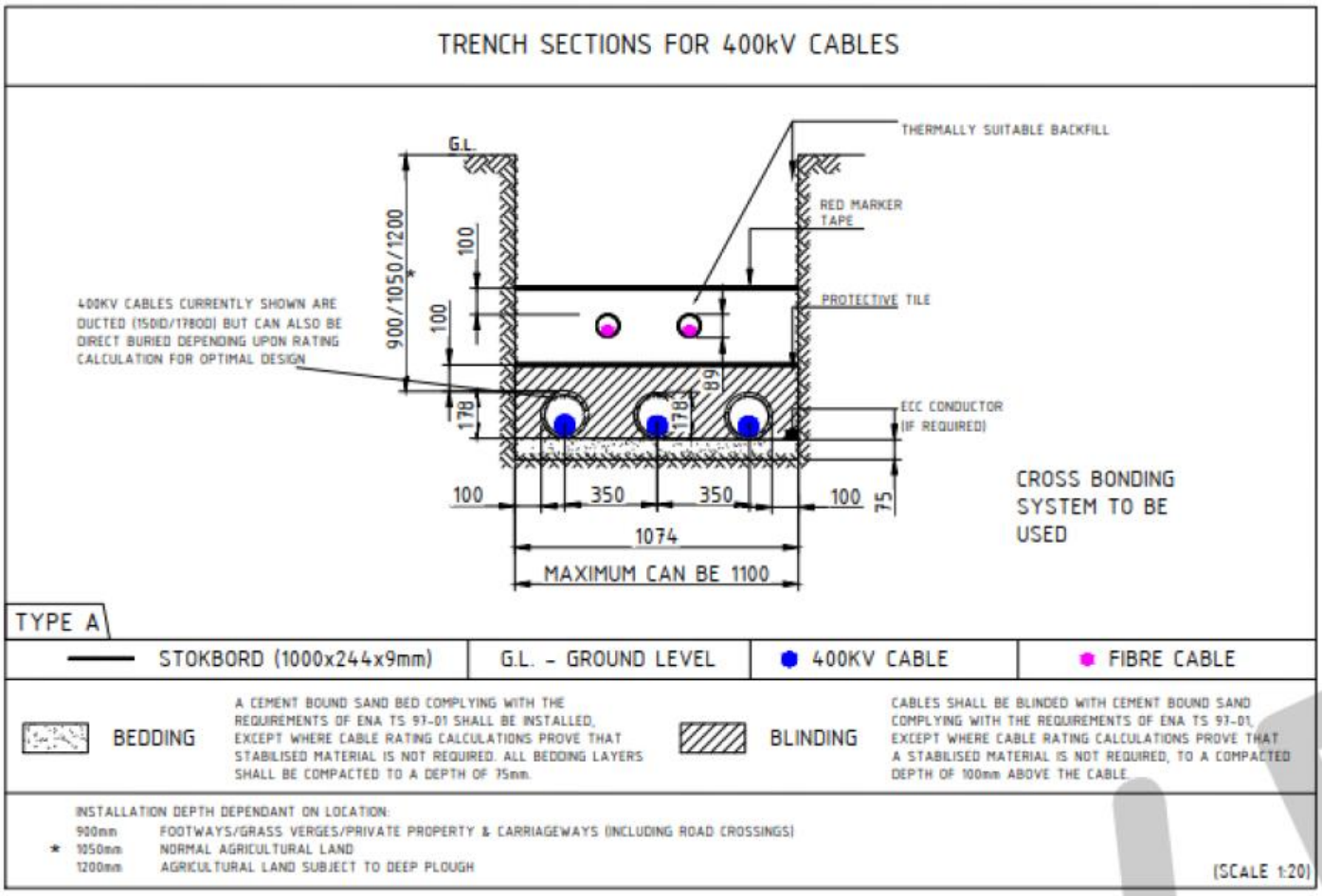
1.4.29 Based on the **Outline Construction Environment Management Plan [EN010159/APP/7.4]**, it is anticipated that the earliest construction will commence is Q1 2026 for a period of 26 months. A detailed construction programme has yet to be undertaken as input information on the cable configuration, NGET approval, construction sequencing, access arrangements and permissible HGV traffic movements etc. are to be confirmed.

