EIS Volume 1 Chapter 7

Project Description

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7. Project Description

7.1. Introduction

This chapter describes the key elements and activities of the Project. These details have been used as the basis for determining the potential impacts of the Project (see Chapters 9 to 19). This chapter presents several options and scenarios in order to :

- allow for conservative environmental and social assessment
- provide flexibility for detailed design, operational change and continual improvement without compromising the ability to mitigate potential negative impacts and enhance positive impacts of the Project.

Where relevant, the environmental and social impact assessments presented in Chapters 9 to 19, assess the more conservative scenarios. For example, the tallest tower option has been assessed for visual impact assessment and the maximum vegetation clearance option assessed for ecology impacts. ElectraNet and its selected engineering, procurement and construction contractor (EPC) will endeavour to reduce environmental disturbance as far as possible using alternative design and construction techniques (subject to technical and financial feasibility, workforce and public safety and the quality and reliability of the infrastructure).

7.2. EIS Guidelines

The EIS Guidelines require a description of the proposal as set out in Table 7-1.

Table 7-1: EIS Guidelines addressed in the Project Description chapter

EIS Guidelines and Assessment Requirements	Assessment level
General Requirements	
Description of the Proposal • The nature of the proposal and location • A project plan to outline objectives, constraints, key activity schedule and quality assurance • Site layout plans (including indicative land division plan, if relevant) • The construction and commissioning timeframes (including staging) • Details of all buildings and structures associated with the proposed development • Details of any other infrastructure requirements and availability • Details of the construction methods to be used • Details on the operation of the proposed development, including proposed maintenance programs • A contingency plan for delays in construction	
Hazard Risk *Assessment Requirement 10:* The construction and operation of a high voltage powerline involves a range general and specific risks.	
• 10.3: Describe any hazardous materials, with reference to storage, use, handling and disposal of these materials during construction and operation.	Medium
Alternatives *Assessment Requirement 11:* There are a number of alternatives that require exploring	
• 11.3 Identify alternative design and construction techniques to meet the proposed objectives (e.g. undergrounding, tower design and placement), with reference to any hazards / risks and the social, environmental and economic advantages and disadvantages of each.	Medium
Traffic Effects *Assessment Requirement 14*: The proposal requires access for the transportation of infrastructure and construction material to site and ongoing access for maintenance purposes.	

<table>
<tr><th>EIS Guidelines and Assessment Requirements</th><th>Assessment level</th></tr>
<tr><td>• 14.1 Describe all components of transport and storage of infrastructure (including towers and substation kit) and construction materials to site. Include reference to anticipating timing, sources of materials, routes, number and methods of transport (e.g. by shipping, vehicle and/or helicopter).</td><td>Standard</td></tr>
<tr><td colspan="2">Construction, Operation and Maintenance Effects
Assessment requirement 15: The construction and operation of the proposal would require a range of impacts to be minimized, mitigated and monitored through an environmental management plan framework</td></tr>
<tr><td>• 15.1: Describe construction techniques and the timing of construction, with reference to any climatic and temporal implications for the biophysical environment. This should include reference to potential land degradation, pollution and implications for the breeding seasons of native species.</td><td>Standard</td></tr>
<tr><td>• 15.2: Outline the sources of waste and methods of disposing waste material, including reference to management of vegetation removed, indication of temporary and final locations for spoil and other waste and the possibilities for reuse or recycling of all waste streams. Provide details of a waste management plan.</td><td>Standard</td></tr>
<tr><td>• 15.5: Describe sources of water for construction, including for the construction worker's accommodation camps, concrete batching plant and dust suppression.</td><td>Standard</td></tr>
<tr><td>• 15.9: Outline the approximate size of the construction workforce including any need for any construction workers camps or accommodation. Describe the location and management of accommodation camps including sources of water and power, and the management of waste, wastewater and noise impacts.</td><td>Standard</td></tr>
<tr><td>• 15.10: Outline any on site infrastructure required during construction (e.g. borrow pits, site compounds, concrete batching facilities etc.) including the management and decommissioning of these areas.</td><td>Standard</td></tr>
<tr><td>• 15.11: Describe the location(s) where mobile concrete batching plants would be used and the management of wastewater, dust emissions and noise from such plant.</td><td>Standard</td></tr>
<tr><td>• 15.12: Describe the rehabilitation of the areas needed for construction including lay down, concrete batching and construction worker's accommodation areas.</td><td>Standard</td></tr>
</table>

Aspects of assessment requirements identified in Table 7-1 above which are not addressed in this chapter are listed in Table 7-2 together with the applicable chapter.

Table 7-2: Aspects of assessment requirements addressed in other chapters

Assessment Requirement	Chapter
10.3 Storage, use, handling and disposal of hazardous materials during construction and operation.	Chapter 10 Physical Environment
11.3 Outline of alternative construction methods	Chapter 3 Alternatives to the Project
15.1 Potential land degradation and pollution	Chapter 10 Physical Environment
15.1 Implications of construction timing and technique for native species breeding seasons	Chapter 11 Flora and Fauna
15.2 Soil stockpiling and management	Chapter 10 Physical Environment
15.2 Outline the sources of waste and methods of disposing waste material	Chapter 19 Waste Management
15.9 Management of soil, waste, wastewater from construction camps	Chapter 10 Physical Environment
15.9 Noise impacts from construction camps	Chapter 15 Noise and Vibration
15.9 Size of the construction workforce and any need for any construction workers camps and accommodation	Chapter 17 Socio-Economic Environment
15.9 Waste from construction camps	Chapter 19 Waste Management
15.11 Management of wastewater from concrete batching	Chapter 10 Physical Environment
15.11 Management of dust emissions from concrete batching	Chapter 14 Air Quality

Assessment Requirement	Chapter
15.11 Management of noise emissions from concrete batching	Chapter 15 Noise and Vibration
15.12 Rehabilitation of areas needed for construction	Chapter 10 Physical Environment

7.3. Overview of the Project

As discussed in Chapter 1 Introduction, the Project comprises:

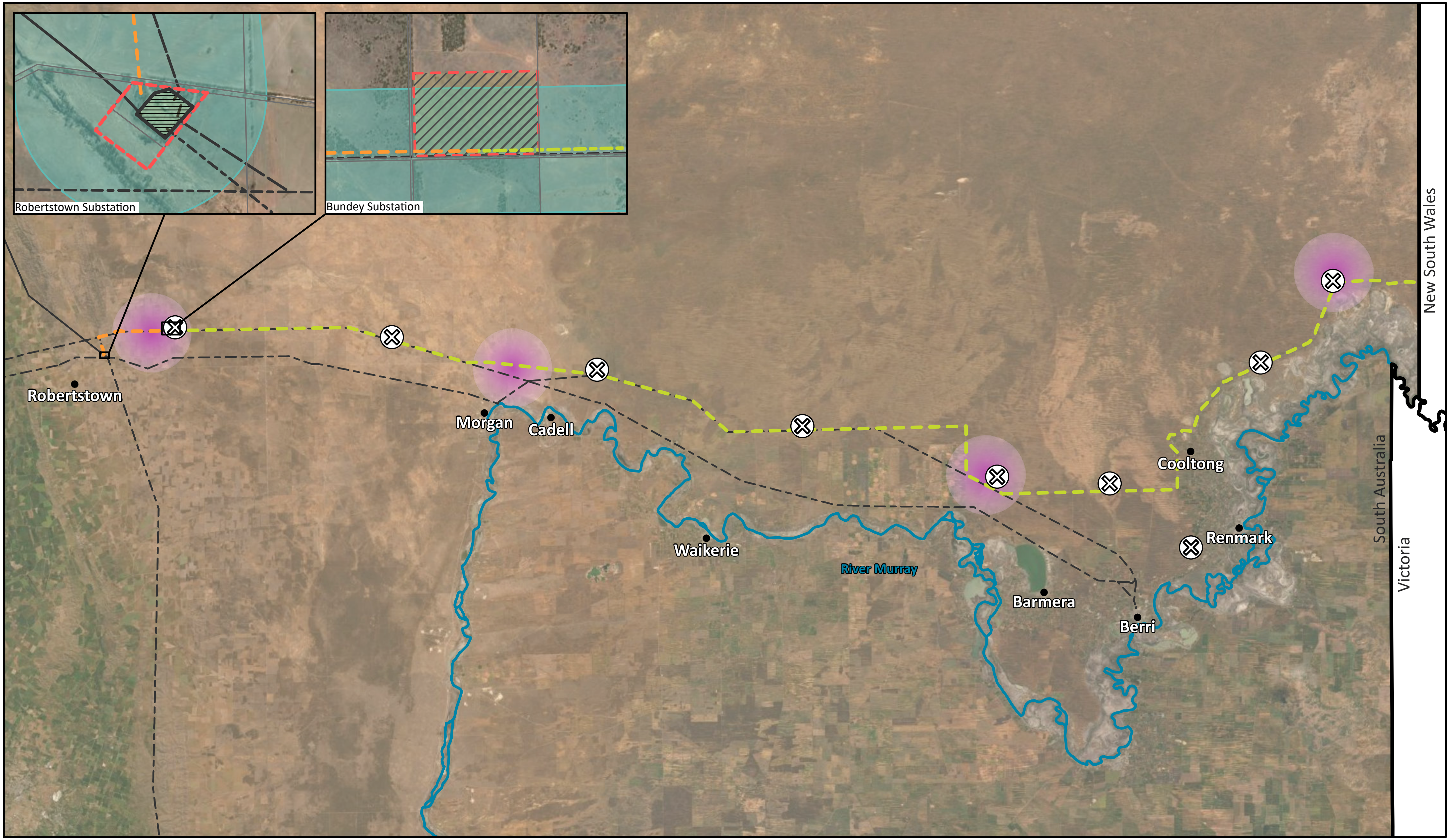
- a new substation located at Bundey, towards the western extent of the transmission line, approximately 14 km north east of Robertstown, that will facilitate the increase in voltage required from the existing system (from 275 kV to 330 kV) and control the flow between the two systems. A description of the substation and its construction is provided in Section 7.5.2
- approximately 10 km of 275 kV overhead transmission line supported by steel lattice towers from the existing Robertstown substation to the proposed new Bundey substation
- approximately 195 km of 330 kV transmission line supported by steel lattice towers from the new Bundey substation to the SA / NSW border at the interface point with TransGrid's NSW portion of Project EnergyConnect. The component parts of the transmission line are described with construction detail in Section 7.5.3
- associated telecommunications infrastructure for operation of the transmission line comprising overhead optical ground wires linked by radio towers (one in SA)
- associated access tracks to provide access to tower sites for construction and maintenance of the transmission line
- associated temporary facilities (i.e. construction compounds, site offices, laydown areas, borrow pits, mobile concrete batching plants, helicopter staging sites, and mobile construction camps).

7.4. Project Location

The Project will traverse approximately 205 km between Robertstown in the Mid North and the SA – NSW border. Chapter 4 Route Selection describes the approach used to identify and refine the transmission line corridor and proposed alignment. An overview of the key components is discussed further in Section 7.5 and illustrated in Figure 7-1 below.

The final alignment and easement of the transmission line will be confirmed during detailed design and is expected to remain largely within the transmission line corridor (refer Section 4.8).

Preliminary plans of the proposed route and the Bundey substation are contained in Appendix D and Appendix E respectively.



Robertstown substation augmentation
Transmission line corridor
Existing Robertstown substation
Proposed Bundey substation
Potential temporary worker accomodation laydown and staging location

Existing ElectraNet transmission line
Proposed alignment
330 kV
275 kV
River Murray
Potential helicopter staging sites (indicative)

Figure 7-1
Project components

0 20
Kilometres
N

ElectraNet
project energy connect
JBS&G

7.5. Key Infrastructure Components

7.5.1. Robertstown substation

The existing Robertstown substation owned by ElectraNet is currently undergoing augmentation as part of the installation of two synchronous condensers at the site (separately approved June 2019 – DA 422/V004/19). The purpose of these synchronous condensers is to manage changes in system strength, inertia and voltage control and they are anticipated to be energised in April 2021.

Two existing 275 kV bays at the Robertstown substation will be made vacant by the synchronous condensers project through the extension of the substation bench to the south-west and construction of new bays to integrate the plant into the network. The new Project EnergyConnect 275 kV feeders will be terminated on the gantry structures in these vacant bays at Robertstown substation.

Environmental assessments and approvals for this proposed augmentation are subject to a separate approval and are not covered within this EIS.

Plate 7-1: Existing Robertstown substation

7.5.2. Bundey substation

Proposed substation layout

The Project will require a new substation to be sited at Bundey, approximately 14 km north-east of Robertstown (refer Figure 7-1). This substation will connect the 275 kV and the 330 kV transmission lines and control the flow between the two systems.

ElectraNet is in final negotiations for the land selected for the Bundey substation. The site measures approximately 80 ha, however only 400 m by 250 m (9 ha) is required (subject to detailed design) for the development of the Bundey substation and its associated bench, allowing room for potential future expansion. The final area required for the Project will be confirmed during detailed design.

The Bundey substation will comprise typical primary plant (see Figure 7-2), including:

- transmission gantries which guide transmission lines into the substation

- surge arrestors to protect equipment within the substation from any voltage spikes on the transmission lines
- power transformers which allow the step change in voltage
- line disconnectors which allow the transmission lines and equipment within the substation to be safely isolated for maintenance work
- voltage and current transformers which measure voltage and current entering and moving through the substation
- circuit breakers which are automatic switches that interrupt electrical flow to de-energise equipment and clear faults
- busbars which are conductors that connect equipment within the substation
- light poles which provide emergency lighting for crews that might need to attend the site in the event of a fault
- lightning masts which attract lightning strikes away from sensitive substation equipment
- a weather station which provides real time information about localised conditions that could affect the safe and reliable operation of the transmission network
- communication / radio tower which allow the substation to be remotely monitored and operated
- associated control and amenities buildings.

