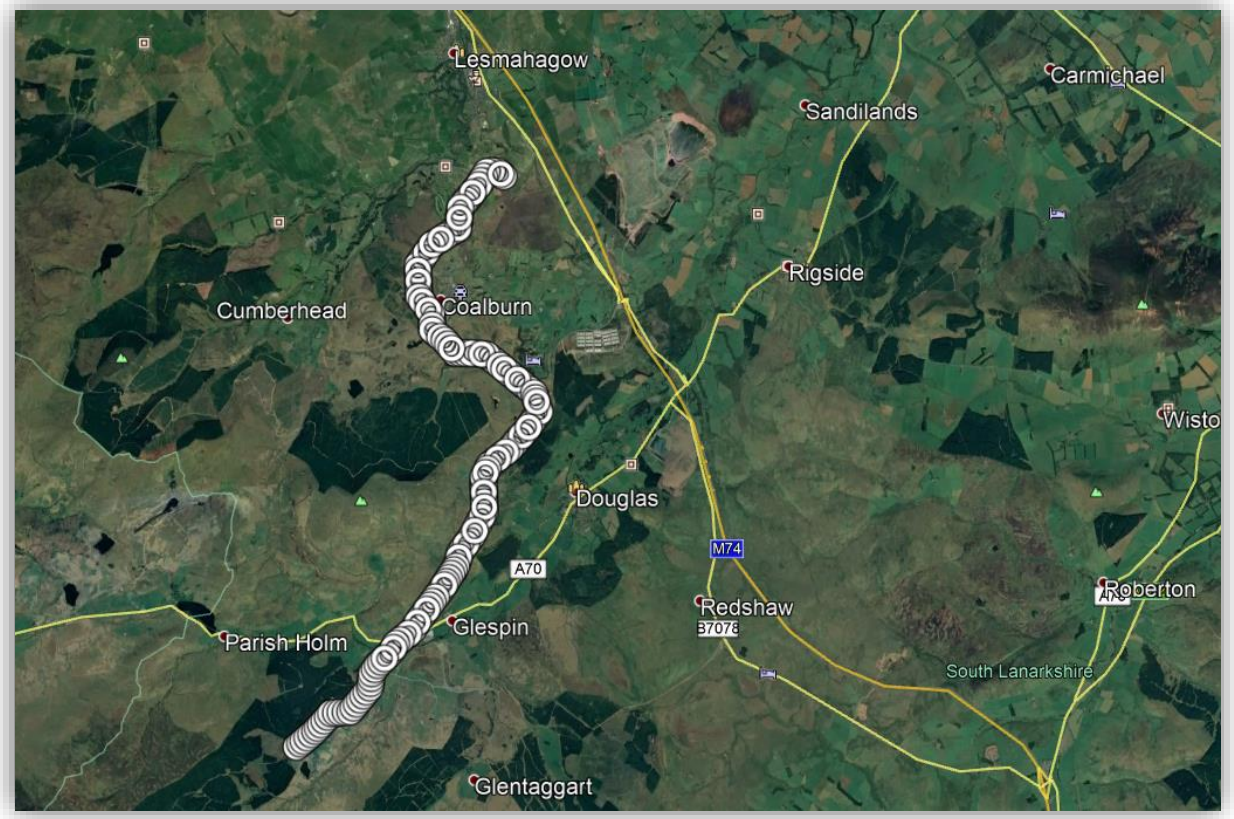
# CONSTRUCTION AND OPERATION METHODOLOGY

## Kennoxhead Windfarm Substation – Coalburn Substation 132kV Overhead Line



# CONSTRUCTION METHOD STATEMENT

## 1. PROJECT OVERVIEW

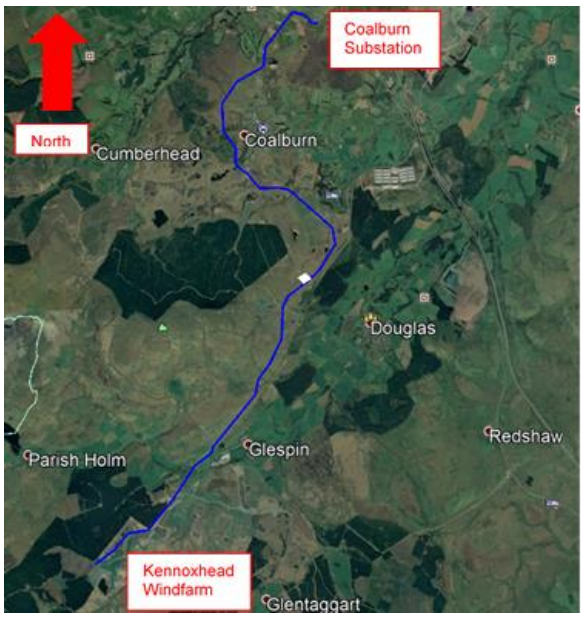
An application has been received from Brookfield Renewable UK Ltd, via NGESO, for a 132kV Point of Connection (PoC) for Kennoxhead Wind Farm (112MW) which is located approximately 14km south of Coalburn 132/400kV substation.

It is proposed to establish a new 132kV switchbay at Coalburn 132/400kV substation.

From here approximately 0.2km of 800mm$^2$ AL XLPE underground cable will be installed before connecting to approximately 16km of Trident wood pole overhead line using Poplar conductor.

Following this another cable section approximately 3.1km of 800mm$^2$ AL XLPE connecting to Kennoxhead Windfarm substation.

At Kennoxhead Windfarm substation, a standard disconnector, circuit breaker, disconnector arrangement will be installed.




All standard Protection & Control works associated shall be installed.

## 2. CONSTRUCTION METHODOLOGY

The process of construction for an overhead line project (OHL) such as the one being constructed between Kennoxhead Windfarm and Coalburn Substation involves several key areas.

This document will highlight the relevant key areas associated with the construction phase and will provide information on typical methodologies to be deployed by the construction teams.

The contractor will be responsible for the timing of all activities and will be required to take account of seasonal influences, such as but not limited to weather, environmental and ecological constraints which will be detailed in the Project Documentation. These include but are not limited to the Traffic

Management Plan, The Environmental Management Plan, Peat Management Plan and all relevant Health & Safety Legislation.

Construction works shall be in compliance with all conditions of consent.