1.4.30 An example breakdown of the construction sequencing and timeframes for the cable routing based on similar project scales is provided in **Table 1.2** below. Note that this is indicative only and will be subject to a range of unforeseen factors such as planning and connection approvals, supply chain variability, inclement weather.

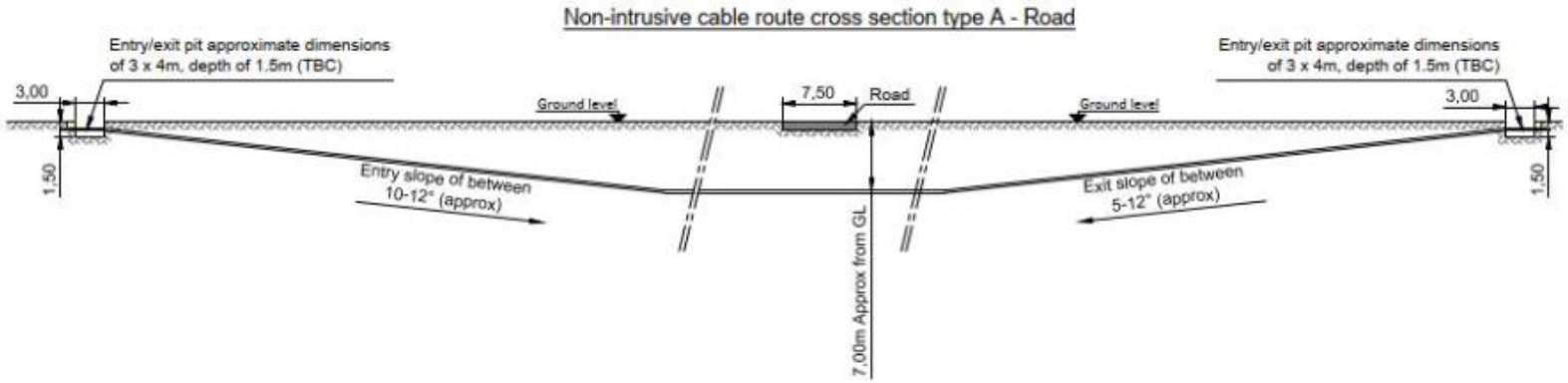
Table 1.2: Typical Cable Routing Construction Programme EXAMPLE

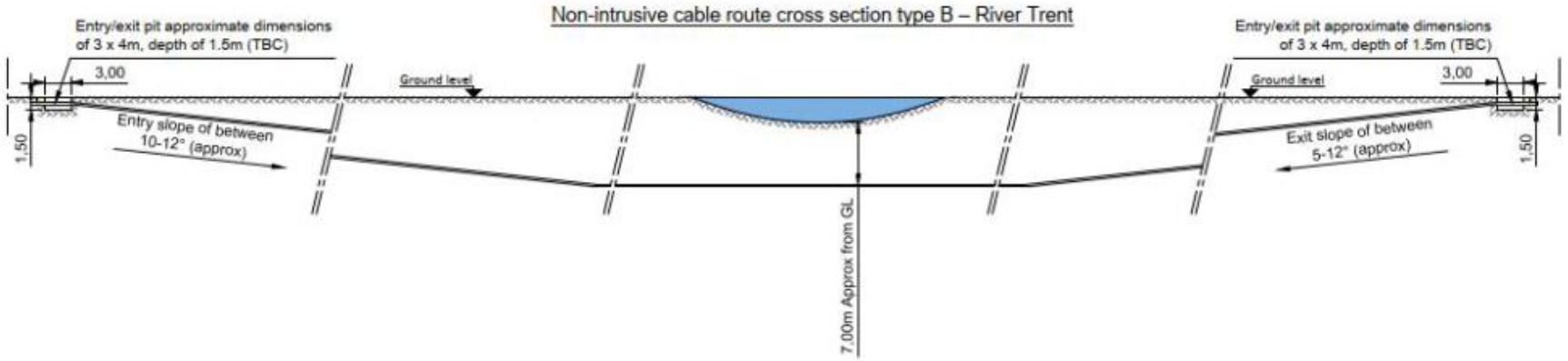
Construction Task - Typical Cable Routing Construction Sequence and Timeframe	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Establish primary construction compounds and site access points, which may include Public Road Improvements (PRIs) where required.												
Site preparation including fencing and haul road construction												
Establish satellite construction compounds												
Excavate pre installed ducts and jointing pits, install cables and reinstate												
Carry out any onshore HDDs (or other trenchless crossings)												
Pulling Cables												
Removal of the haul road, reseeding etc.												
Testing and Commissioning												
Demobilisation of satellite compounds												
Demobilisation of construction compounds												