Figure 7-3 shows the indicative layout and elevations of the proposed Bundey substation.

The tallest structures will be a lightning mast (approximately 30 – 50 m), telecommunication tower (approximately 50 m) and gantries (approximately 25 m).

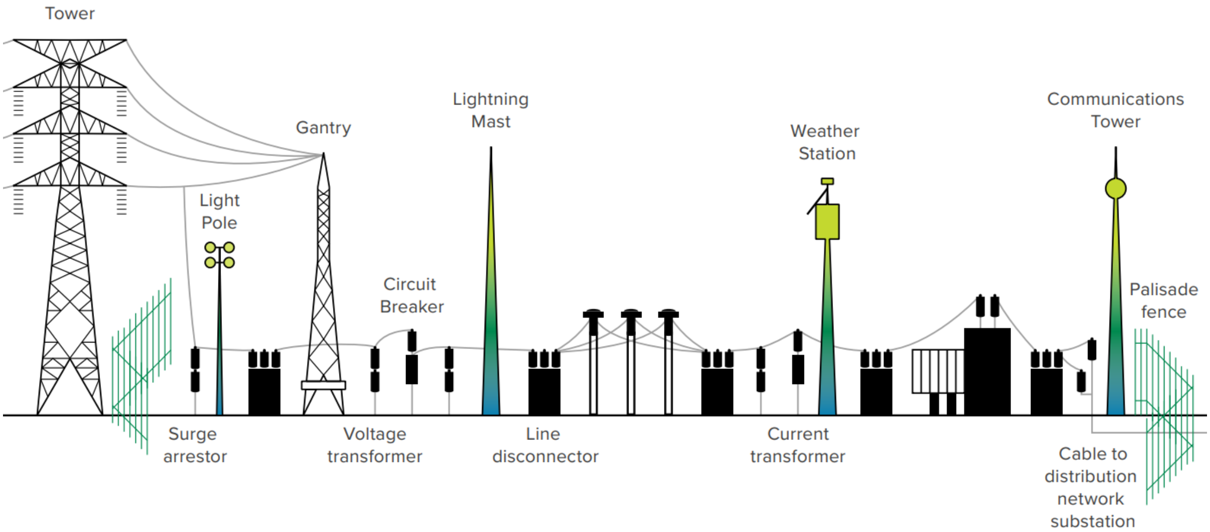
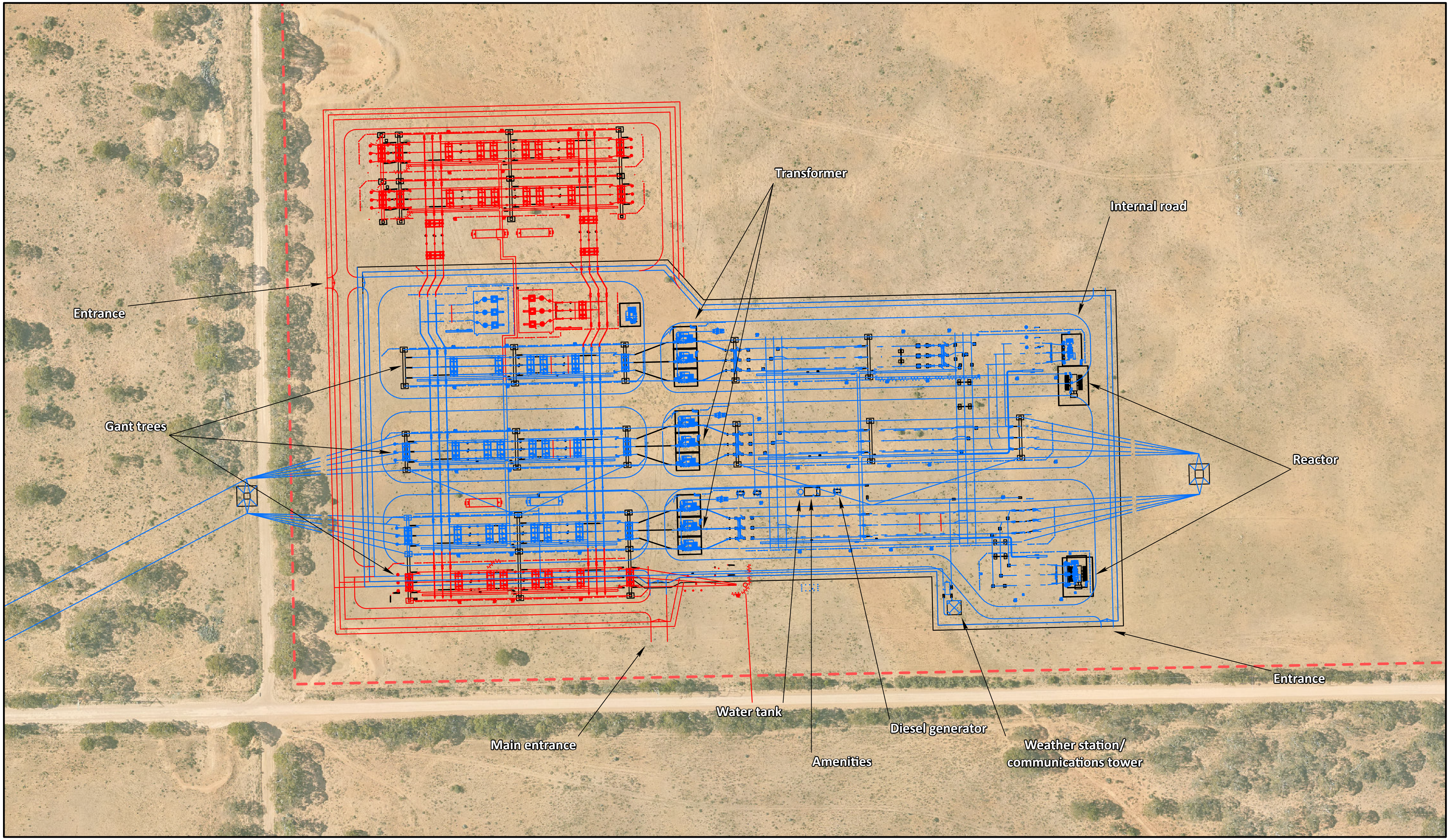


Figure 7-2: Typical substation components



Proposed Bundey substation Certificate of Title

Indicative Bundey substation layout

Current proposed

Potential future

Figure 7-3
Indicative layout of the proposed Bundey substation

0 100
metres

N

Fencing and security

Multi-layered security and safety measures are required around ElectraNet substations to ensure public safety, protect the integrity of the equipment and ensure uninterrupted operation. The developed area of the Bundey substation will be surrounded by an approximately 3 m high palisade perimeter fence, in accordance with ElectraNet's requirements for substation fencing. This fence will be made of galvanised steel (or similar) with up to two main access points with sliding gates. The substation will include all appropriate safety and public information signposts.

Lighting

Site lighting will be required for the operation of the Bundey substation. These external lights are only utilised when operational or maintenance crews need to attend the site in the event of a fault and do not remain illuminated at night. Typically, substation lighting is positioned on poles approximately 4 m in height along the site boundary and within the substation site. Lighting will be designed and installed to minimise light spill outside of the substation site boundary, particularly to traffic traveling on Powerline Road or any fauna in the area. All lighting will be in accordance with ElectraNet's requirements for substation lighting.

Access and parking

Bundey substation will be accessed via Powerline Road, a public unsealed two-way road under the care of the Regional Council of Goyder / Mid Murray Council. The substation site will have two main entry points, one on the southern boundary with Powerline Road and one on the western boundary, off the existing Sutherlands Road. The access driveways will be designed to allow suitable vehicle access for construction and operation and in accordance with relevant road design and council guidelines.

All parking for both the construction and operation of the substation will be accommodated within the site boundary. An internal perimeter road will be constructed as shown in Figure 7-3.

Water supply and sewage

Due to the remote location of the Bundey substation, suitable mains water is not available. A minimum of a 9 kilolitre rainwater tank will be installed at the site and reticulated to the amenities facilities. The rainwater tank will be positioned to enable it to be supplied by rainwater runoff from the roof of the amenities and control buildings. The tank will be filled on construction completion. The amenities will include connection to an on-site septic tank system.

Stormwater and drainage

An on-site stormwater drainage system will be designed and installed to capture and discharge stormwater runoff collected from the site during construction and operation. The substation earthworks will be undertaken in accordance with ElectraNet's Asset Design Manual (1-11-ADM-5) for substation earthworks and stormwater drainage requirements. Transformers will be bunded and incorporate a flame trap and drainage point in the event of an emergency. The substation site will be covered with gravel fill. Hardstand areas will be designed to drain to a reinforced concrete oil water separator / containment tank. General runoff would be discharged to adjacent land using appropriate dispersion / dissipation structures or drainage systems in accordance with the substation detailed design. Stormwater management will be in accordance with ElectraNet's discharge requirements.

Landscaping

The road reserve along Powerline Road and Sutherlands Road has existing vegetation which offers some screening. No additional landscaping on or surrounding the site is proposed as this presents security and bushfire risks.

7.5.3. Transmission lines from Robertstown substation to the SA / NSW border

Transmission technology alternatives

Transmission technology alternatives, including in the form of high-voltage electrical current (Alternating Current (HVAC) or Direct Current (HVDC)) and design (overhead line (OHL) or underground cable (UGC)) were considered by ElectraNet through the RIT-T process and preliminary environmental scoping studies.

Through numerous specialist studies it was ultimately determined that HVDC technology would be significantly more expensive than the HVAC option, for a similar capacity, and not provide any additional benefits from a system security perspective.

UGC options were also considered and deemed to have significantly higher environmental and cost impacts than an OHL. UGC options were ruled out for the following reasons:

- UGC would require approximately six metre wide trenches of one metre in depth be dug over the extent of the underground section, requiring approximately 6 cubic metres of material be excavated per linear metre, resulting in unacceptable land disturbance and environmental impact.
- Should there be a fault, outage or maintenance work, re-excavating a whole section of UGC and installing new cable and joint bays may be required thus causing ongoing impacts. Reclosing the UGC would also require manual switching at each underground / above-ground transition station, which would not meet operating criteria for the Project.
- UGC and associated transition stations would cost more than three times more than OHL and depending on the distance required would result in the interconnector being cost prohibitive or reduce the potential benefits.

Overhead HVAC interconnection was determined to provide the best solution to meet the Project objectives.

Transmission line easement

The proposed alignment will be situated within an easement typically 80 m wide that allows the construction, operation and maintenance of the transmission line. The easement is a permanent legal right which will allow ElectraNet to use and access property, and which will be registered on the relevant land title and remain part of the land title regardless of changes in ownership. While existing land uses will be able to continue across much of the easement, and most existing vegetation will remain undisturbed, the easement will also restrict certain landholder activities.

The purpose of the easement is to provide a safety margin between the high-voltage transmission lines and surrounding structures, a path for ground-based inspections and access to the transmission towers for repairs and maintenance. Where possible, the easement has been aligned with existing infrastructure easements, road reserves, existing tracks and disturbed areas to minimise the need for new disturbance.

Land access protocols will be established with each landholder during the acquisition of property or easement interests, including access requirements where necessary. Access to the proposed easement for construction and operational purposes would preferentially use existing public and private roads and tracks although some new access may be required to provide appropriate access to construction areas and may be retained for operational purposes in some circumstances.

Following cultural heritage surveys in February 2021, sites of aboriginal cultural heritage significance were identified in Hawks Nest Station. As a result, an alignment deviation was necessary to avoid these sites. The deviation aligns with the western boundary of Hawks Nest Station, existing access tracks and the existing ElectraNet 132 kV transmission line. The Hawks Nest alternative is illustrated in Figure

7-1. The exact location of the easement will be determined following detailed design, micro-siting and survey activities.

Transmission line structures

A range of tower structure types are typically used to support transmission lines, depending on the voltage of the line, the function of the structure as well as physical, environmental and engineering constraints. An example of the various transmission towers currently used across SA is provided in Figure 7-4.

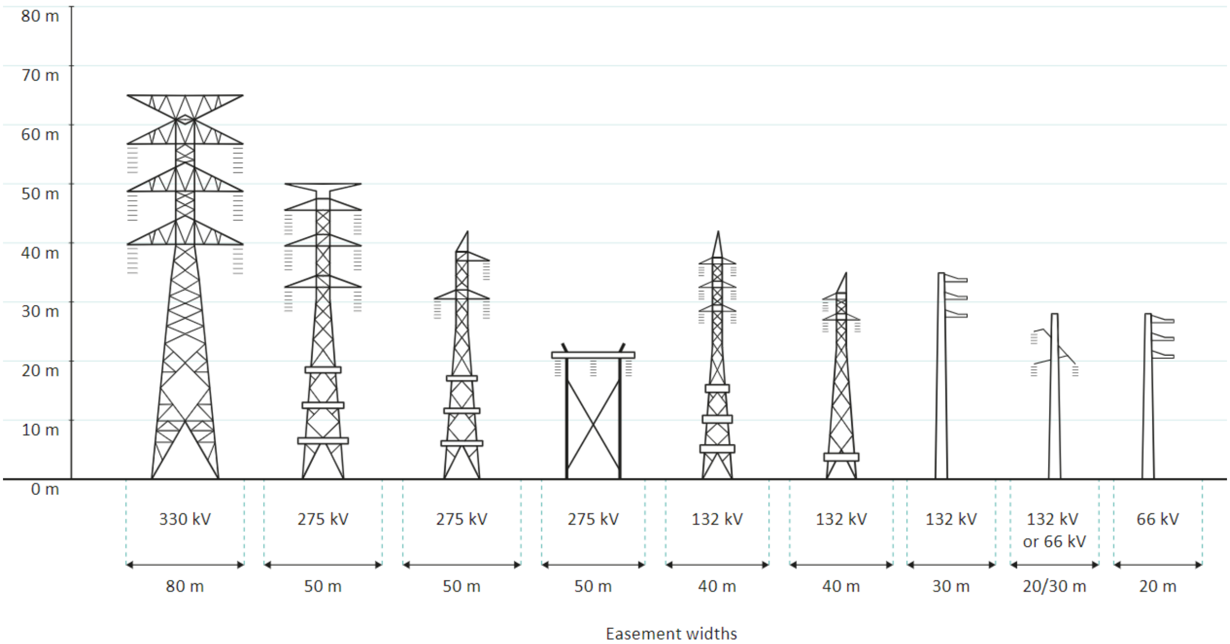


Figure 7-4: Typical structure types and easement width

Transmission structure alternatives were assessed by independent specialists for the Project using a multi-criteria analysis during the preliminary design process and environmental scoping studies. These investigations assessed the use of self-supporting steel lattice towers, self-supporting monopoles, guyed towers, and chainette towers. Criteria assessed were ease of construction, ease of operation and maintenance, line security, access / easement requirements, and potential environmental impacts. It was determined that self-supporting lattice towers performed the best when assessed against the Project specific criteria. This is consistent with international and Australian practice where lattice towers are the standard for double circuit high voltage transmission lines where reliability and security are paramount (Beca 2019).