## 2.1 Description of overhead line

The proposed overhead line will be constructed using a twin wood pole structure in a H style formation. Each pole structure will be topped by a galvanised steelwork cross-arm. The steelwork cross-arm will have polymeric insulators (grey plastic) attached, that will carry a single three-phase circuit, which means that the poles will support three conductors strung with 200mm$^2$ AAAC "Poplar" phase conductors for the external phases and 200mm$^2$ AAAC "Poplar" equivalent OPPC phase conductor (fibre-optic telecommunication wire for control purposes) in the middle phase at a maximum operating temperature of 75°C. (Appendix1)

The wood poles will be seasoned and treated with a suitable preservative, resulting in a dark brown appearance. This will weather to a silver/grey colour over a period of approximately five years following installation.

The respective heights of the wood poles will vary in height (including steel work and insulators) in relation to the topography of the land to ensure suitable ground clearance from the conductors or any associated apparatus. The minimum required height clearance for 132kV OHL is 6.7m over normal land and roads, excluding '6.1m high load' routes where 7.5m clearance is required.

The spacing between the poles will also vary, this can range from 60m to 155m with an average span length of 103m to accommodate environmental and technical constraints and variations in topography.

The distance between the poles will be finalised prior to application for consent and will take into account all environmental considerations along the route as well as construction requirements. Stays (guy lines) will be required to provided additional structural stability for poles that are being used to create changes in direction.

# 3. ON SITE CONSTRUCTION WORKS

## 3.1 Project Timeline

To be confirmed.

## 3.2 Site Compound

Establishment of the site compound include the setting up of the contractor's compound and offices for use by the Contractor and Engineers. This includes cabins, stores, welfare facilities and a car park. These are covered under the relevant planning regime (i.e. planning permission or Permitted Development) as appropriate. The typical size of a main CDM hard standing laydown area would be around 80m x 150m. (Appendix 2)

Preparatory works for the temporary site establishments will involve some site clearance work, minor earthworks operations to level the site, drainage works for the car park and service installation.

Due to the size of the project, it is anticipated that other smaller mobile welfare units will be established at different locations along the route.

Services to the site cabins and offices will include electrical, communications, water and sewerage facilities.

The site compounds will to be erected, maintained and subsequently removed in a manner that will have minimum impact on the area and in accordance with the planning regime.

Project Management and Site Operatives will use the site establishment on a daily basis once the facilities are completed, and access is available for personal vehicles and other forms of transport.

Construction plant and materials will be delivered to the site compound however, where appropriate it will be delivered directly to the working areas of the OHL route.

Pole storage will be in a defined bunded area away from any water courses and take into consideration the control of any preservative from the poles which may cause potential contamination.

Typically, this will be by storage on a hard standing area, with a nonpermeable membrane to prevent leaching. This will be agreed with

site management and environmental advisors. These typical storage hardstanding areas will be spread across the route over 3 – 4 locations, with an average size of 50m x 50m. (Appendix 3)

All waste will be stored securely and disposed of through a licensed waste carrier in accordance with waste regulations and the Site Waste Management Plan. The waste hierarchy will be followed to keep waste to a minimum.

### 3.3 Service Diversions

It is possible that some service diversions will be undertaken in advance of the main construction works. This can include already existing distribution and transmission overhead lines & other possible utilities that may obstruct the construction of our new proposed OHL.

Services are either located above or below ground. For works above ground poles, towers or pylons will have to be either temporarily or permanently undergrounded to allow the erection of the Overhead line, e.g. BT line to be undergrounded between pole 139 to 140 which runs parallel to Coalburn Road.

### 3.4 Pre-Construction surveys

Prior to any work commencing on site, environmental, archaeological and topographical surveys will be undertaken to identify any hazards and/or constraints.

The information gathered during these surveys will be used to develop the project environmental, quality and health & safety plans and associated documents. These documents are live documents and will be updated regularly in accordance with the project requirements.

### 3.5 Project Management

The Kennoxhead Line Project will have an extensive project management team who will be responsible for ensuring the project is delivered in line with the consents and permissions obtained to allow the construction to be undertaken. In addition, the management team will ensure the industry best practise standards and guidance is followed where practicable.

## 3.6 Construction Mitigation

In accordance with the Construction (Design and Management) Regulations 2015, construction of the project (and hence management of "construction mitigation") will be detailed in a Construction Phase Plan, prepared by the Principal Contractor. This Plan will then be reviewed by the Principal Designer prior to works commencing.

## 3.7 Pre-works Activities

Prior to the commencement of any construction activities, method statements detailing the particular activities, timetable and working methods which will be undertaken will be written by each contractor and submitted to SPEN for review and comment. This requirement is embedded within the management of health, safety and environmental risk.

## 3.8 General Best Practice

The following best practice measures (Table 1) in relation to the control of mud, noise, vibration, fire and dust are industry expected standards and will be monitored by SPEN.

Table 1: Best Practice Measures

| | Source | Best Practice |
|---|---|---|
| Mud | Access tracks and haul roads – vehicle movements on wet days, excavation works in particular overburden, loading of wet material;<br>Excavations – removal and loading of wet material;<br>Restoration works – unloading of materials, placement of material. | Undertake the construction works such that the generation of mud is minimised at all times, by adopting methods of working that eliminate the potential for mud to be transferred offsite by vehicles leaving the Site. |
| | | Road cleaning or sweeping measures will be implemented to remove any mud deposited on the public highway. |
| Vibration | Access tracks and haul roads – vehicle movements, excavation works in rock material;<br>compaction of road construction materials;<br>Excavations – removal and loading of rock material; | Undertake the construction works such that vibration will be minimized at all times, by adopting methods of working that eliminate the potential for vibration to be detected offsite. |
| | | Disturbance from Vibration is considered to be a minimal risk due to the type of works and remote location. |
| Dust | The prime sources of dust on the site are: Haulage vehicles, both on-site and road licensed;<br>Handling of soils;<br>Overburden and stone;<br>Overburden and site stockpiles;<br>Un-seeded topsoil and subsoil stockpiles;<br>Loading of vehicles (with soil, overburden or stone);<br>Excavation areas; | Operatives should be especially watchful in dry conditions and should either avoid actions likely to generate airborne dust, or alternatively ensure appropriate dust suppression measures are in place prior to commencing operations. The use of water bowsers is proposed as the method for dust suppression, |
| | | Construction works will be undertaken in accordance with industry best practice standards and as such ensure that the generation of dust is minimised at all times. |

| | Source | Best Practice |
|---|---|---|
| Noise | During the construction works the main sources of noise are considered to be:<br><br>Access tracks and haul roads – vehicle movements, excavation works in rock material; compaction of road construction materials<br>Excavations – removal and loading of rock material;<br>Restoration works – placement of rock material. | Undertake the construction works in accordance with The Control of Noise at Work Regulations 2005 such that the generation of noise is minimized at all times. |
| Fire | A fire caused by either a discarded cigarette or by hot works could result in smoke pollution being emitted from the site. | Implementation of a "no smoking" policy whilst in vulnerable areas of the site. Smoking will only be permitted within designated areas where all discarded cigarettes can be extinguished in a safe and proper manner. |
| | | Hot works will only be permitted where a "Hot Works Permit" has been allocated for that specific task. |
| | | An Emergency Response Procedure will be produced prior to construction commencing which will details the procedures to be carried out in the event of an emergency occurring, including a fire. |