Appendix A Indicative Open Cut Trench Cross-Section

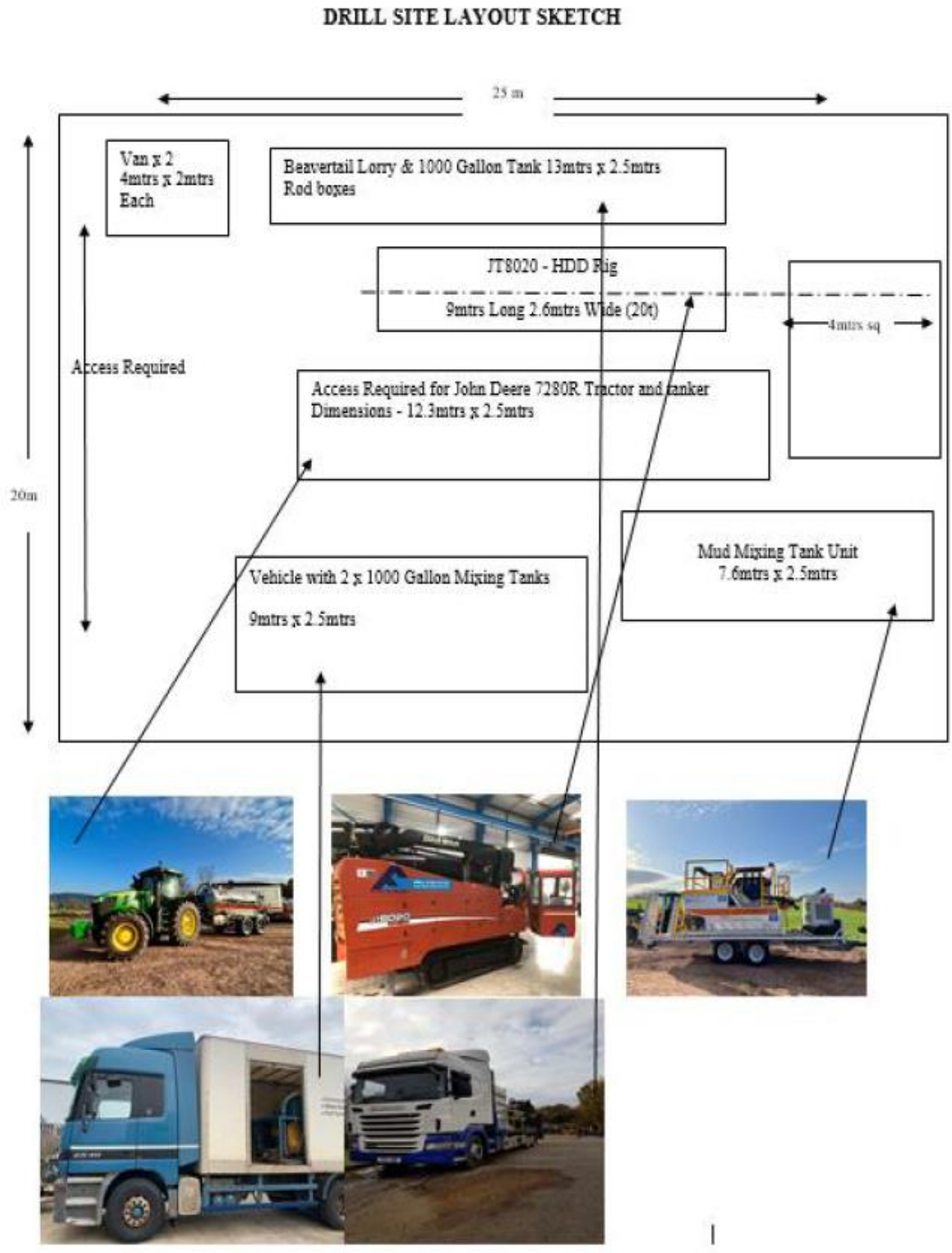


Appendix B Example Trenchless Crossing Cross-Sections