The Project proposes to utilise steel lattice towers for both the 275 kV and 330 kV double circuit transmission lines. These structures will typically include a combination of steel lattice suspension towers and steel lattice strain towers. Alternative structure types, such as monopoles, may be used in selected isolated circumstances in order to mitigate potential impacts.

Suspension structures are designed to carry the overhead conductors for the in-line sections of the transmission line, or for minor bends in the alignment. Suspension structures are designed to withstand the vertical and transverse wind loadings of the conductors. The tension (or pulling) forces from the conductors are generally equal on either side of a suspension structure. Figure 7-5 shows a conceptual model of the suspension structures to be used for the majority of the proposed alignment.

Strain towers, also known as tension structures are of heavier and wider construction than suspension structures in order to withstand the horizontal loadings associated with significant changes in direction (angle strain) and line terminations (see Figure 7-5). The tension forces can be much greater on one side of a tension structure than the other, resulting in greater stress on the structure.

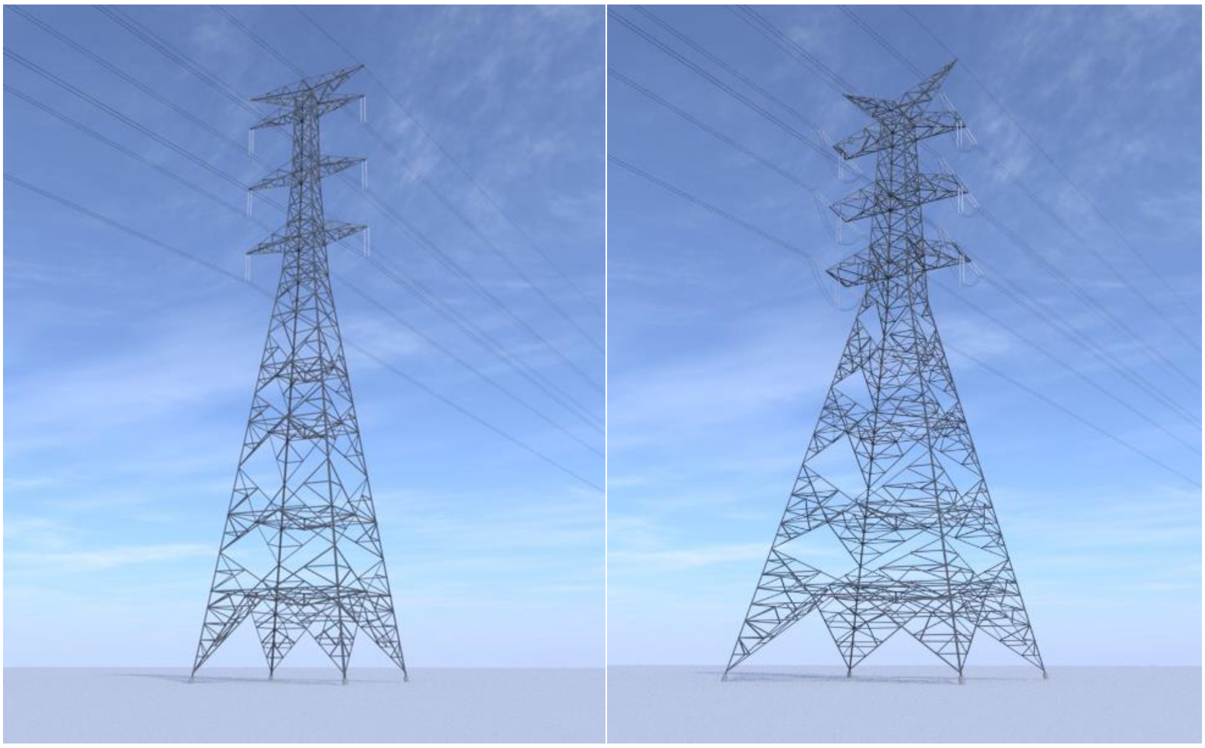


Figure 7-5: Indicative modelled suspension tower (left) and strain tower / terminal tower (right) to be used for the Project

These structures will range between approximately 45 and 65 m in height and will typically be spaced between 400 m and 600 m apart. This type of structure was chosen as the preferred tower type over guyed structures, which are being used on the NSW portion of Project EnergyConnect, due to the reduced footprint required and associated vegetation clearance requirements. Preliminary designs estimate approximately 380 towers in total for the Project, however the exact number and design of the towers will be determined during detailed design and following the micro-siting process.

Foundations and footprint

Concrete foundations will be constructed underground to hold up the towers. The type and size of tower foundations is influenced by the type of structure, terrain and the underlying geotechnical conditions. Strain structures require more extensive foundations for support than suspension structures.

Bored pier foundations will typically involve a cast in-situ concrete foundation of 13 – 16 m deep and 1.2 – 1.8 m in diameter at each leg of the tower. Up to 600 mm of the concrete footings will protrude above ground level (see Plate 7-2) which will vary in diameter and height according to tower type and local ground conditions. Strain towers will have larger footings than suspension towers. Footing designs will be finalised during detailed design.

Plate 7-2: Base of typical lattice tower

Conductors and insulators

The primary function of transmission line conductor systems is to carry the electrical power between designated locations. The Project proposes to use double circuit aluminium conductor steel reinforced (ACSR) of varying diameter. The conductors are attached to the tower cross arms using toughened glass disc insulators.

The transmission lines will also include earth wires with the optical ground wires (OPGW), which provide the function of both grounding and communications. This provides an electrical path for lightning and fault currents to earth, reducing the likelihood of direct lightning strikes or other electrical damage to the conductors. Dampers are used on conductors to control wind-induced vibration and movement.

The 330 kV transmission line between Bundey substation and the SA / NSW border will utilise twin mango conductor (12 wires) and the 275 kV transmission line between Robertstown substation and Bundey substation will utilise single olive conductor (6 wires).

Transmission line markers and bird diverters

Transmission line markers, which are typically made of fibreglass, will be attached to the conductors in areas of the proposed alignment that are close to airstrips to provide visual warning to aircraft of the location of the wires.

In addition, bird diverters will be attached to the conductors selectively in areas where the proposed alignment parallels sensitive wetlands, water courses or known migratory bird flight paths. The diverter target swings and spins freely in the wind and is easily seen by a bird in flight. These diverters mitigate the risk of bird strike.

Typical transmission line components and their configuration may be seen in Figure 7-6 below.

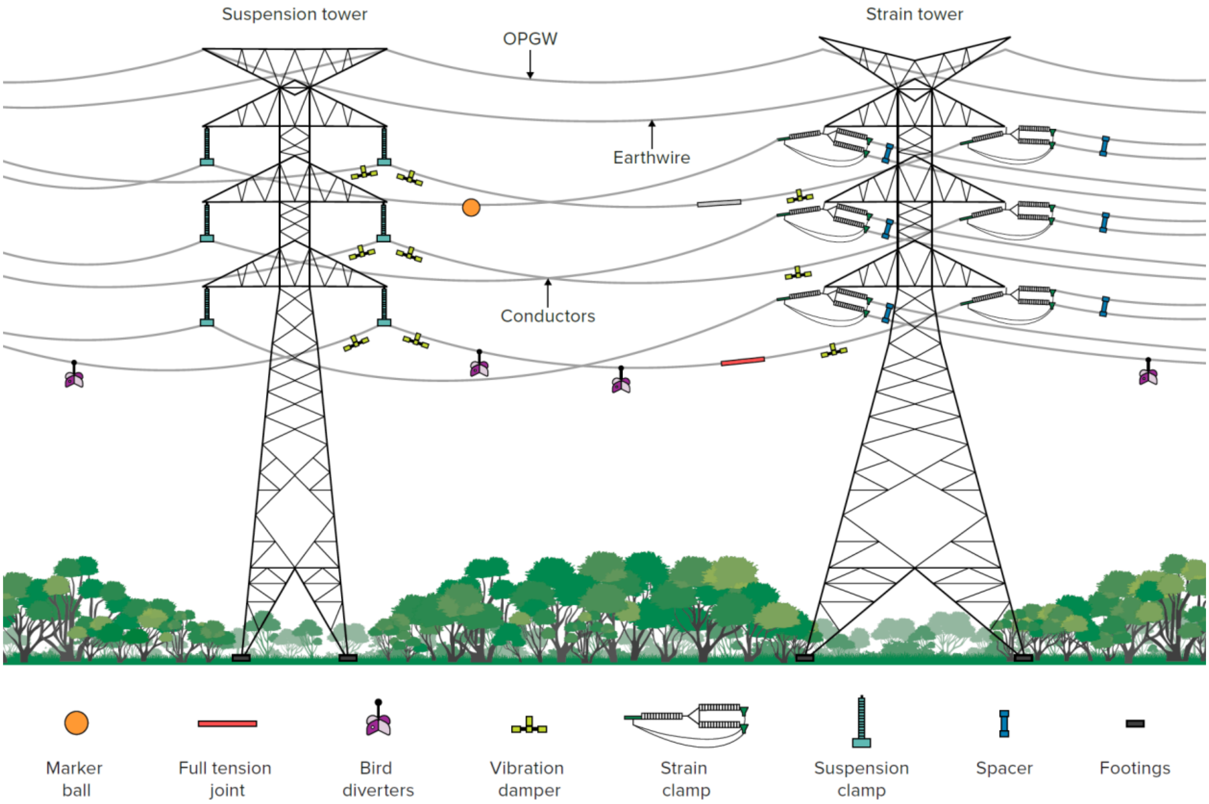


Figure 7-6: Typical transmission line components

7.5.4. Telecommunications

Telecommunications for operation of the transmission line will be through the OPGW, which consists of an optical fibre core within the earth wire discussed above, and by radio links. It is anticipated that one new radio site is required for the Project to enable the system to connect into the existing network and the additional radio sites which will be constructed in NSW and Victoria. The radio site in SA will consist of an approximately 50 m high radio tower and a local telecommunications hut which will all be contained within the footprint of the Bundey substation site.

A repeater station will also be required in a location close to the SA/ NSW border. The repeater station will typically include a fully enclosed containerised communications room approximately 3 m by 4 m. It will also require a small set of solar arrays (approximately 4 m by 5 m) for power, an access track and will be fenced with palisade fencing around its perimeter.

7.5.5. Access tracks

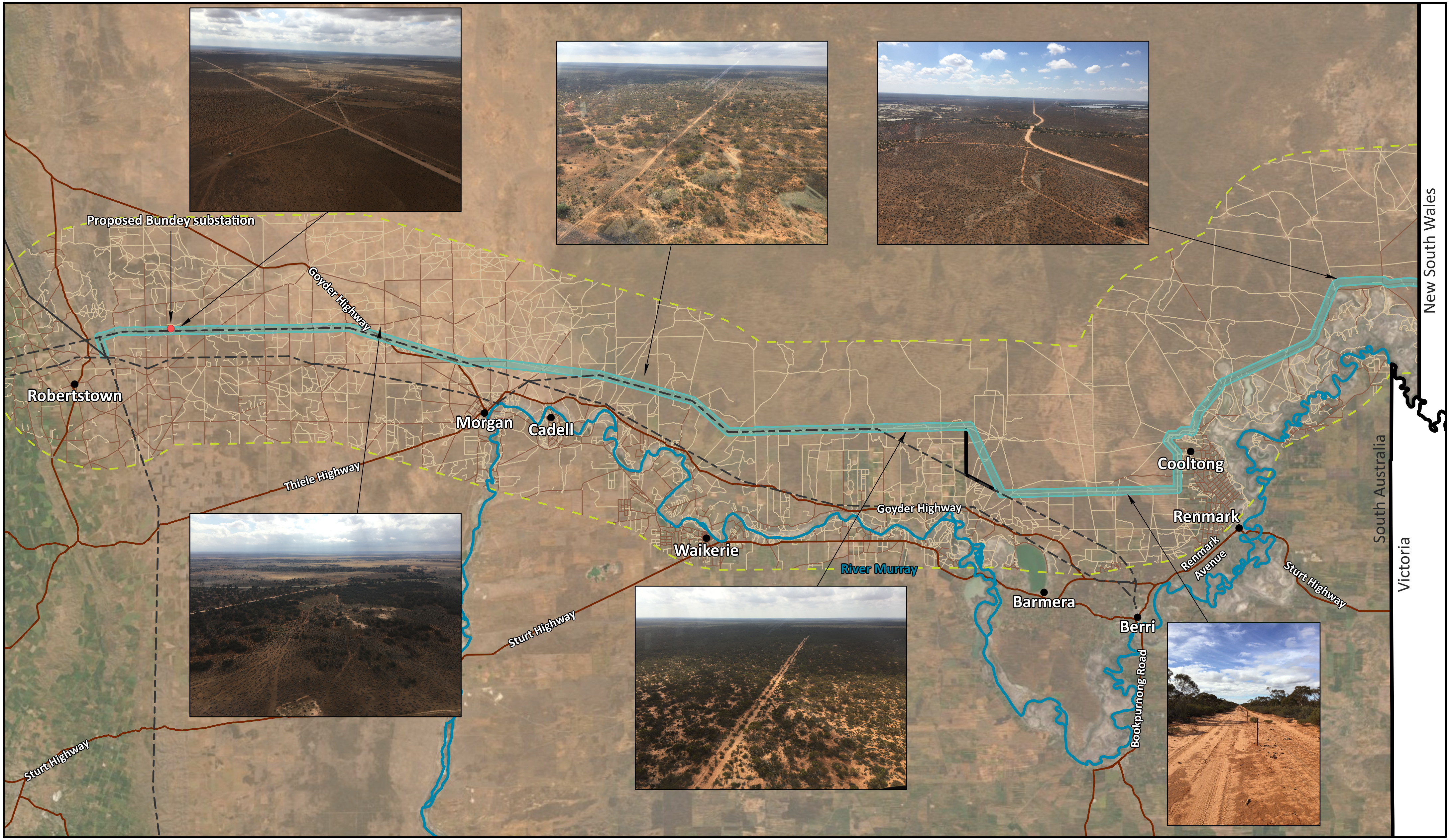
Access to the proposed easement will be required for both construction and operation of the Project.