## 3.9 Activity Specific Environmental Controls

The environmental and ecological risks specific to the route and work activities have been identified by SPEN and control measures have been developed and documented. Table 2 outlines the environmental risks associated with work activities and the documentation that outlines the approach/controls to be adopted by contractors. These documents are in addition to general best practice as outlined above and will include a constraints plan that will be produced for construction, identifying sensitivities and appropriate steps to be taken (fencing off/identifying on ground where necessary in liaison with ecologist).

| Table 2 Summary of activities, associated environmental risks and SPEN documentation | | | |
|---|---|---|---|
| **Stage** | **Activities** | **Environmental Risks** | **SPEN Document** |
| Felling | Felling and Mulching | Protected and notable species (UK and EPS) | Ecological Management and Mitigation Plan.<br>Breeding Bird Protection Plan. |
| | | Private Water Supplies | Private Water Supply Risk Assessment. |
| | | Public Water supplies | Pollution Prevention Plan. |
| | | Surface water | Surface Water Monitoring Strategy. |
| | | Watercourse crossings | Watercourse Assessment. |
| | | Waste Management | Environmental and Quality Management Plan. |
| | | Peat Management | Method Statement for Temporary Peat Storage and Removal. |
| | | Biosecurity | Environmental and Quality Management Plan.<br>Biosecurity, American Signal Crayfish. |
| | | Ground Water Dependent Terrestrial Ecosystem (GWDTE) | Ground Water Dependant Terrestrial Ecosystems (GWDTE) Strategies. |
| | | Contractor handover - Environmental Handover | Environmental Site Information Handover. |
| Construction | Temporary Access Roads - Cut and Fill | Surface water | Surface Water Monitoring Strategy. |
| | | Ground Water Dependent Terrestrial Ecosystem (GWDTE) | Ground Water Dependant Terrestrial Ecosystems (GWDTE) Strategies. |
| | | Peat Management | Method Statement for Temporary Peat Storage and Removal. |
| | | Protected and notable species (UK and EPS) | Ecological Management and Mitigation Plan.<br><br>Breeding Bird Protection Plan. |
| | | Private Water Supplies | Private Water Supply Risk Assessment. |
| | | Public Water supplies - | Pollution Prevention Plan. |
| | Culverts | Watercourse crossings | Watercourse Assessment. |
| | | Surface Water | Surface Water Monitoring Strategy. |
| | | Fisheries | Ecological Management and Mitigation Plan. |

| | | | |
|---|---|---|---|
| | | Biosecurity | Environmental and Quality Management Plan.<br>Biosecurity, American Signal Crayfish |
| | | Protected and notable species (UK and EPS) | Ecological Management and Mitigation Plan.<br>Breeding Bird Protection Plan. |
| | Establishment of working areas, excavation and pole installation | Ground Water Dependent Terrestrial Ecosystem (GWDTE) | Ground Water Dependant Terrestrial Ecosystems (GWDTE) Strategies. |
| | | Private Water Supplies | Private Water Supply Risk Assessment. |
| | | Public Water supplies | Pollution Prevention Plan. |
| | | Surface Water | Surface Water Monitoring Strategy. |
| | | Protected and notable species (UK and EPS) | Ecological Management and Mitigation Plan.<br><br>Breeding Bird Protection Plan. |
| | | Waste Management | Environmental and Quality Management Plan. |
| | | Peat Management | Method Statement for Temporary Peat Storage and Removal. |
| | Stringing | Protected and notable species (UK and EPS) | Ecological Management and Mitigation Plan.<br><br>Breeding Bird Protection Plan. |
| | | Private Water Supplies | Private Water Supply Risk Assessment. |
| | | Watercourse crossings | SWS BCD Watercourse Assessment. |
| | | Waste Management | Environmental and Quality Management Plan. |
| | | Biosecurity | Environmental and Quality Management Plan.<br><br>Biosecurity, American Signal Crayfish. |
| | | Earthworks (GWDTE) | Water Dependant Terrestrial Ecosystems (GWDTE) Strategies. |
| | | Public Water supplies | Pollution Prevention Plan. |
| | | Surface Water | Surface Water Monitoring Strategy. |

### 3.10 Access and enabling works

To facilitate the access to the site at various locations along the OHL route it will be necessary to install temporary roads by methods of Trackway/Terrafirma panels or stone roads, bellmouths and working areas as part of the overall infrastructure. This will be detailed in the Proposed Overhead Line Alignment / Cable Route & Temporary Accesses drawing.

The installation of stone roads is typically achieved by the using predominately crushed stone placed on a synthetic geotextile membrane or grid (Appendix 4). It is also possible that some areas may be accessed utilising Trackway panel installation where possible as this is a less invasive form of access routing (Appendix 5). Temporary stone roads will be used to access main laydown areas (3/4 areas throughout the OHL) and at the main CDM compound.

To facilitate the access from the public road into the site, bellmouths will be required when accessing into some locations e.g. Pole 139 & 140 off Coalburn Road (Appendix 6). This will be detailed in the Proposed Overhead Line Alignment / Cable Route & Temporary Accesses drawing.

The bellmouths will be designed in accordance with the approved Traffic Management Plans.

Initial site investigation works will be undertaken to establish the make-up of the ground and its bearing capacity.

The initial objective is to establish a base surface which establishes a route profile which is appropriate to the type of vehicles anticipated to utilise the road.

Dependant on the design which is created utilising the site investigation works; the road will be built up in layers typically on compacted crushed stone placed on a synthetic geotextile membrane or grid.

The road depth and width will vary depending on the type of vehicle's intended to utilise the roads, they will be typically 3.5m wide and 150mm in depth.