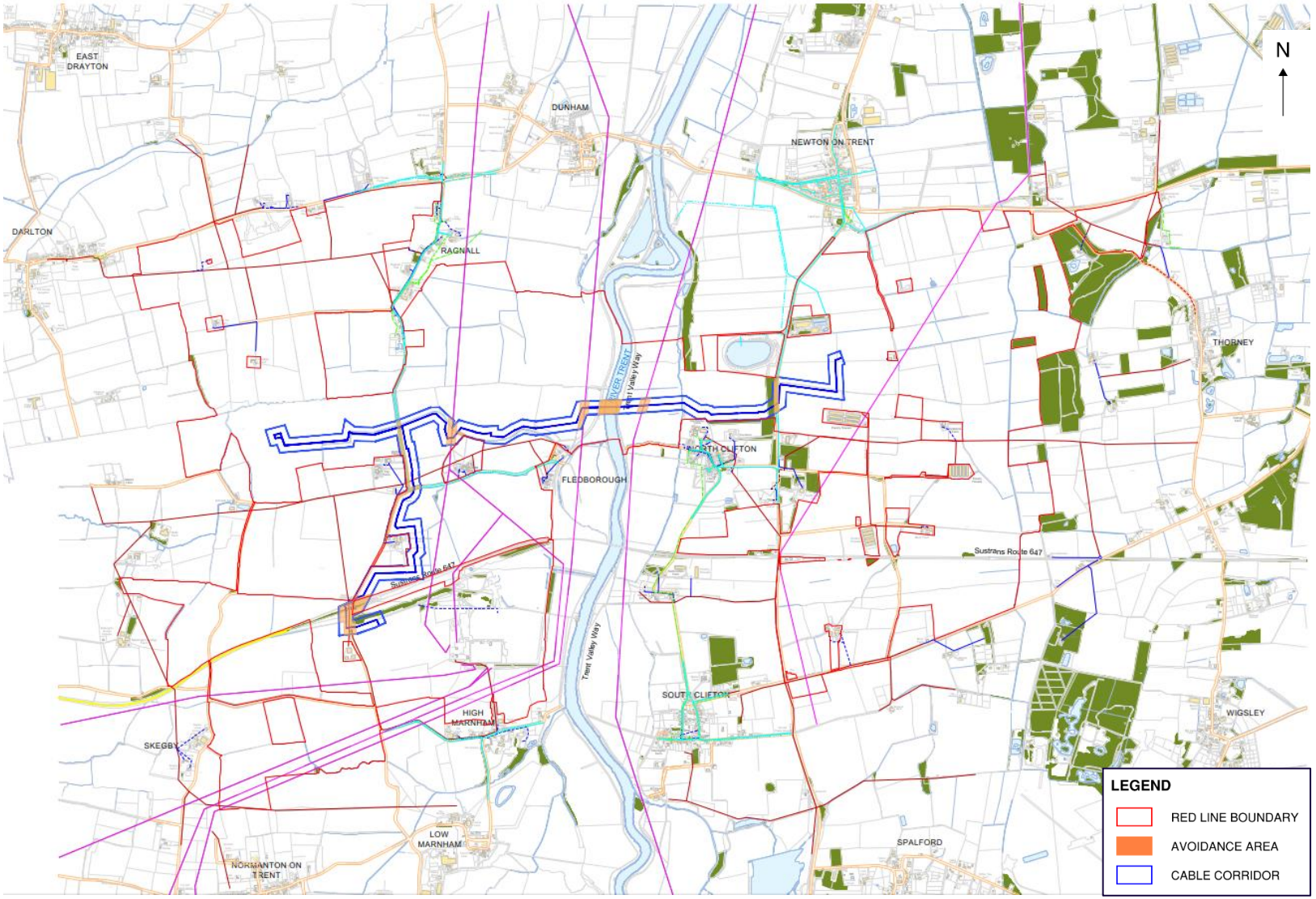




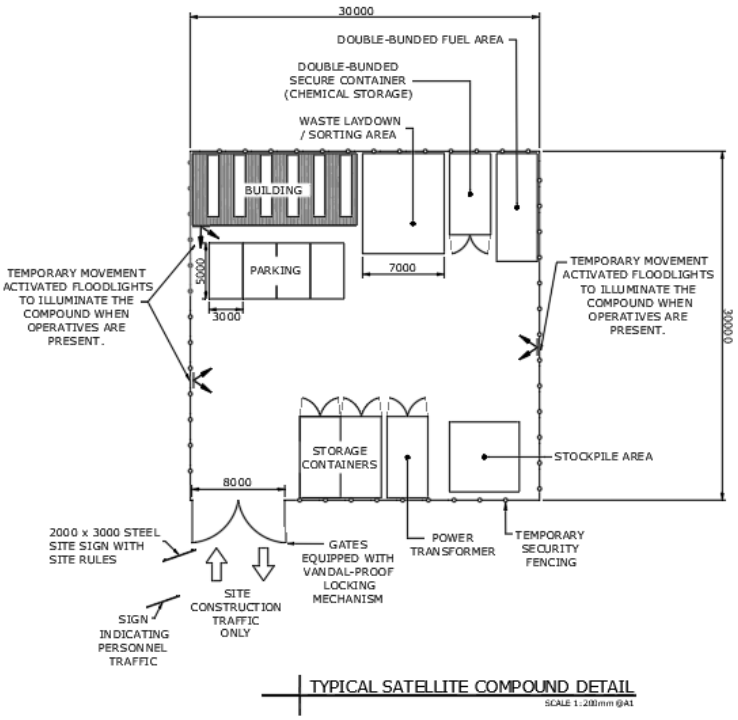
Appendix C Illustrative 25m x 20m Trenchless Launch Pit Layout for a 400 kV Connection