Preliminary access alternatives were assessed through the route selection process (refer Chapter 4 Route Selection) where existing public and private roads, tracks and easements were targeted for the proposed alignment to allow easy access and reduced environmental disturbance. Primary access to the easement will preferentially be via the use of existing public and private roads and the host of existing tracks on the properties traversed by the Project and adjacent properties subject to landholder agreement, including the access tracks and easement used to maintain ElectraNet's existing 132 kV transmission lines.

Some of these existing access tracks will be upgraded (where required) and new access tracks constructed in areas where there are no existing tracks to facilitate access for the construction of towers. Imported fill material may be required for upgrading or establishing new access tracks, particularly through sandy areas. The exact composition and quantities of fill material will be determined following geotechnical investigation during enabling works and through detailed design. Should fill material be required, this will be sourced from local quarries with approved extractives minerals licences or new licences will be applied for by the EPC contractor.

Access tracks for construction will need an approximately 5 m cleared track to each tower location with additional access and temporary stringing corridor between each structure. Additional temporary clearance may be required for access to stringing and brake and winch sites, as discussed further in Section 7.8.1.

Locations and examples of existing access tracks may be seen in Figure 7-7. Further detail on access track establishment and vegetation clearance requirements for both construction and operation is discussed further in Section 7.8.



30 km investigation corridor
Transmission line corridor
Cultural heritage avoidance alignment
Road
Access track
Main road
Existing ElectraNet transmission line
River Murray
Proposed Bundey substation

0 20
Kilometres
N

Figure 7-7
Existing access track locations

ElectraNet
project energy connect
JBS&G

7.5.6. Associated temporary facilities

Temporary construction camps

While it is anticipated that the local townships (including Morgan and Renmark) will be capable of providing a portion of the accommodation requirements for the Project, the workforce will be distributed along the length of the proposed alignment and it is unlikely that local townships will be able to accommodate the peak workforce. Travel time from local townships to the proposed alignment will also add significant travel limitations and safety risks.

Preliminary construction planning assessed multiple location alternatives and it is anticipated that up to four self-contained temporary worker camps along the proposed alignment may be required. Dependent on whether one, two, three or four camps are utilised, they will need to cumulatively accommodate a total of approximately 200 – 250 workers during peak construction. The construction workforce may be as low as 20 during site establishment, increasing to approximately 120 – 250 during the later stages. Further detail on Project staging is provided in Section 7.6.

Temporary worker camp locations will be determined during detailed design. These locations are likely to be close to the Bundey Substation, North West Bend / Morgan, Hawks Nest Station and Chowilla as indicatively shown in Figure 7-1. This will allow ease of access to construction locations. The appointed EPC contractor will engage local council and hotels to discuss accommodation in local townships (including Morgan and Renmark).

ElectraNet requires that all temporary worker camps are sited in areas already disturbed by development or in areas with limited native vegetation, using the following criteria:

- location is close to the proposed alignment, is relatively flat, stable and capable of being secured and screened
- suitable access for B-double trucks
- site has previously been cleared, requiring no (or minimal) native vegetation clearance, where possible
- no listed flora and fauna species are present
- there are no environmentally sensitive watercourses or wetlands within close proximity
- items or sites of cultural heritage significance are not affected and relevant clearances have been obtained
- site is located away from residences and other sensitive social receptors.

It is estimated that each temporary camp would require between two and five hectares of land. Each temporary camp will provide accommodation, amenities and kitchen (dry mess) facilities for the construction work force. The camp will also incorporate local site offices, workshops, car park, site communications, local power generation facilities (requiring integrated self-bunded diesel fuel storage tanks), wastewater treatment and stormwater management regimes. A typical construction camp layout is shown in Figure 7-8 below.

The appointed EPC contractor will obtain all necessary licences and approvals for establishing and operating the temporary camp (s) from the relevant authorities prior to establishment.

Being of a temporary nature, the workers camp sites will be cleared and rehabilitated immediately after use.

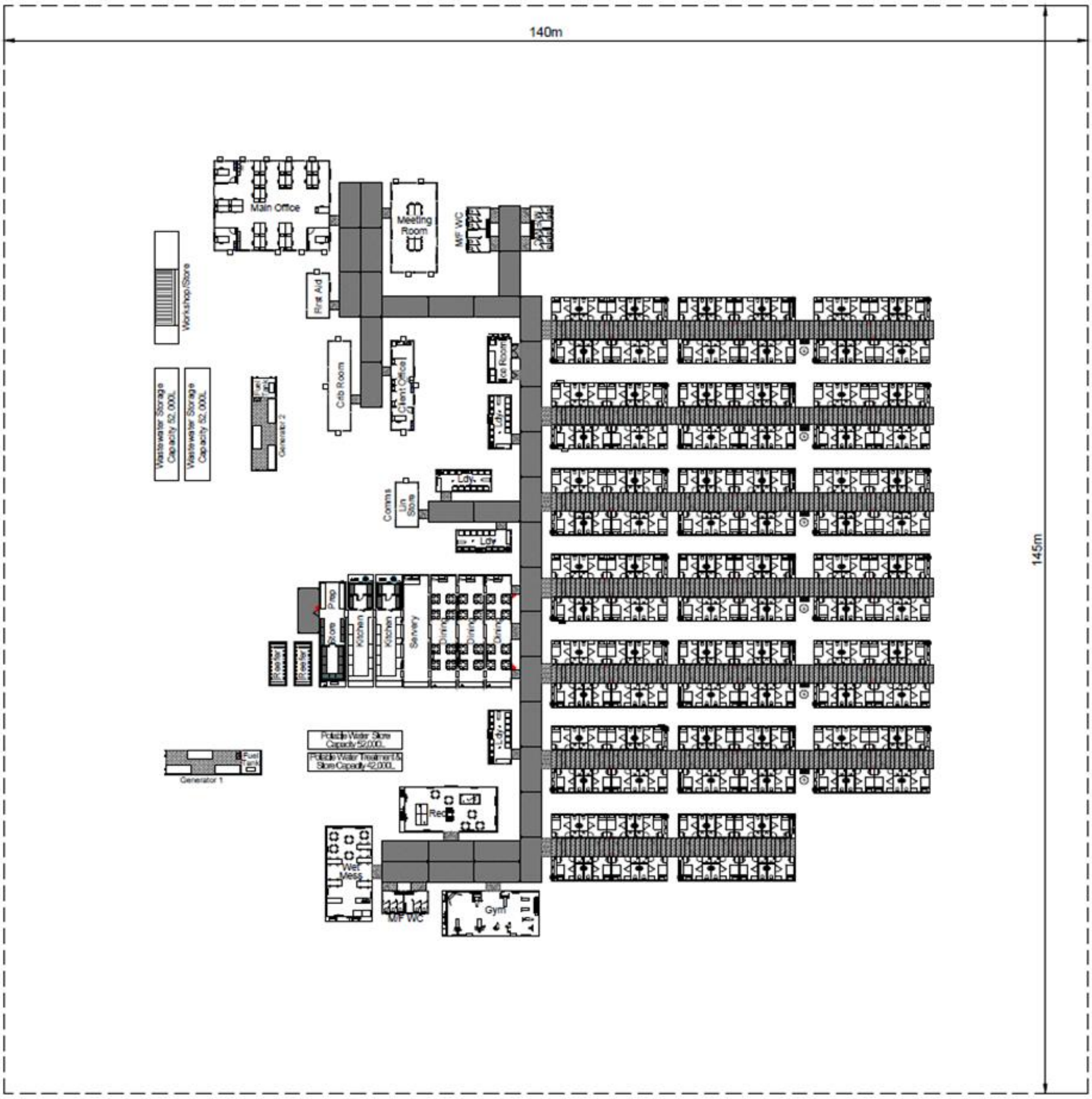


Figure 7-8: Typical temporary worker construction camp layout

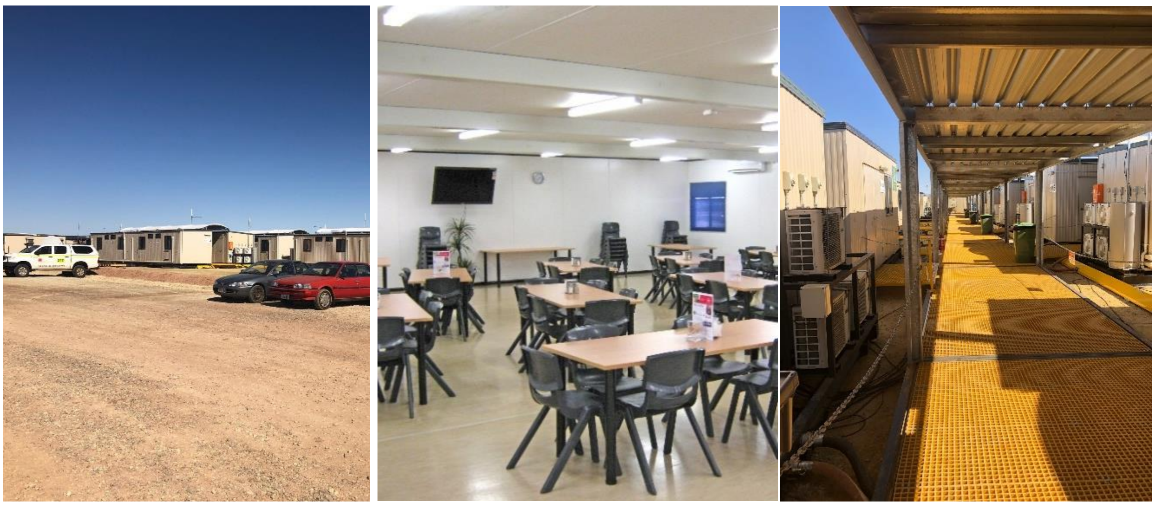


Plate 7-3: Indicative temporary worker construction camp

Temporary laydown areas

The Project requires the development of up to four main laydown areas, each approximately one to two hectares in size. These areas will likely be located on the western, central and eastern sections of the proposed alignment (nominally in the proximity of the Bundey substation, North West Bend substation, Hawks Nest Station and Chowilla). Where possible, these will be co-located with the temporary worker camps.

These main laydown areas will be used to store heavy vehicles, equipment and bulk materials (including large drums of conductor and earth wire cabling) needed to construct the transmission line and for the handling and preassembly of towers, depending on the construction method employed. The laydown areas will include associated temporary offices and amenities if not co-located with construction camps. Final siting of the laydown areas will be determined by the appointed EPC contractor as part of the detailed design phase, using the same site selection criteria detailed above.

The EPC contractor undertaking the works will access the main laydown areas to collect required equipment and materials which will then be transported to specific construction sites along the alignment. Smaller temporary laydown areas will be set up on existing access tracks along the transmission line corridor (where possible) and in tower construction footprints (pads) for assembly, depending on the construction method employed. Tower structure components will be transported directly to each tower site, where possible and depending on the construction method employed.

Helicopters staging sites

The application of aerial technologies on transmission lines is gaining popularity in both project execution and for operation and maintenance of existing networks around the world. Advanced technologies like helicopter tower transport, tower erection and stringing, Light Detection and Ranging (LiDAR), sky crane and Unmanned Aerial Vehicles (UAVs) or drones are used in planning, design and construction of overhead transmission lines and for ongoing maintenance tasks. The Project may utilise helicopters during both construction and operation.

Aerial installation using heavy lift helicopters and sky cranes can be faster than traditional ground-based construction methods and often adopted in ecologically sensitive areas, where towers can be constructed off site in designated staging areas and flown into place partially assembled. There is still a requirement for a ground crew to be present to secure the tower to the foundation, but the size and impact of the ground-based construction vehicles and activities may be decreased.

This method will be considered further during detailed design, however it is anticipated that this technique may be used through sensitive areas with difficult access, such as Calperum Station, Taylorville Station and Hawks Nest Station, subject to health and safety, commercial and technical feasibility. This method is expected to reduce construction footprints and required vegetation clearance, and save time in delivery and erection of towers.

Subject to land access, detailed design and construction planning, helicopter staging sites may be required approximately every 50 tower structures. These staging sites would be used as laydown areas where towers would be preassembled before being flown to tower locations via helicopter. These staging sites would also include a helipad and refuelling station and would be preferentially located in areas previously disturbed and away from potential noise sensitive receptors. Depending on the location and number of helicopter staging sites these would require a temporary cleared area of up to approximately 6 ha. Nominal spacing of these staging sites are illustrated in Figure 7-1.