Some roads will be wider in places to accommodate passing places located at a suitable frequency to provide a line of sight between passing places. These passing places can be constructed by trackway panels or upgrading existing access tracks (Appendix 7) This will be detailed in the Proposed Overhead Line Alignment / Cable Route & Temporary Accesses drawing.

**Road Maintenance.**
Inspection works, and maintenance is proposed for all roads used by construction traffic. Routine maintenance will include works such as surface rehabilitation, drainage works, safety barrier works, structural inspections and repairs. All of these may require traffic management measures to be implemented to ensure the safety of the workforce and road users during the works.

Winter maintenance will involve gritting and snow clearing to ensure the road surface is safe to drive on.

The main items of plant required for the Road Construction / Maintenance activities will include but is not limited to:

- Crawler tractors with scrapers for cut / fill operations
- Bulldozers to grade banks in cuttings
- Front loading bucket excavators and dump trucks in cuttings
- Bulldozers with ripping blades or tracked excavators with a hydraulic breaker for rock excavations
- HGV Lorries for off-site disposal of unsuitable and surplus
- Bulldozers to layer and grade soil deposited in embankments
- Smooth or vibrating rollers to compact the fill in layers
- Motor graders to plane and trim the formation
- Temporary Works

## 3.11 Temporary Works

Temporary works are generally described as the parts of a construction project that are needed to enable the permanent works to be undertaken. Usually the temporary works are removed after use; however, items such as environmental mitigation or drainage may be required to be left permanently, particularly where they result in betterment for the natural/environmental surroundings, and at the request of the landowner as long as they obtain the necessary consents.

These Temporary Works may include:

- Scaffold erection – Road crossings, Existing distribution/Telecom crossings (Appendix 8)
- Formwork – i.e. Cattle grid install (if required to upgrade an existing access track)

- Excavations – i.e. Smart ditch (if a watercourse was required to be diverted under licence) – (Appendix 9)
- Temporary support systems – i.e. Trench Shoring for unstable ground, if required at terminal poles where cable is to be installed. (Appendix 10)
- Temporary Bridges (Appendix 11)
- Culverts (Appendix 12)
- Access - Temporary stone access tracks into main CDM/laydown areas may require temporary drains/ditches to divert surface water. This will be controlled by installation of French/Carrier drains with outlets into existing ditches or newly constructed ditches with sediment/check dams if required, filter drains with temporary settlement and storage ponds if required (Appendix 13)

Temporary traffic management will be in place during construction at works on private and public roads and at site access and egress points.

Such measures will include combinations of the following:

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

### 3.12 Tree felling and removal

Tree clearance may be required to be undertaken along the route of the OHL to create the necessary wayleave corridor. In practice this requires felling to a wind firm edge and will involve felling identified tree blocks. Landowner agreement will be reached for this and in most cases private felling licenses are already in place.

This will be a mixture of commercial mechanical harvesting, and hand felling.

## 3.13 Temporary Fencing

The land area occupied by the works will be identified accurately on the ground by surveying and installing appropriate pegs and posts, prior to the works commencing. The area defined will be the area of land acquired through the landowner consent process and any other areas the contractor has acquired by agreement to facilitate construction of the works due to their own method of working.

This will involve the installation of temporary fencing where it is necessary by project needs, for example at areas where land will be returned to agriculture following completion of the works, or if the contractor considers that there is a safety issue or risk of damage to the permanent works during construction.

Temporary fencing will generally be a post and wire type.

Other specific fencing that may be required temporarily will include silt/sediment fences to prevent sediment from reaching watercourses (Appendix 14) and higher security fences at compounds or where additional security of the works is required.

## 3.14 Construction methods for wood pole overhead line erection

The following process would be followed for the erection of a wood pole overhead line:

- Access, delivery and assembly would be taken using a tracked excavator and low ground-pressure vehicles (e.g. tractor, Argo cat, quad bikes). In certain situations, Helicopters may be used for pole delivery to point of installation. Helicopter delivery would involve flying the poles from a main laydown area to the pole position, ready for installation by excavators. This reduces the number of trips back and forth by other means of machinery, reducing land damage (Appendix 15).
- Bog mats and temporary track mats would be used to cross soft ground where existing access tracks are not available.
- Excavators may need to create a level pad to work from which would be reinstated upon completion.
- Turf and topsoil would be removed together to retain the turf root system and placed separate for later reinstatement. A Peat management plan from the OHL contractor will be a mandatory

requirement before construction begins and will form part of their Construction Environmental plan, which will require approval in writing by the Planning Authority. E.g. The aim to reinstate areas as soon as practically possible. Vegetation and the topsoil seed bank will be removed and stored carefully for use in restatement works etc.

- A hole would be excavated to allow the pole, brace block and/ or steel foundation braces to be positioned in place. A typical pole excavation is $3m^2$ x 2m deep with a maximum excavation of 3m depth.
- The excavated material is then sorted into appropriate layers and used for backfilling.
- The poles are erected using normal agricultural machinery such as a digger with a lifting arm.
- The excavator(s) would then hoist the assembled structure into position and, once the structure has been braced in position, the trench is backfilled. (Appendix 16).
- The hole would be backfilled with soil replaced in reverse order to the order it was excavated to ensure environmental continuity.
- Backfilling would be progressed in layers of approximately 300 – 400 mm deep, with stone hard core added as required around foundation blocks to ensure adequate compaction and suitable geotechnical conditions are maintained between each layer.
- When replacing the topsoil/turf around the pole it would be left slightly proud of ground level (approximately 150/ 300 mm) to allow for the excavation to naturally compact further through time.
- It is anticipated that all material excavated for the installation of the poles and stays would be used in backfilling the excavations.

## 3.15 Method for overhead line conductor stringing

On completion of the pole structure erection in a given section of the overhead line, the installation of the overhead line conductors can commence.

The conductor drums and associated installation plant will be transported to the site from the site compound.

Each pole type will have different requirements in terms of plant and equipment; typically, a line or intermediate pole would require a small

amount of plant and equipment whereas a tension or terminal pole would require significantly more.

### Tension or Terminal Poles

Typically, a conductor winch, conductor drums & tensioner will be located at each end of the section of the overhead line that is getting strung whether it be a tension or terminal Pole. Additionally, mobile elevated working platforms, conductor fittings, mechanical presses and insulators will be required at these locations. Additional Trackway panel/Stone road installation maybe required at these locations, to provide a suitable working platform (Appendix 17).