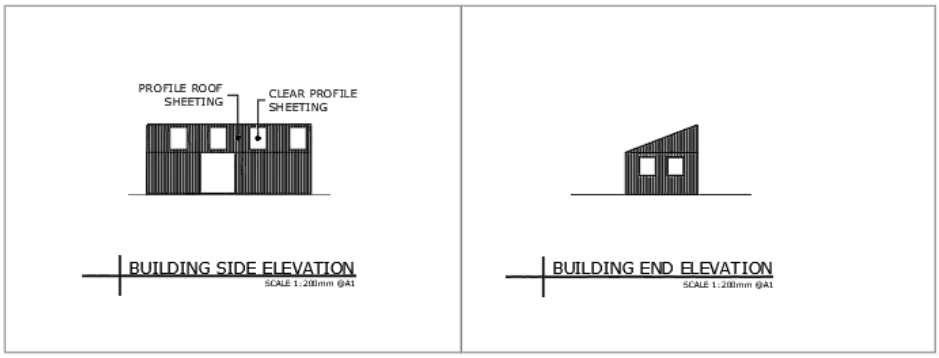


Appendix D Indicative Open Trench Avoidance Areas



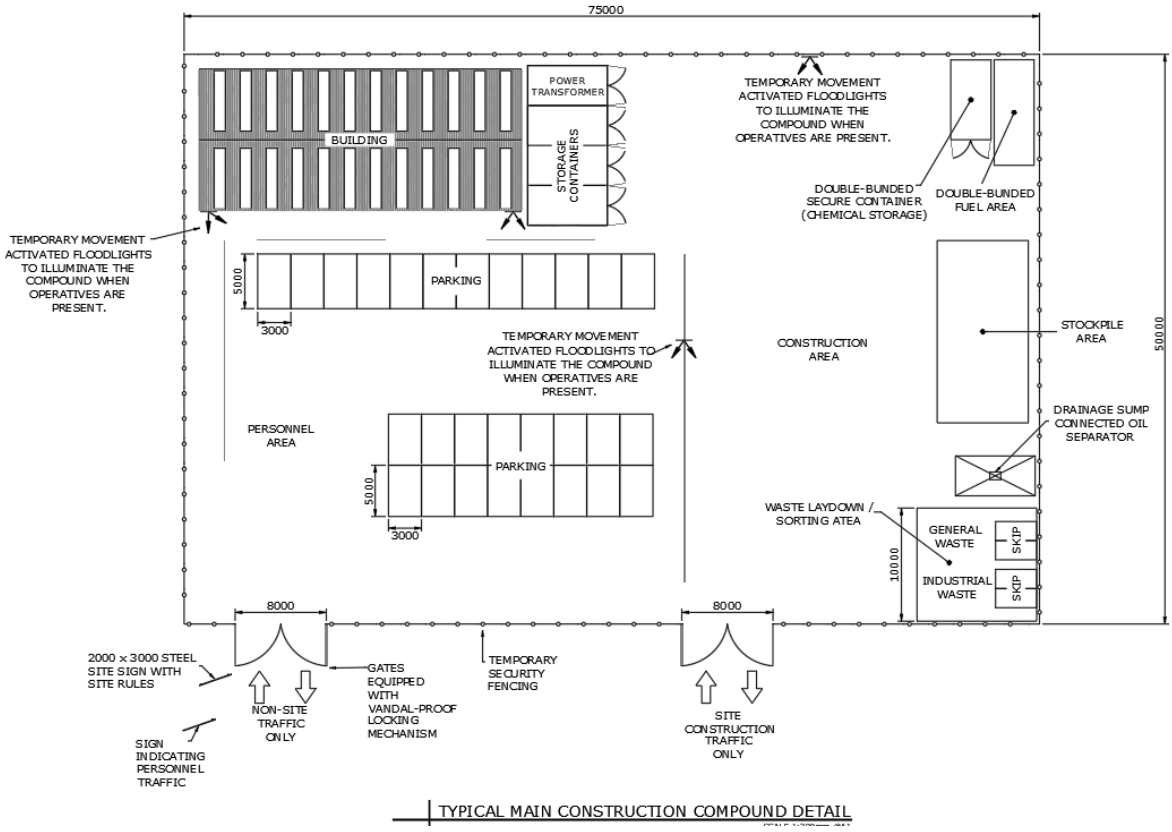
Appendix E Indicative Satellite Compound Typical Detail



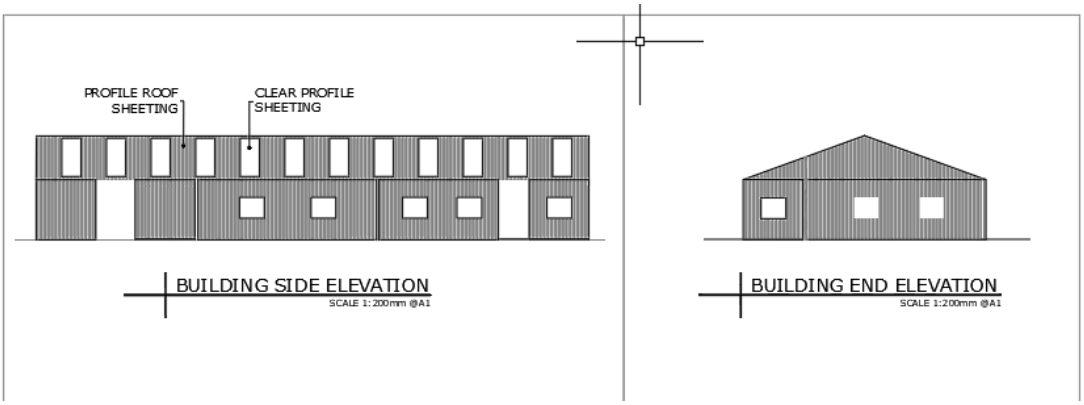


NOT FOR CONSTRUCTION
FOR INFORMATION ONLY

Appendix F Indicative Construction Compound Typical Detail



TYPICAL MAIN CONSTRUCTION COMPOUND DETAIL



BUILDING SIDE ELEVATION
SCALE 1:200mm @A1

BUILDING END ELEVATION
SCALE 1:200mm @A1

NOT FOR CONSTRUCTION
FOR INFORMATION ONLY

one earth

solar farm