In addition to tower transport, the Project may utilise helicopters for aerial stringing of conductors. This would be subject to health and safety, commercial and technical requirements. The use of aerial stringing may further reduce disturbance footprints and required vegetation clearance as conductors can be strung over ecologically or culturally sensitive areas and reduce the requirement for a temporary 10 m cleared stringing corridor between towers in certain sections. Brake and winch site will however still be required. Should helicopters be used for stringing, these smaller helicopters will use the same helicopters staging sites as per tower transport helicopter and / or may also use the required brake and winch sites to reduce the need for additional disturbance. Aerial installation and stringing techniques and are discussed further in Section 7.8.4.

7.6. Project Timing and Construction Staging

7.6.1. Indicative construction programme

The construction of the Project is expected to require staging of certain elements. Staging is proposed to enable the commencement of some activities, such as enabling works or low impact activities in advance of the detailed design being finalised and environmental approvals being obtained.

The main construction activities (as discussed in Section 7.8) are anticipated to commence towards the end of 2021, subject to all necessary state and Commonwealth environmental approvals and land acquisition requirements.

7.6.2. Early contractor involvement

ElectraNet engaged in an early contractor involvement (ECI) process for the Project in February 2021. An ECI process is a type of construction contract where an EPC contractor is engaged at an early stage in the Project to offer input into the pre-design and design phase. It is in contrast to the typical design–bid–build model where the EPC contractor is only brought onboard at the end of the design phase. The model allows the contractor to have an input in the design of the Project and suggest value engineering changes. The ECI model is also valuable in integrating the finding of the EIS and proposed mitigation measures into the design and planning process.

7.6.3. Enabling works

Enabling works are mobilisation activities that would typically be carried out before the start of construction, in order to make ready the key construction sites and to manage specific features or risks to the Project.

Enabling works are expected to include:

- targeted ecological and cultural heritage micro siting surveys and demarcation
- property surveys by a registered land surveyor
- geotechnical and contamination investigations and remediation activities (as required)
- other ground clearance and survey work, including road dilapidation surveys, surveys of existing utilities etc
- establishment of environmental management measures (as appropriate), including installing temporary fencing and security measures, erosion and sediment controls, truck wheel wash or rumble grids etc.

Enabling works are anticipated to commence in Q1 2021.

7.6.4. Site establishment

At the commencement of construction, the first activities which would be undertaken would include:

- clearing and removal of vegetation and topsoil (as appropriate)
- access track establishment (refer to Section 7.5.5) and any specific vehicle access and egress points including adjustment of state and regional roads to ensure safe vehicle movements at relevant locations

- establishment of temporary workers camps (refer to Section 7.5.6) and ancillary facilities, including offices, amenities, workshops, laydown areas, storage and hardstand areas, connections to utilities (water and power, if available), and mobile cement batching plants.

7.6.5. Construction of the Bundey Substation

As discussed in Section 7.5.2, a new substation is proposed at Bundey. The construction of the Bundey substation would include bulk earthworks to form the substation bench, civil construction, electrical works and pre-commissioning works. Key substation activities are discussed further in Section 7.7.

Construction of the Bundey substation is expected to commence in Q4 2021 and will take approximately 18 months.

7.6.6. Construction of the transmission lines from Robertstown substation to the SA / NSW border

Construction would typically occur in a linear manner along the proposed alignment, likely from the SA / NSW border in a westerly direction towards Robertstown, subject to access, weather conditions etc. This means construction activities at each transmission line structure location would be intermittent with construction activities anticipated to progress between 8 to 12 km per month. Up to three work fronts may be running simultaneously on different sections of the proposed alignment.

Indicative workflow process may be seen in Figure 7-9. It should be noted that although the construction processes flow consecutively there may be up to one to three months break between activities. For example, following foundation and footing establishment concrete will be left to cure for a period prior to erection.

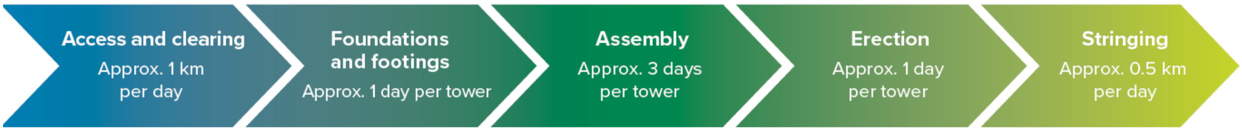


Figure 7-9: Indicative construction process and duration for transmission lines

Should helicopters be used for tower transport and stringing, this may speed up the assembly, erection and stringing timeframes. The construction of the transmission line from the SA / NSW border to Robertstown would take approximately 16 – 18 months.

There are inherent risks associated with wet weather in April, as well as periods of extremely hot dry weather from December to February. Construction delivery planning will seek to minimise the program exposure to extreme weather conditions. Ecological considerations with regard to construction schedule, including migration or breeding periods near wetlands, are discussed in Chapter 11 Flora and Fauna.

The commissioning phase involves a series of inspections to check aspects such as phases, line clearances, connections, joints, towers / poles, earthing, line sags and communications prior to energisation of the line. It is anticipated that energisation of the Project would occur in Q2 2023 to align with the NSW portion of Project EnergyConnect.

7.6.7. Clean-up and reinstatement

Areas of temporary disturbance such as stringing corridors, construction footprints, laydown areas, and workers accommodation would be cleaned up and reinstated. Reinstatement would involve removal of construction material, surface contouring and scarifying where required, and respreading of topsoil and cleared vegetation to encourage natural recruitment of vegetation. Construction and operational environmental management plans for the Project are provided in Volume 3.

Site demobilisation, clean-up and reinstatement will occur progressively but will extend approximately four months post energisation, with full completion of works by mid-2023. Figure 7-10 presents an indicative construction schedule.

7.6.8. Operation and maintenance

During standard operation the transmission line will require very little ongoing maintenance. Access tracks, including any imported fill to enable safest operational access to the transmission line towers would be retained for inspection and maintenance activities, predominantly by light 4WD vehicles. The maintenance program would typically involve one detailed ground inspection every three years for signs of unusual wear, structural integrity and corrosion or damage. Bird nest removal is undertaken where required, in accordance with permits obtained under the *National Parks and Wildlife Act 1972*. Helicopter-based inspections and maintenance would be undertaken annually. Insulators would typically be replaced every 25 years.

Extensive vegetation maintenance on the easement during operations is not expected to be required as the vegetation present is generally slow growing and at mature height. Vegetation trimming is typically carried out every three to four years to allow for a three-year growth period. This may vary depending on the type of vegetation and speed of growth. Further detail on vegetation clearance requirements is discussed further in Section 7.8.7.

Although minimal intervention is anticipated, line or tower failures can result in the need to reintroduce heavy equipment, work crews, excavation, and materials transport to affected areas.

7.6.9. Life of asset and decommissioning

The design life of the proposed transmission line, with appropriate maintenance, is approximately 100 years, after which it may need to be replaced in order to ensure the continuity of a safe and reliable supply. Future use will be evaluated by ElectraNet in consultation with the State government and other parties at such a date. The transmission line and associated above-ground infrastructure will be decommissioned to an appropriate standard that addresses environmental objectives, as appropriate and as required by the legislative requirements at the date of decommissioning.

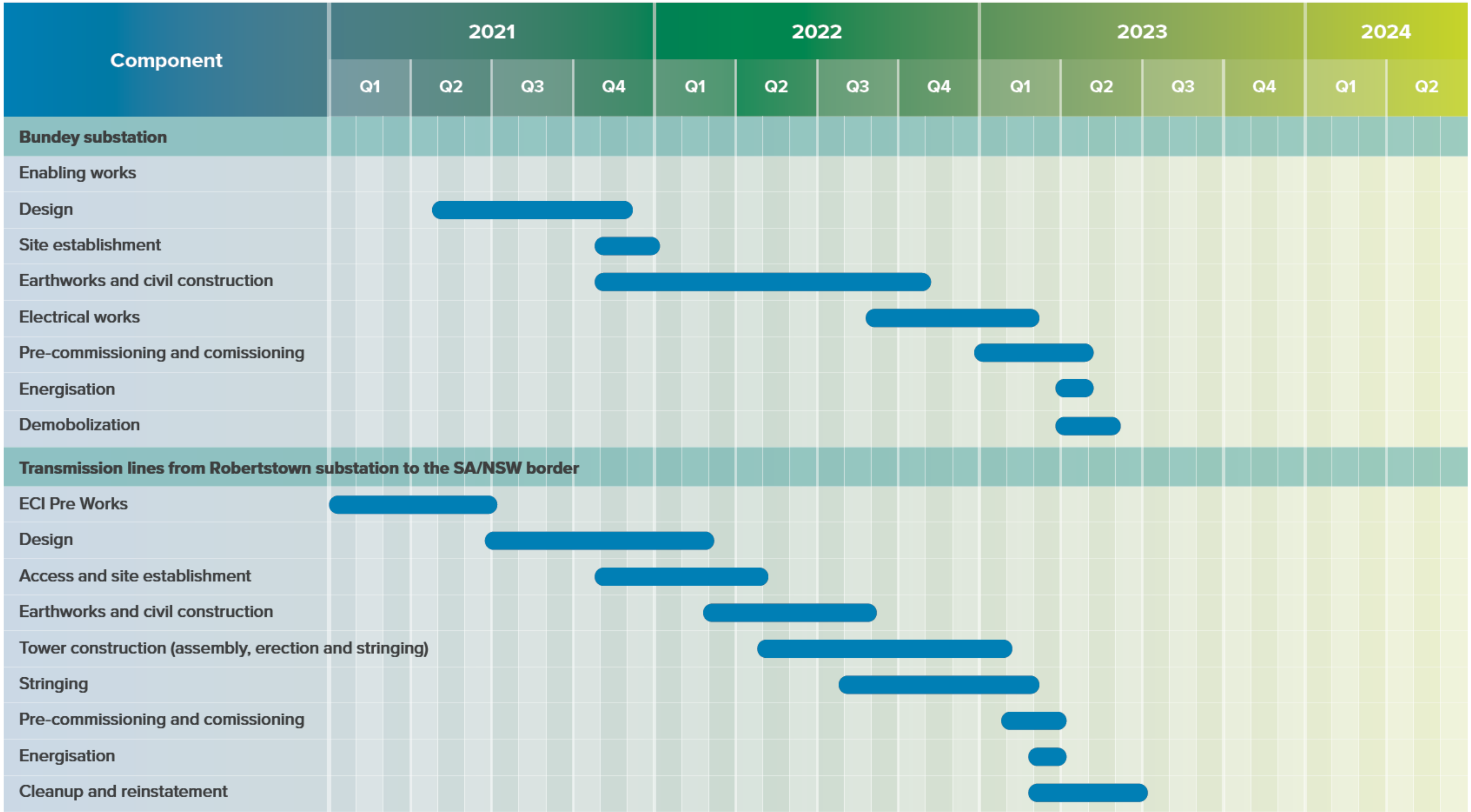


Figure 7-10: Indicative Project timing

7.7. Key Project Activities (Bundey Substation)

7.7.1. Site clearance

New access will be required for the new Bundey substation site. It is anticipated that the main entrance will be located off Powerline Road and a secondary entrance off Sutherlands Road. These entrances will be approximately 8 m wide with the ability to receive B-doubles. Access will be directly onto the site and limited vegetation clearance will be required within the existing road reserve for these entrances. Roadside and boundary vegetation will be retained as far as possible to screen the substation site.

The substation will be located on land previously utilised for livestock grazing. This land has limited to no native vegetation present, however any remnant vegetation, roots, stumps, boulders or rubble will be cleared and the areas backfilled and compacted in preparation for the bench earthworks.

Topsoil will be stripped from the proposed earthworks area and spread across the site in areas outside of the construction footprint.

7.7.2. Earthworks and civil construction

A bench will be constructed from cut and fill material on site or via imported borrow material. The exact composition and quantities will be determined following geotechnical investigation during enabling works and through detailed design of the substation. Should borrow material be required, this will be sourced from local quarries with approved extractives minerals licences.

The EPC contractor will remove all excess material which is unsuitable for use as fill from the site to a suitable (registered if required) disposal facility.

Bulk earthworks and drainage will be undertaken in accordance with detailed design and ElectraNet's Substation Earthworks and Stormwater Drainage requirements (1-11-ADM-15). This site will be surfaced with gravel approximately 100 mm thick and will be sourced from local high spots, depressions or undulations.

Following formation of the bench, internal roads will be established (see Figure 7-3) and trenching of 500 mm for installation of the earthing system which will then be backfilled to continue construction of the substation.

A drill rig will be utilised to drill all structure foundations. If rock is encountered, the use of a rock drilling machine will typically be used. Once drilled, fabricated reinforcement cages will be placed into the foundation, hold down bolts put in place and concrete poured.

The equipment stands will typically be installed onto the footings at each equipment location. This stage involves:

- steel equipment stands delivered in pieces to the site's laydown area or pre-assembled and brought in via a flatbed truck
- stands are either then assembled and / or directly moved to the required structure locations and erected.

Major substation plant will be delivered to the sites laydown area where it will also be assembled and move to its required location and erected. Transformers and control buildings will be delivered directly to their set location.

7.7.3. Electrical works

Final construction of the substation will entail connection all of the equipment via bare steel / aluminium conductor and solid aluminium busbar. Construction teams will utilise elevated work platforms and hand tools to complete the connections.

Major plant auxiliary and protection systems will be wired back to the control rooms via control cables laid in the conduits and trenches which provide vital information for the protection systems and the control room to safety operate the network.

Pre-commissioning and commissioning activities will then be completed where the continuity of the electrical systems are proven and all major plant, protection systems, control systems and communications are rigorously tested to prove functionality and operation.

7.7.4. Operation and maintenance

Routine maintenance tasks will be completed in accordance with ElectraNet's Asset Management maintenance requirements. These tasks will include but not limited to:

- oil sampling and testing
- routine operation testing of major plant
- visual inspections
- routine operation testing of control and protection systems.