### Line Poles

At line pole locations only the running out blocks, insulators and conductor fittings are required. A mobile elevated work platform may also be required.

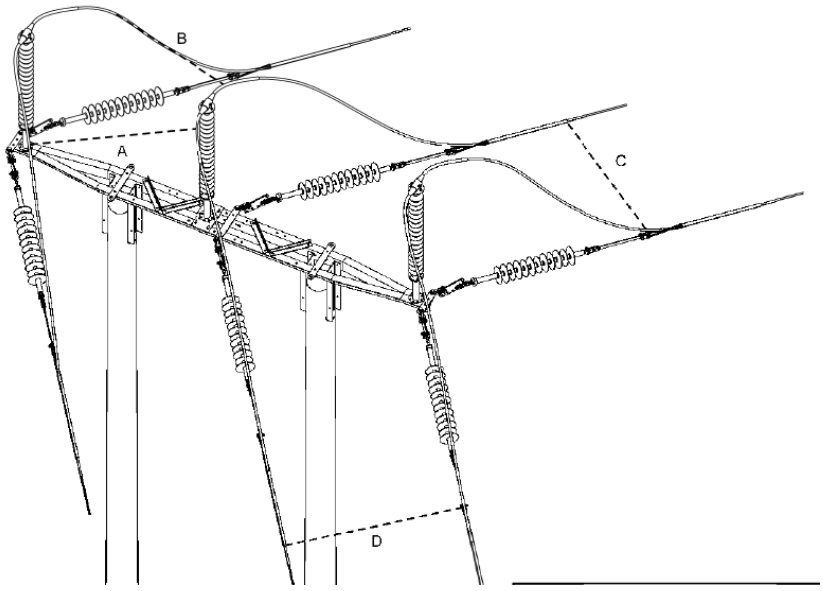
## 3.16 Commissioning

Overhead line commissioning is generally confined to inspection of the installation works, each pole will be independently inspected, and a report submitted to the project manager. A snagging list of any reported detail will be compiled and rectified before the line is commissioned.

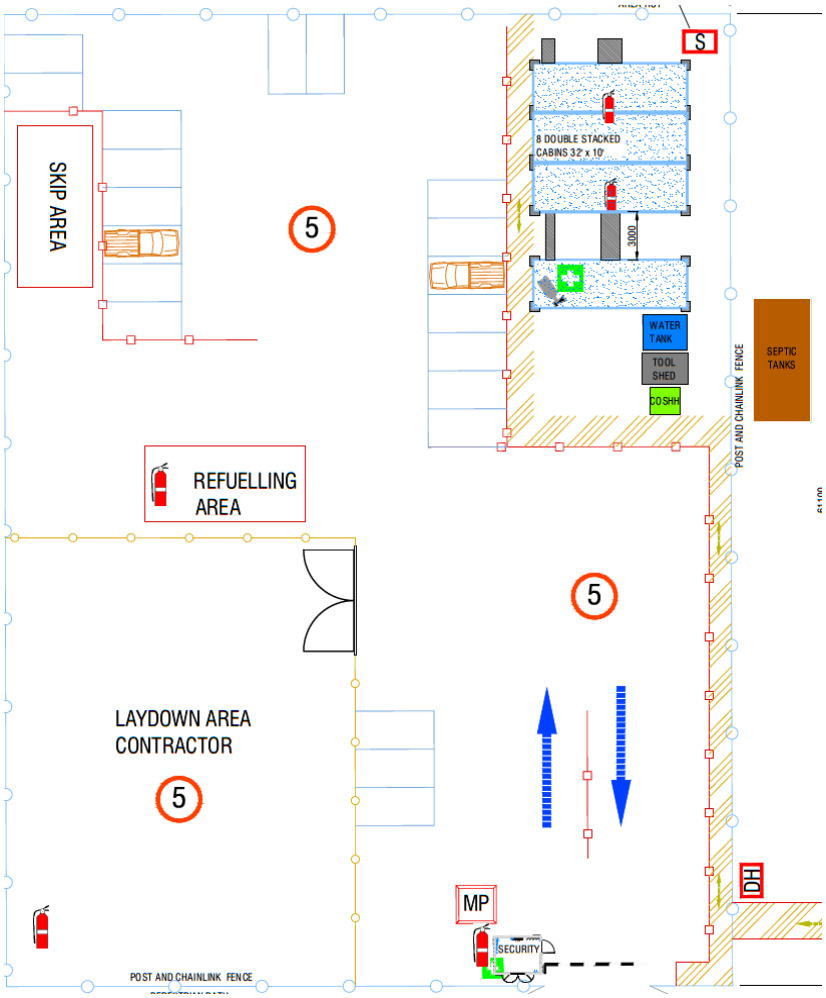
## 4. Appendices

- **Appendix 1 -** Typical 132kv Wood Pole Overhead line

**132kV Section Angle Pole**



- **Appendix 2** – Typical CDM setup on hard standing with parking facilities & illustration of a typical detailed plan.

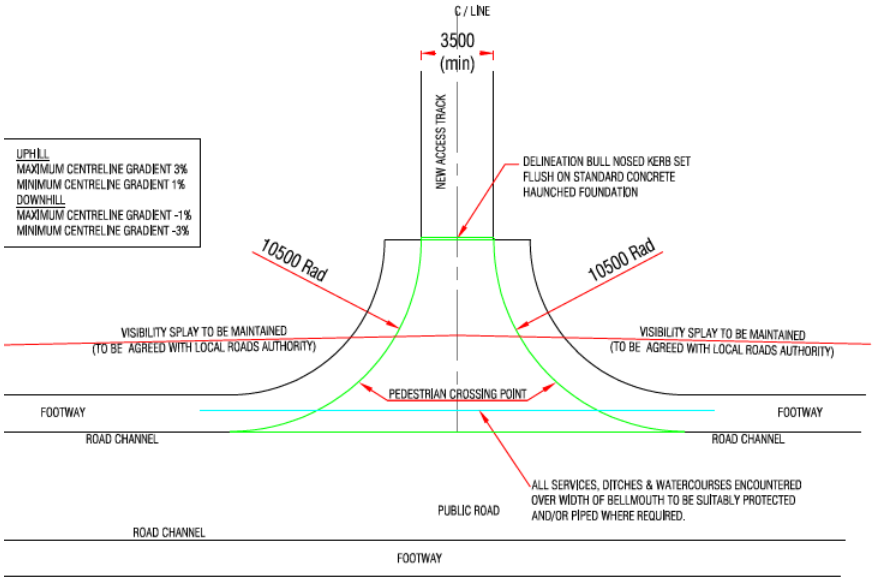


- **Appendix 3** – Pole storage on a hard standing area, with a nonpermeable membrane with sand to prevent leaching.