7.8. Key Project Activities (Transmission Line)

7.8.1. Establishment of access tracks

Tracks are required to allow access along the transmission line corridor and to each tower location for construction and operation of the transmission line, as discussed in Section 7.5.5.

Where new tracks are required, dozers and graders will be used to clear vegetation (where necessary) to provide a trafficable surface to allow safe passage for large / heavy vehicles and equipment during the construction phase. Light grading alone is often enough, depending on terrain and preparation requirements. Dune and or boggy areas may require capping with imported material.

Tracks will be designed to take the shortest route (with the potential to use short spur tracks off existing roads or access tracks) and with as little impact as possible to native vegetation, existing land uses and landholders. Access tracks for construction will need an approximately 5 m cleared track to access tower construction footprints.

Potential arrangements for access tracks, including situations where there is existing nearby access, are shown in Figure 7-11.

Temporary stringing access corridors approximately 10 m wide between tower locations will also be required to allow stringing of the conductors (see Section 7.8.5). These are typically not graded (except where the access track forms part of the corridor) and need only to be suitable to allow machinery (e.g. a tractor or dozer) carrying draw wires between towers to traverse safely, and to allow draw wires and conductors to be pulled upwards without being impeded by vegetation. Low level vegetation will be rolled where required, rather than removal.

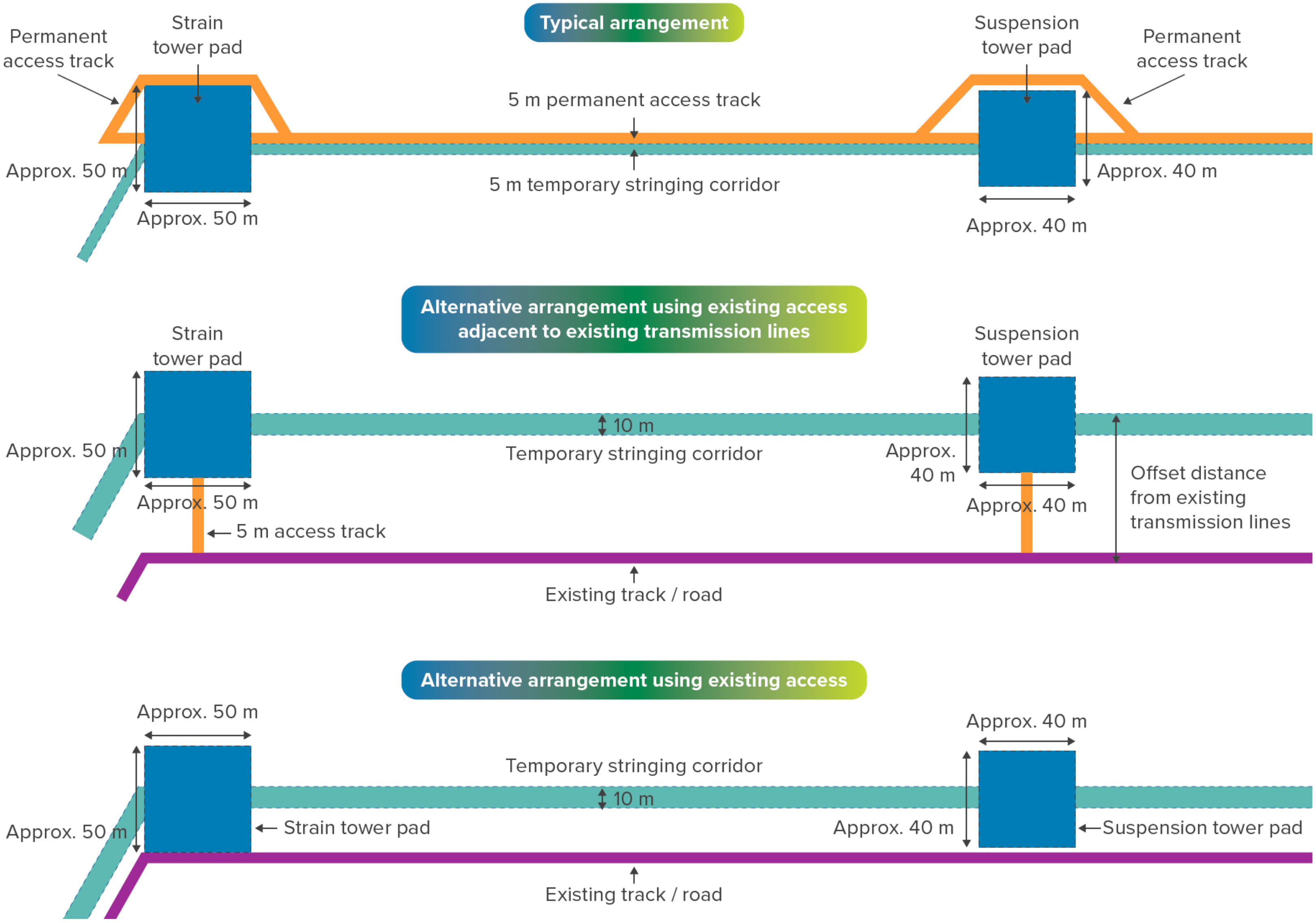


Figure 7-11: Construction and operation access track options

7.8.2. Vegetation clearance and topsoil stockpiles

In areas where native vegetation is present, clearance will be required for access tracks, tower installation (tower pads), stringing pads and other temporary construction activities (e.g. construction camps, laydown, brake and winch sites and helicopter staging sites). Areas where native vegetation is degraded or has been previously cleared will be utilised in preference to clearing vegetation wherever practicable. Cleared vegetation will be stockpiled for use in rehabilitation where required.

Conservative estimates of land disturbance for each component of the Project are provided in Table 7-3. These have been used as a basis for calculation of vegetation clearance in Chapter 11 Flora and Fauna. It is noted that the total area of land disturbance is significantly higher than the potential vegetation clearance area, as many areas along the proposed alignment are already disturbed and devoid of vegetation or comprising only sparse vegetation regrowth (e.g. Bundey substation site, existing access tracks, existing fire break on Calperum Station etc), which will significantly reduce the actual area of vegetation disturbance.

Where feasible, vegetation will be rolled or trimmed rather than being completely removed, however sites such as access tracks, tower locations, helicopter staging sites and some brake and winch sites will require complete removal of vegetation. Removal of larger trees (e.g. trunk diameter over 30 cm) will be avoided where possible.

Preparation of the stringing access corridor between tower locations will typically be undertaken using a dozer with blades raised to remove larger trees while keeping shrubs, grasses and topsoil largely intact. Where possible, the stringing access corridor will be rolled to allow access. Larger trees in the stringing access corridor may be cut off above ground level with rootstock left intact to allow regeneration rather than being removed where practicable.

Trimming of vegetation to maintain electrical clearance requirements for operation may also be required, dependent on detailed design of the line and the height of mature vegetation, as discussed in Section 7.8.7.

Table 7-3: Estimated area of land disturbance for the various project elements

Project component	Assumptions / description	Estimated disturbance area (ha)	Post reinstatement
Access tracks (permanent)	5 m wide access track for entire proposed alignment. This is considered an extremely conservative estimate as existing tracks and minimal clearance is required for much of the line. Alternative access arrangements will be utilised in sensitive areas. Alternative arrangements are covered in Section 7.8.1	Approx. 102 ha (0.5 ha per km) permanent disturbance	Light vehicle access
Stringing access corridor (temporary)	5 m wide temporary disturbance alongside 5 m access track for the entire proposed alignment to allow for stringing access and passing bays. This is considered an extremely conservative estimate as existing tracks and minimal clearance is required for much of the line. Where existing offset access track is used, the temporary stringing access corridor will be up to 10 m in width. Alternative arrangements are covered in Section 7.8.1	**Approx. 102 ha (0.5 ha per km) temporary disturbance**	Nil – These sites are temporary and will be reinstated post construction. Ongoing maintenance clearance requirements are discussed in Section 7.8.7

Project component	Assumptions / description			Estimated disturbance area (ha)	Post reinstatement
Substation (permanent)	400 m x 250 m			**Approx. 9 ha permanent disturbance**	9 ha
Worker accommodation camps, laydowns and helicopter staging sites (temporary)	Up to a maximum of 4 temporary construction camps (2 – 5 ha each) Up to 4 main laydown areas (1 – 2 ha each) Between 4 – 9 helicopter staging sites for tower transport (Up to 6 ha each) (this may reduce the footprint of tower pads to 28 m x 28 m)			**Temporary camps – total maximum clearance of ~ 20 ha** **Temporary laydown areas – total maximum clearance of ~ 8 ha** **Temporary staging – total maximum clearance of ~ 54 ha**	Nil – These sites are temporary and will be reinstated post construction
Concrete batching (temporary)	Up to 3 concrete batching plants			**Approx. 3 ha temporary disturbance**	Nil – These sites are temporary and will be reinstated post construction
Brake, winch and OPGW sites (temporary)	Assuming every 16 km, 3 brake / winch sites (0.24 ha each) and 2 further OPGW sites (0.18 ha each) 1.08 ha per 16 km = 13.84 ha for total alignment, assuming dual use of brake / winch and OPGW sites / helicopter stringing sites			**Approx. 17.3 ha (13.84 plus 25% contingency for additional angles anticipated through Calperum Station) temporary disturbance**	Nil – These sites are temporary and will be reinstated post construction
Towers	**#**	**Assembly method**	**Ha per tower**		
Strain towers *[includes 4 Medium Terminal towers*]	**76**	2-stage Assembly method (50 x 50 m) Alternative methodologies are covered in Section 7.8.4. Should helicopters be used smaller pads will be required.	0.25	**Approx. 19 ha total – 5 ha permanent disturbance and 14 ha temporary disturbance**	Partially rehabilitated. Assumed 25% of area remains cleared. Ongoing maintenance clearance requirements are discussed in Section 7.8.7
Suspension towers *[Assumes heavy, though light is same clearance]*	**300**	2-stage Assembly method (50 x 50 m) Alternative methodologies are covered in Section 7.8.4. Should helicopters be used smaller pads will be required.	0.25	**Approx. 75 ha total – 19 ha permanent disturbance and 56 ha temporary disturbance**	Partially rehabilitated. Assumed 25% of area remains cleared. Ongoing maintenance clearance requirements are discussed in Section 7.8.7
Topsoil stockpiles	**376**	Topsoil removal of 100 mm depth for 76 strain tower locations = approx.. 250 m^3**.** Assume 2 m high Topsoil removal of 100 mm depth for 300 suspension tower locations = approx.	0.0125 0.008	**3.35 ha temporary disturbance**	

Project component	Assumptions / description			Estimated disturbance area (ha)	Post reinstatement
		160 m³. Assume 2 m high			
Total (Upper estimate) disturbance for the Project				135 ha permanent 278 ha temporary	

Note: Much of the infrastructure will be located in previously disturbed areas, and little to no vegetation removal will be required.

The temporary stockpiling of topsoils and subsoils may be required during the construction phase of the Project, specifically for the establishment of lattice towers and for laydown areas along the proposed alignment. Stockpiles will be located in areas clear of vegetation as far as practicable and away from defined watercourses to reduce the potential for surface water erosion impacts to creek lines and may be temporarily covered with cleared vegetation to reduce the potential for wind erosion. Stockpiles at tower locations will be located outside of the defined tower pad.

Following the completion of construction activities, the stockpiled topsoil and subsoil would be re-spread over the cleared area with the cleared vegetation, and the sites left to naturally revegetate. Where appropriate and as per discussions with the landholder, topsoil may be provided to the landholder for re-use. Where not suitable the spoil may be used for other purposes such as capping or taken to a licensed facility for disposal (See Chapter 19 Waste Management further detail).

7.8.3. Foundations and footings

A drill rig will be employed to drill structure foundations. If rock is encountered, the use of a rock drilling machine is typically used to pre-drill pilot holes. Once drilled, fabricated reinforcement cages will be placed into the foundation, the stub set in place and concrete poured (see Plate 7-4).

Plate 7-4: Example of foundation construction

7.8.4. Tower assembly and erection

The towers will typically be installed onto the footings at each structure location. This stage involves:

- Steel towers delivered in pieces to the structure location on a semi-trailer or via helicopter (as discussed further below)
- Towers are then assembled at each location. This involves a two-stage process (if not preassembled at a staging site and transported to the tower pad):

1. An assembly crew join the steel to build tower sections. This work will usually involve a small crane and supporting utility vehicles.
2. The next work crew will follow behind and erect and join the sections to form the complete tower. They will do this with the support of a larger crane and supporting utility vehicles.

An example of a typical two-stage assembly pad layout and footprint is shown in Figure 7-12 and an example of tower assembly and erection may be seen in Plate 7-5.

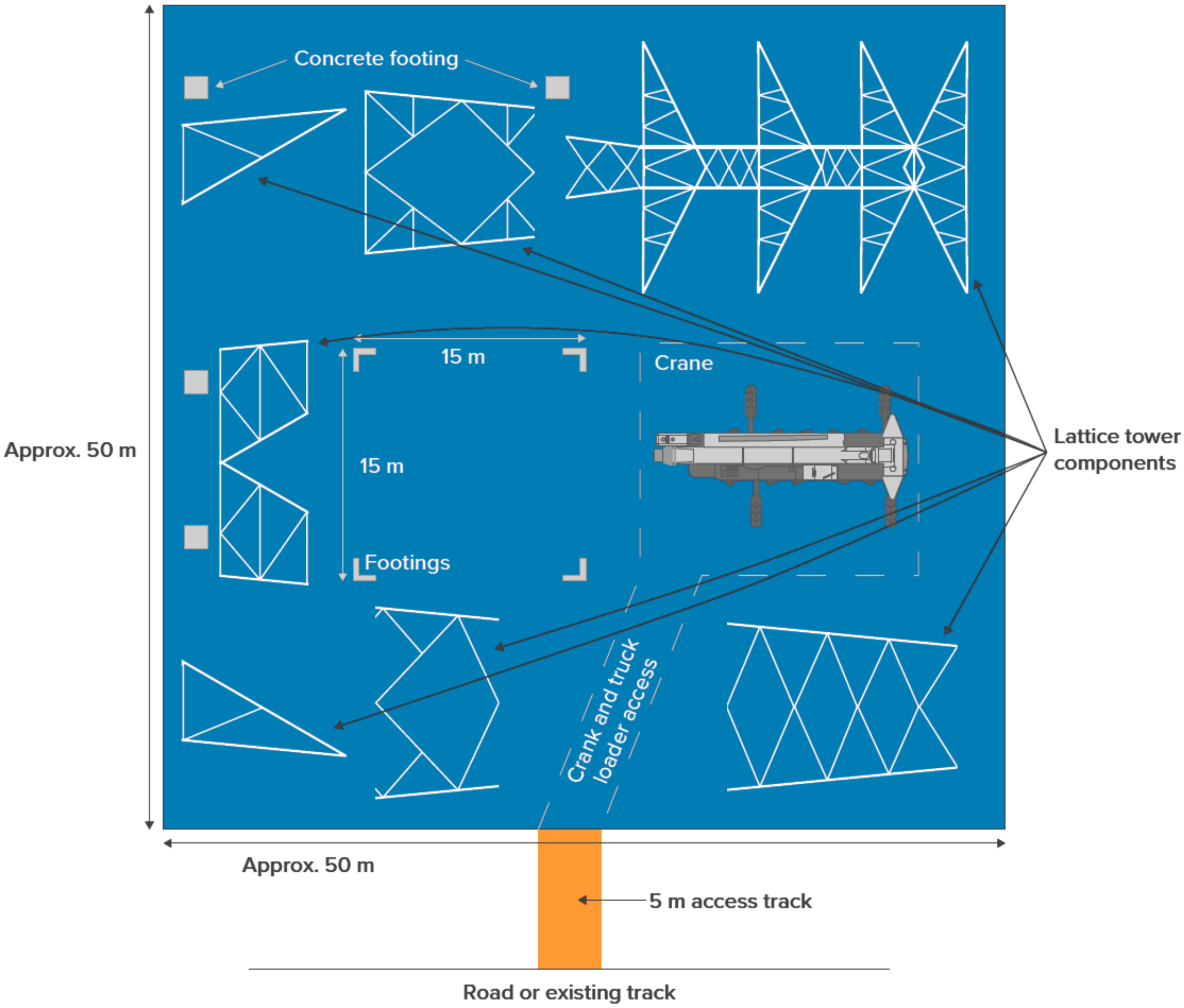


Figure 7-12: Typical pad layout with two stage assembly

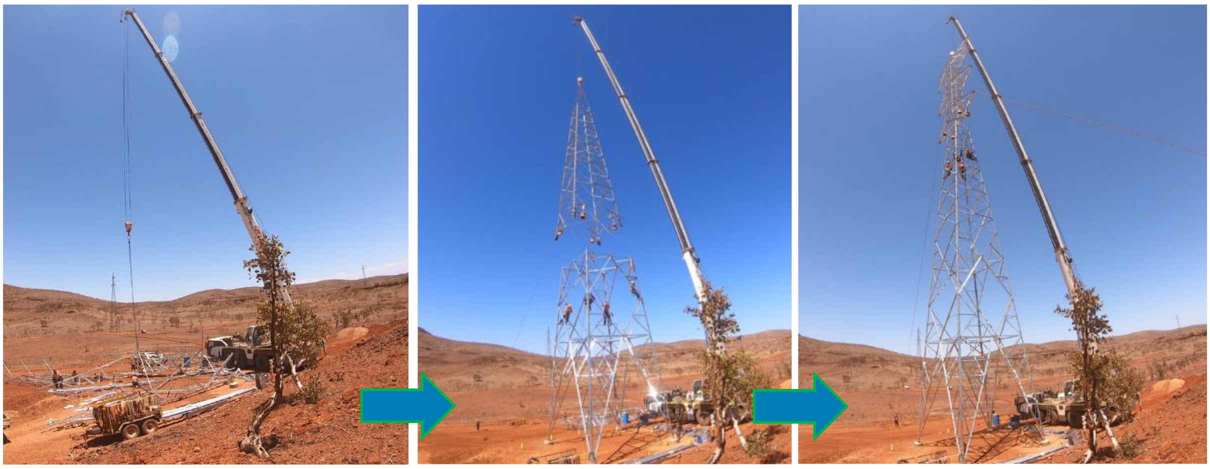


Plate 7-5: Example of tower assembly and erection

Helicopter tower transport and erection

As discussed above, the use of a large twin-engine helicopter or sky crane for the transportation of preassembled towers will be investigated during detailed design as an alternative for tower assembly and erection. Should a helicopter be utilised, it is anticipated that it will transport small sections of towers to tower locations in Taylorville Station, Hawks Nest Station and Calperum Station. Preassembly and helicopter transport of towers, rather than constructing towers at each tower location will significantly reduce disturbance at each tower pad. An example of helicopter lifts and transport may be seen in Plate 7-6.

Plate 7-6: Examples of helicopter lifting and tower transport
(Source: Erickson Incorporated 2020)

7.8.5. Conductor stringing

Once the tower structure has been erected, conductors are strung between the structures. Stringing of the conductor is usually undertaken in sections of 5 – 10 km at a time. Typically stringing will be undertaken within a temporary stringing corridor using equipment such as winches and purpose built stringing machines (see Plate 7-7).

Plate 7-7: Brake site from where the conductor is pulled out under tension

There are two primary methods of stringing, these include strain to strain method and the floating method.

Strain to strain method

The strain to strain method involves the use of pullers and tensioners set up on level pads (see Figure 7-13 and Figure 7-14) to pull the conductor wire under tension from one strain structure to another strain structure. On completion of stringing, the conductor wire is then anchored with rigging gear to the strain cross arms at one end, with the conductor measured, cut, terminated and connected to the strain insulator assembly. At the other end, the conductor wire is pulled to final required tension, measured, cut, terminated and connected to the strain insulator assembly. This process is repeated for all conductor and earth wires before installation of insulator clamp assemblies.

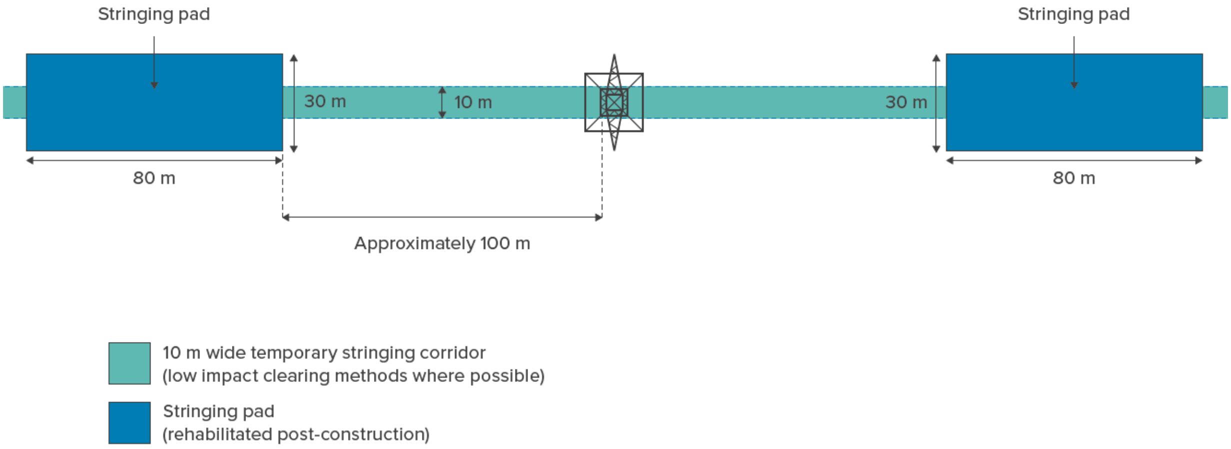


Figure 7-13: Typical stringing-strain to strain arrangement

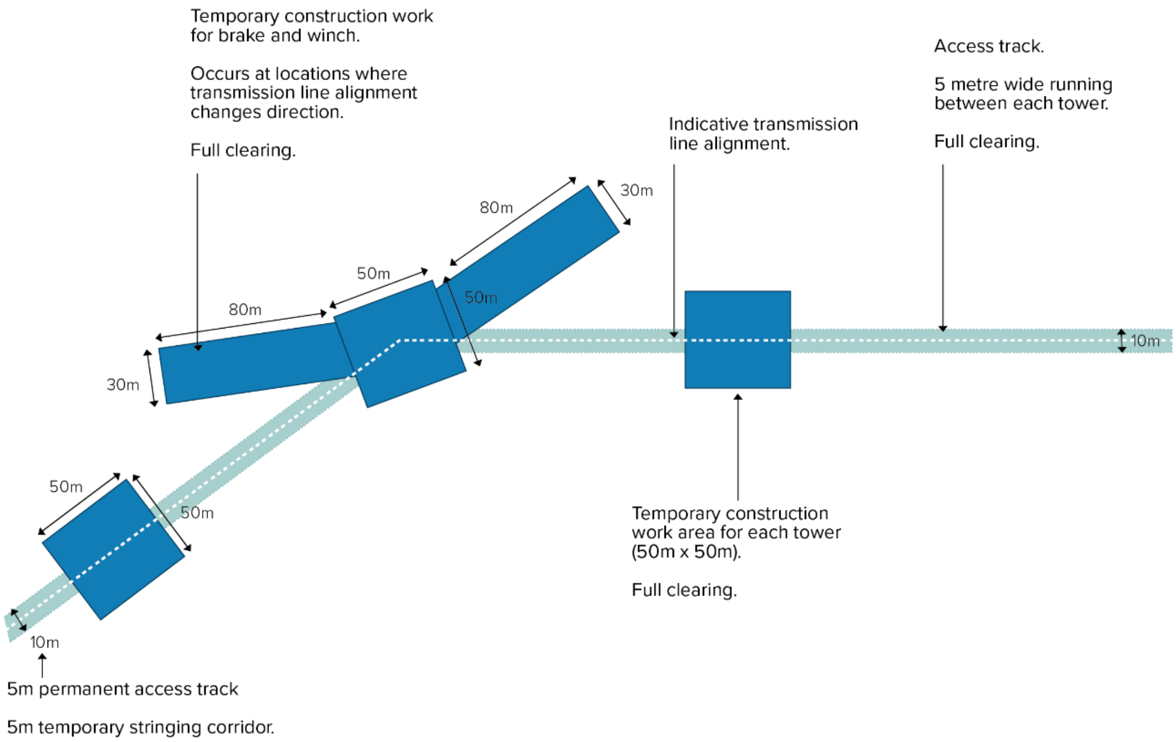


Figure 7-14: Typical stringing arrangement for an angle structure

The OPGW (or optical ground wire) method involves stringing a thinner wire used for both communications and grounding to the top of the structure. As this wire cannot be jointed without bringing it to ground level, additional pads are required along the alignment during the stringing process.

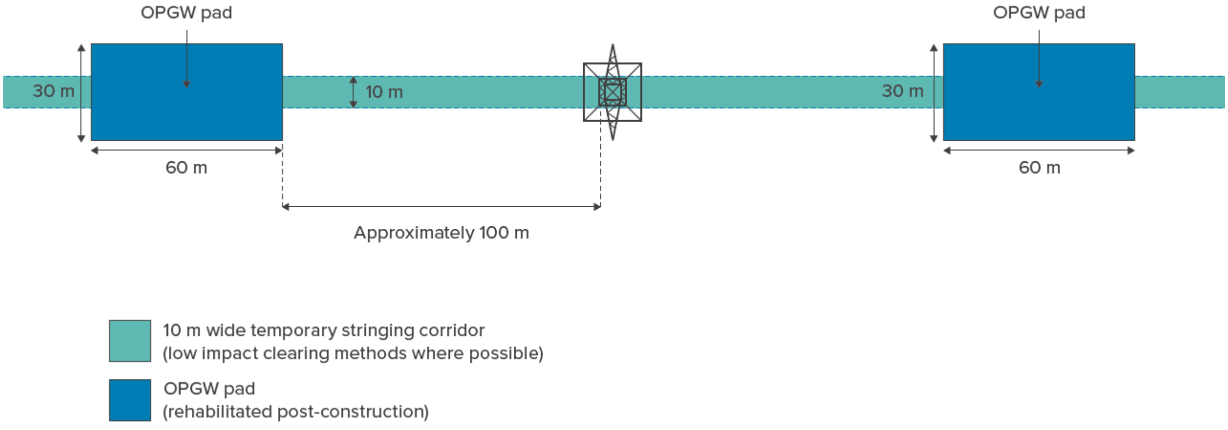


Figure 7-15: Typical stringing pad arrangement with OPGW pads

Floating method

The floating method involves using pullers and tensioners to pull the conductor wire under tension from the middle of a span (see Figure 7-16). On completion of stringing, the conductor wire is then anchored with rigging gear to a ground anchor. The conductor tails are joined using a mid-span joint with the conductor wire then pulled sideways until tension is taken up by a sideways pulled winch. The conductor is then allowed to float until all tension is off the anchors and they can be disconnected. By pulling the other end back the conductor can be taken to final tension, measured, cut, terminated and connected to the strain assembly, or jointed to a previously installed section. This process is repeated for all conductor wires before installation of insulator / clamp assemblies.

This method is generally used for conductor wire stringing.