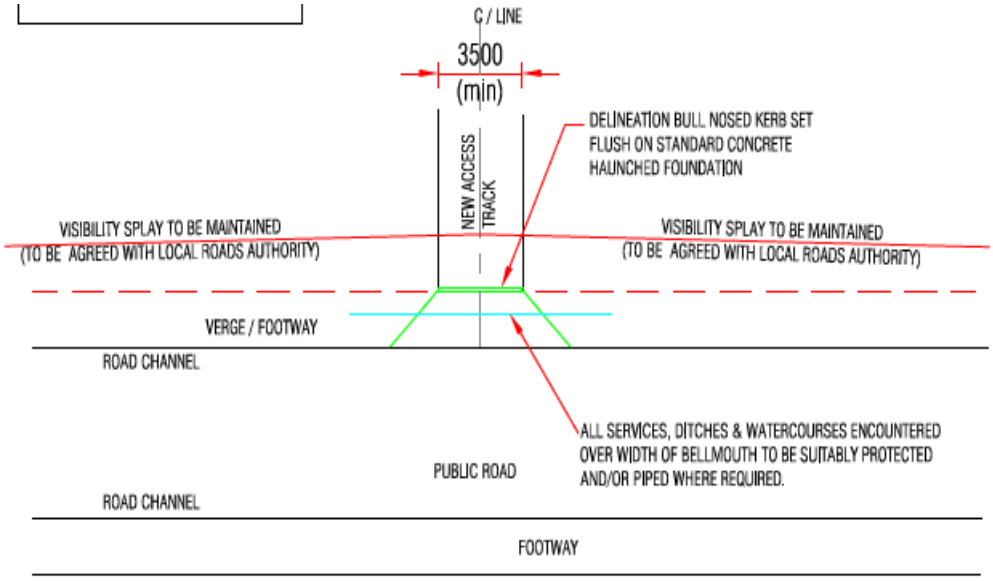
- **Appendix 4** - Stone road installation using geomembrane

- **Appendix 5** – Trackway Panel/Terrafirma Installation

- **Appendix 6** – Typical Bellmouth Layout at Junction with Public Road/Footway & Alternative

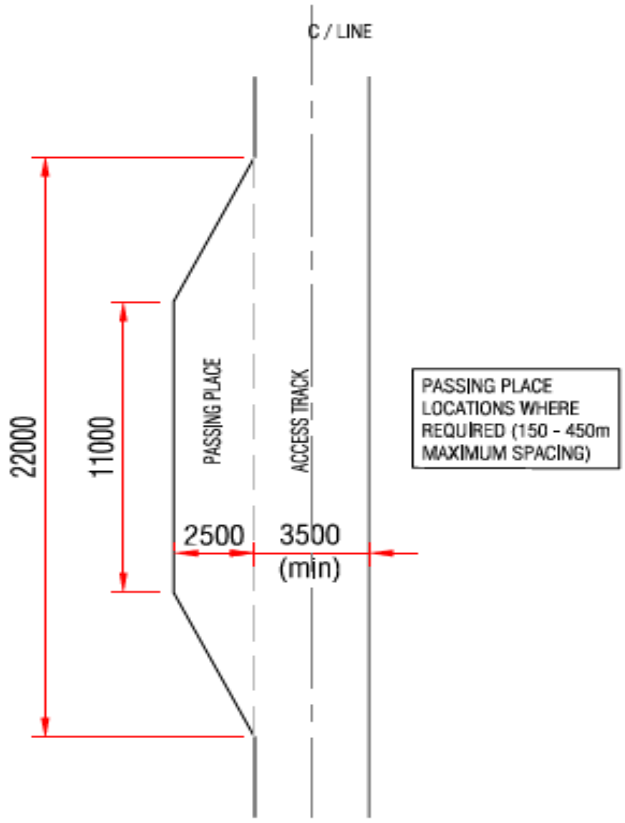



TYPICAL BELLMOUTH LAYOUT AT JUNCTION WITH PUBLIC ROAD/FOOTWAY
SCALE 1 : 200




TYPICAL BELLMOUTH LAYOUT AT JUNCTION WITH PUBLIC ROAD/FOOTWAY (ALTERNATIVE)
SCALE 1 : 200

- **Appendix 7** – Typical Access Track Passing Place Layout

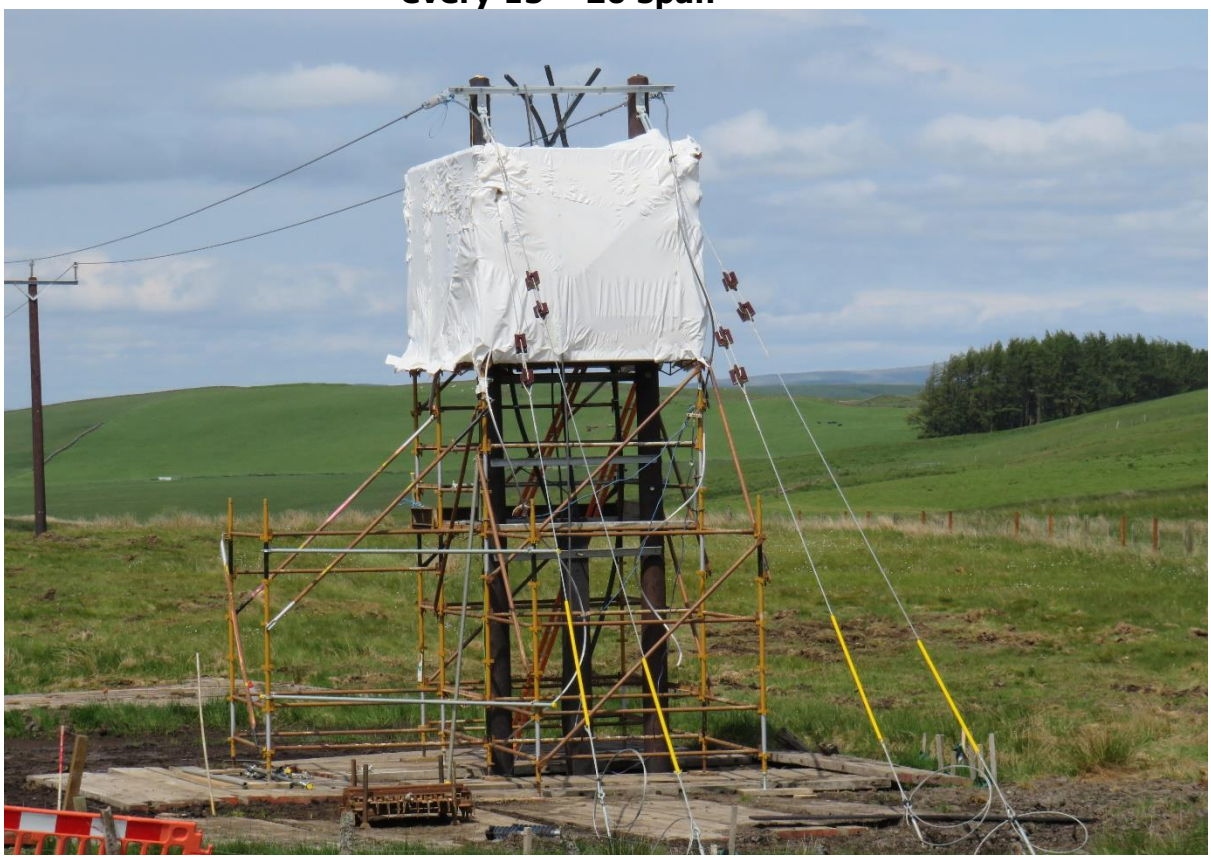



TYPICAL ACCESS TRACK PASSING PLACE LAYOUT
SCALE 1 : 200

- **Appendix 8** – Illustration of a scaffolding setup for a road/access track crossing

Illustration of a Scaffolding setup for Distribution/Transmission/Telecom crossing

**Scaffolding Encapsulation for OPPC enclosure (fibre jointing) every 15 – 20 span**



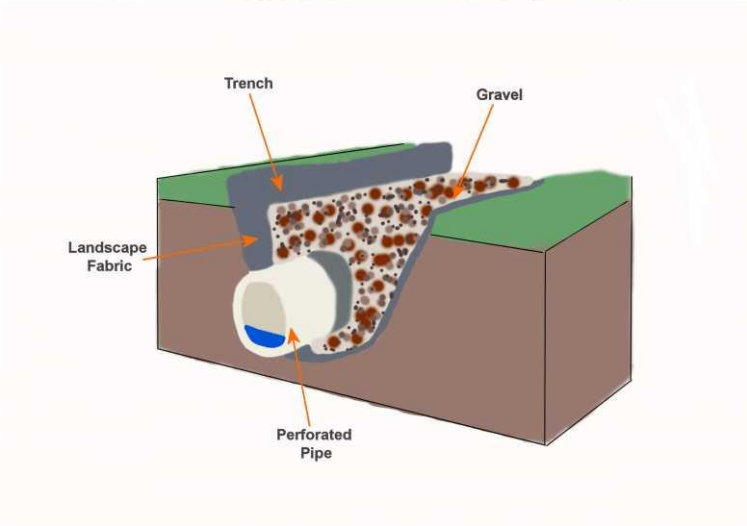
- **Appendix 9** – Illustration of a Smartditch if a watercourse was required to be diverted due to construction difficulties under local planning regime/licence.

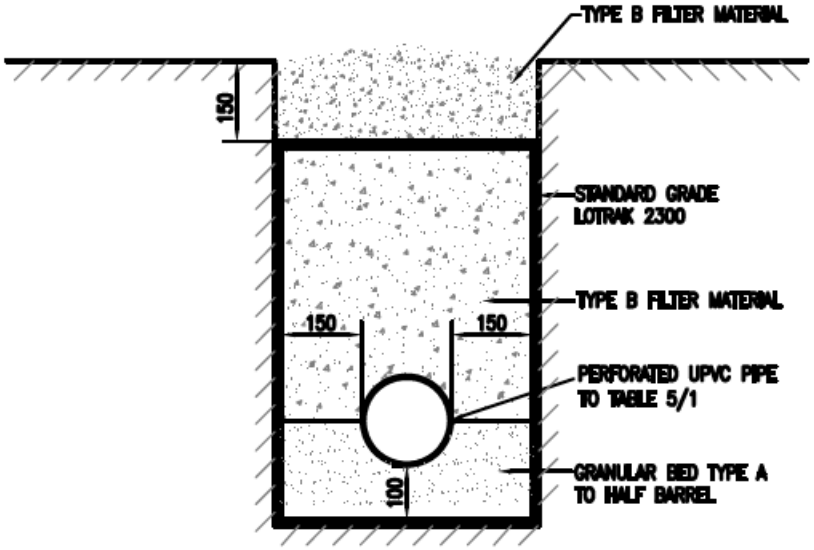
- **Appendix 10 –** Temporary support systems i.e. Trench Shoring

- **Appendix 11 –** Temporary Bridges

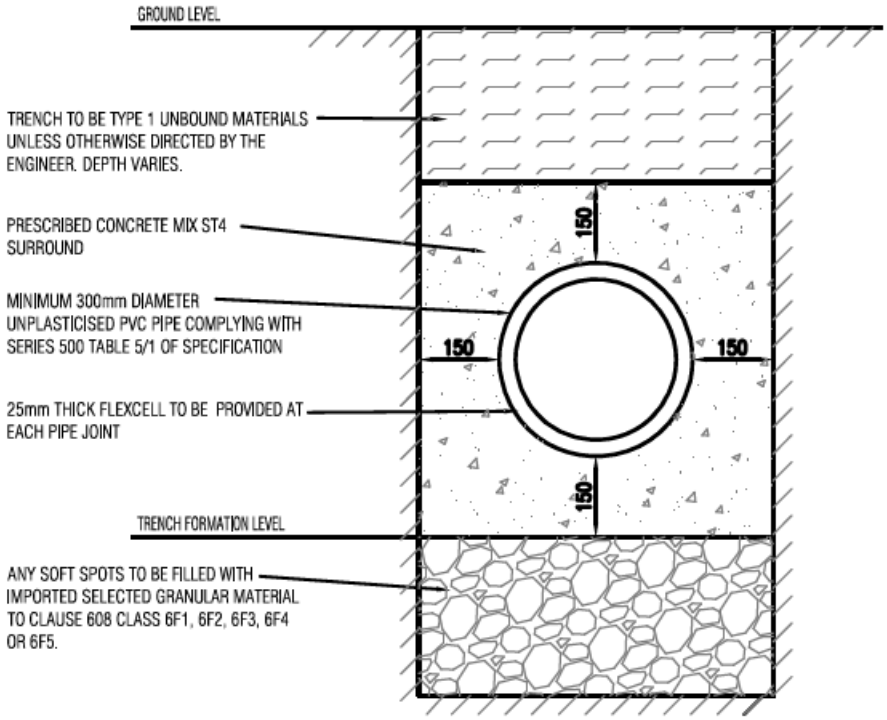
- **Appendix 12 –** Illustration of Culverts

- **Appendix 13 –** Illustration of French/Carrier drains, Sediment/Check dams, ditches, Filter drains & temporary settlement and storage pond



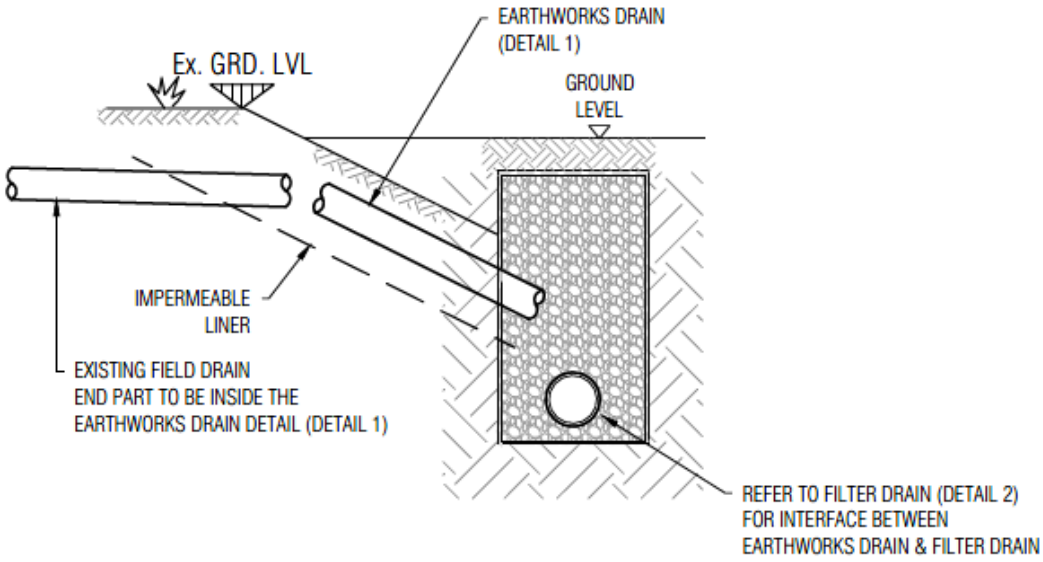




TYPICAL FRENCH DRAIN DETAIL (if required)




TYPICAL DETAILS OF PIPE REPLACING DITCHES UNDER PASSING PLACES AND ROAD JUNCTIONS

SCALE = 1:10




SECTION THROUGH EARTHWORKS DRAIN / FILTER DRAIN

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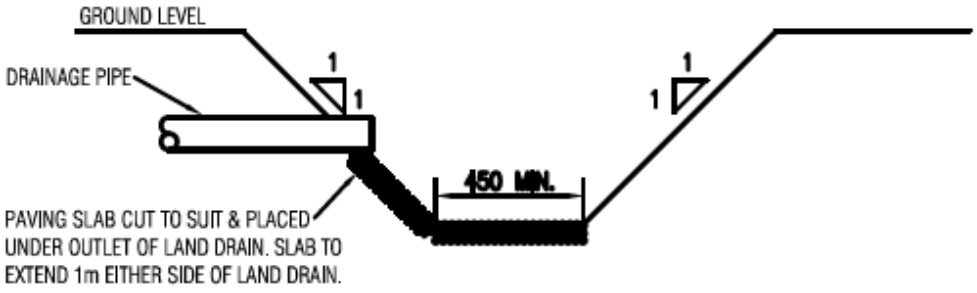
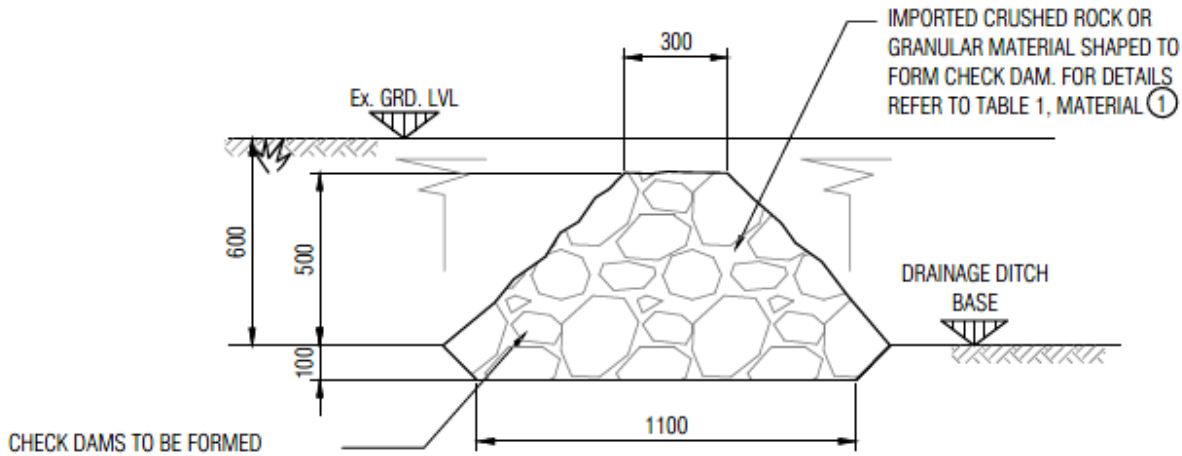



TYPICAL DETAIL AT OUTLET INTO DITCH

SCALE 1:20

## Sediment/Check dams




CHECK DAM DETAIL

(SCALE 1:20)

**Construction of temporary settlement/SUD pond**

- **Appendix 14 –** Illustration of silt fencing

## **Appendix 15 –** Pole delivery by Helicopter

- **Appendix 16** – Pole erection by tracked excavator(s) – *Please note this picture is for illustration purposes only. This is not Trident construction*

- **Appendix 17** – Conductor drums & tensioner at terminal/tension location