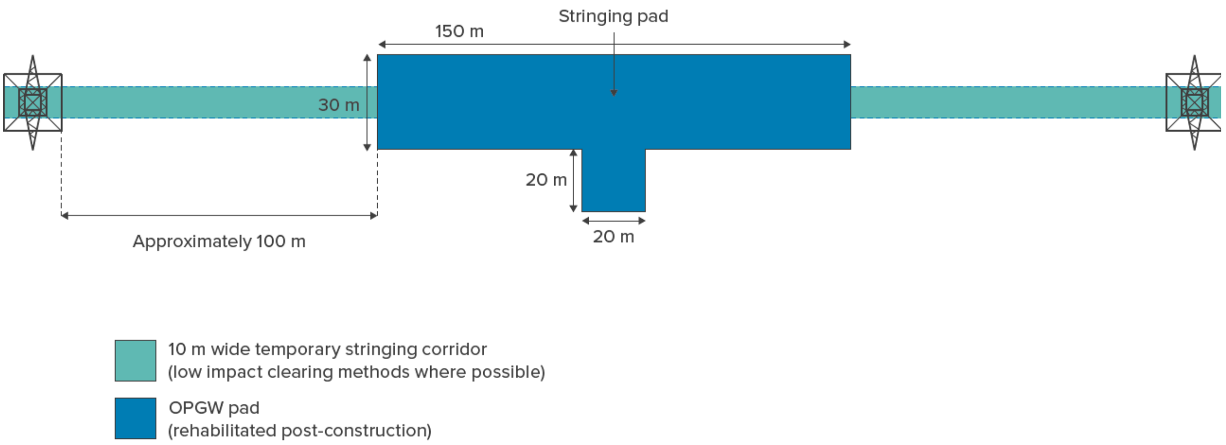


Figure 7-16: Typical stringing pad arrangement (floating method)

Where required, a separate temporary stringing corridor will be established to accommodate the stringing process, as discussed in Section 7.8.2. The vehicle used to carry conductor wires into position will be rubber wheeled (where possible) to minimise damage to remaining vegetation. On completion of stringing, the site will be rehabilitated. Measures will be implemented to prevent stringing access corridors becoming access tracks where possible. There is a possibility that aerial stringing will be used in some locations. This will be confirmed by ElectraNet and the EPC contractor and will be included in the final version of the CEMP.

Helicopter stringing

Helicopters or drones may be used for conductor stringing which will also speed up the stringing process, allowing construction to finish sooner and minimizing disturbance and vegetation clearance.

Helicopters may also be utilised in secondary stringing activities, such as placement of marker balls and spacer rings following completion of stringing. At the forefront of stringing technology is also drone use, which combines the ease of access of helicopter stringing, whilst further minimising environmental impacts through reduced sound levels and carbon emissions.

Pre-commissioning and commissioning

Pre-commissioning involves proving the continuity and insulation of the line (making sure everything is electrically connected from one end to the other and also nothing is accidently connected to earth). This stage involves a range of testing on all pieces of equipment including the substation and transmission lines, to prove that the equipment operates as intended both from the factory and as designed. This process takes approximately one month. Following completion the interconnector will be energised.

7.8.6. Clean up and rehabilitation

Once stringing is complete, areas of temporary clearance will be rehabilitated. This stage involves:

- removing all equipment, vehicles, temporary fencing, signage and refuse from site
- using earthmoving machinery to de-compact areas of compaction (potentially through ripping or appropriate methods) where required
- re-contouring disturbed land to match surrounding ground levels (as appropriate)
- spreading of stockpiled topsoil on top of de-compacted areas.
- in areas of native vegetation - placing cleared vegetation that was stockpiled during access and clearing, over returned topsoil to assist in natural regeneration

7.8.7. Operation and maintenance

Easement access and maintenance

ElectraNet undertakes periodic vegetation management works on all its easements across the South Australian electricity network, to ensure that mandatory minimum clearance between vegetation and transmission lines are maintained. Transmission lines within a designated bushfire or high bushfire rated area are inspected and cleared every year, while lines in all other areas are inspected and cleared every three years.

The clearance distances between transmission lines and vegetation are legal requirements outlined in the *Electricity (Principles of Vegetation Clearance) Regulations 2010* (EPVC Regulations) It should be noted that amendments will be required to be made to these regulations to account for 330 kV transmission lines, which are not currently part of the South Australian electricity network. Vegetation clearing or trimming along the easement will only be carried out where necessary to facilitate access to specific locations such as towers and areas where vegetation will encroach on the clearance zone underneath the transmission line conductors.

Vegetation assessments, including canopy height measurement, are used during the detailed engineering phase to design the line profile. Where possible, conductor heights will be set to avoid or minimise the requirement for vegetation clearance both during construction and ongoing maintenance. Where vegetation clearance is unavoidable and to minimise the risk of power outages, damage to transmission lines or fire starts, vegetation management works are undertaken to make sure that clearance distances between vegetation and transmission lines are established and maintained in accordance with EPVC Regulations (see Figure 7-17).

As much of the native vegetation is relatively low, slow growing and at mature height, it is planned to design the line to span across mature vegetation with minimal clearance required where feasible. If this is not feasible, some clearance or lopping of trees may be required under the conductors in some areas. Preliminary calculations indicated that trees up to a height of approximately 8 m may be able to be spanned without trimming. This will be confirmed when detailed line design is undertaken. Clearance zones required under the EPVC Regulations are shown in Figure 7-18.

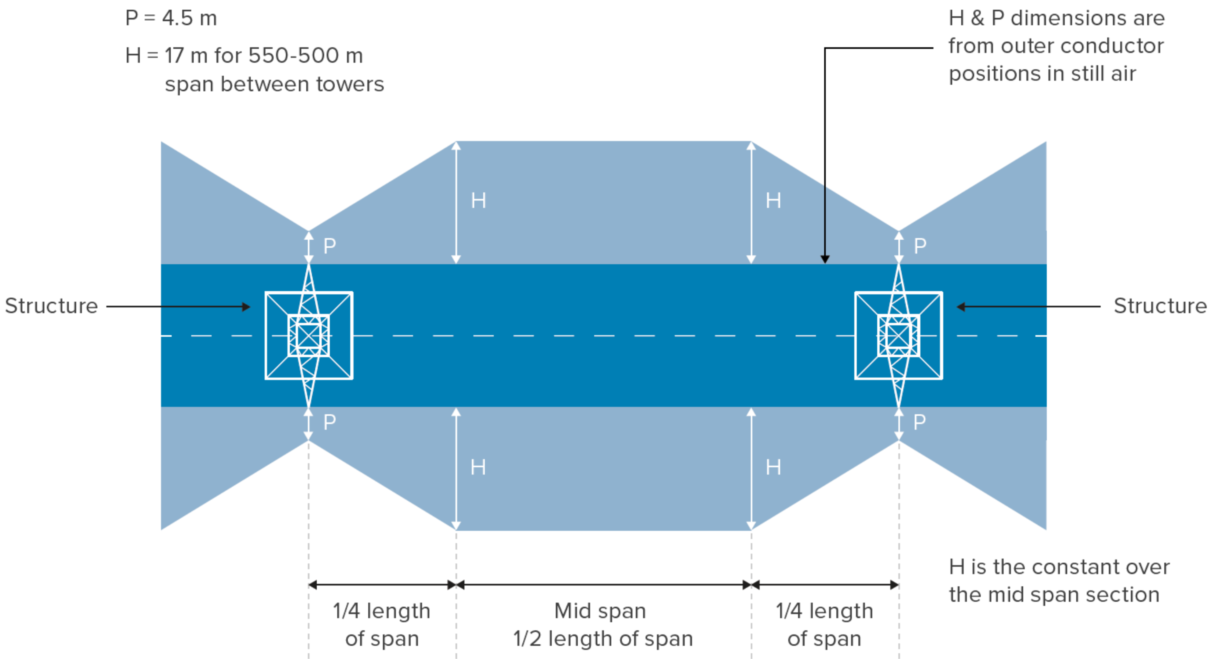


Figure 7-17: Vegetation clearance requirements for operation of the Project

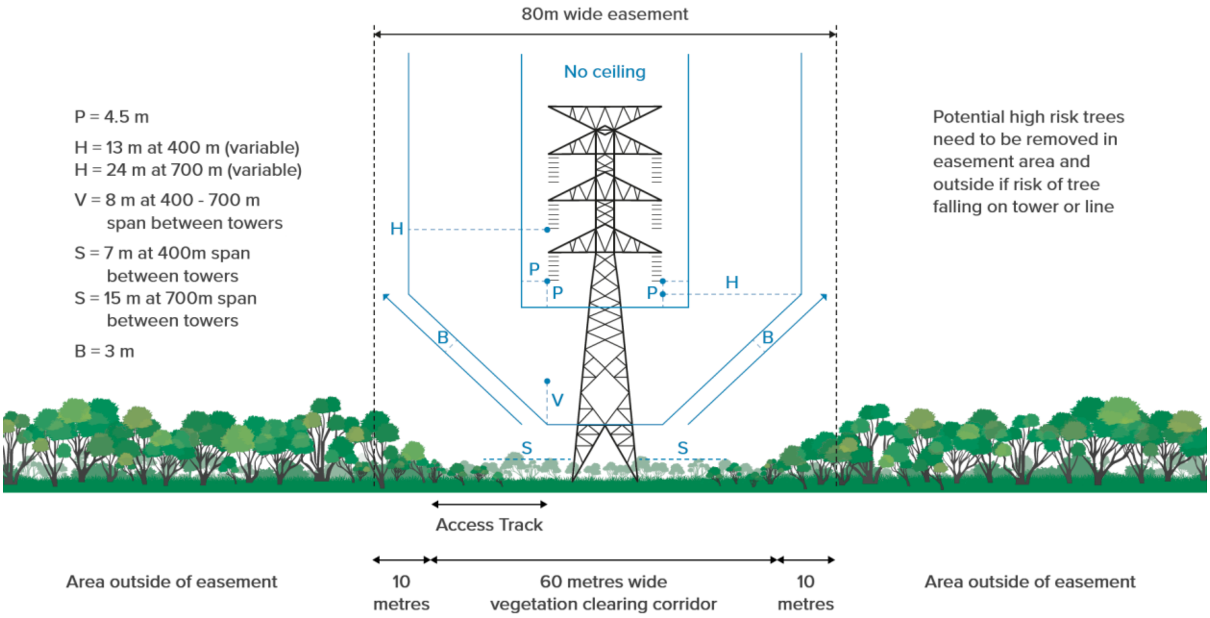


Figure 7-18: Requirements of *Electricity (Principles of Vegetation Clearance) Regulations 2010*

7.9. Resources and Materials

7.9.1. Borrow material

Imported borrow material, such as clay, crushed rock and aggregate would be required for construction. The material will be used in the development of access tracks in some areas such e.g. capping of dunes, and for tower pads in certain conditions. Borrow material and crushed rock (e.g. for concrete manufacture) would be obtained from a range of sources including commercial suppliers, existing approved borrow pits or new borrow pits with appropriate approvals in place (e.g. Extractive Minerals Leases) where required. Material from excavations may be suitable for re-use on site also. Quantities and sourcing locations will be confirmed following geotechnical investigations and during detailed design.

7.9.2. Water supply and use

Initial estimates have suggested approximately 27,500 kL of water will be required for construction. This estimate includes 220 kL of potable water for construction camps, 7,000 kL for concrete batching, 20,000 kL for dust suppression, and 300 kL for miscellaneous use such as wash bays. The water is likely to be sourced from local areas and may be carted in and out of site by tankers. Water for concrete batching must meet the requirements of A1379-1997.

During ECI, water supply options will be reviewed and selected. This could include but is not limited to purchasing water from pre-existing licensed users, including local landholders proximate to the route and local councils. There remains the opportunity to purchase water from council which have wastewater reuse programs. If required, bores maybe installed (subject to permitting requirements) to supply construction dust suppression water as well as water for concrete batching, where the water is of the requisite quality. There is potential for an on-site water treatment plant allowing bore water to be treated and utilised in the temporary workers camps, with the discharge from the treatment plant used for dust suppression.

7.9.3. Concrete batching

Concrete and / or dry concrete premix for the foundations is likely to be supplied by a concrete agitator / truck travelling between local concrete batching plants in Robertstown and Berri. Up to three mobile concrete batching plants will also be required at various locations along the transmission alignment, nominally, located at the laydown/ staging sites at the Bundey substation site, North West Bend substation and a location along the Wentworth-Renmark Road. Final locations will be determined during detailed design and in accordance with ElectraNet’s site selection criteria detail in Section 7.5.6. Each batching plant will require a temporary disturbance footprint of approximately 100 m x 100 m. These will be determined during the detailed design process.

Each tower would require approximately 50 – 100 m^3 of concrete delivered to the site. This would require approximately 16 truckloads per tower. In areas where bored piers are not suitable, foundation footprints and volumes may be larger.

Following the completion of a foundation pour, concrete trucks will back up into a designated temporary washout bay (double lined) and any hardened concrete or residual slurry will be washed out. The washout bay will capture the waste and wastewater. This process will typically occur in the same location as brake and winch/ stringing pads, spaced approximately every 5 km. As such, no additional disturbance will be required. The waste will be transported off site once the wastewater has evaporated and the waste has solidified. The waste will then be disposed of at a licenced facility for reuse or disposal.

Temporary concrete batching and washout bays will not be sited within 350 m of residential premises.

The appointed EPC contractor will liaise with the EPA and will obtain all necessary licences for these temporary plants.

7.9.4. Hazardous materials and chemicals

During construction, typically only fuels and lubricants are stored on site for the operation and maintenance of plant and equipment. Typical substances and use is provided in Table 7-4

Fuel usage estimates will be discussed with local suppliers during the detailed design and ECI phase to establish whether they can provide sufficient fuel for construction of the Project. Should local supply not be available, the appointed EPC contractor will store and manage its own fuel.

Should this be required the following will be provided / considered:

- Storage – Bunded containers with self-contained pumps. Where possible all equipment will use diesel fuel. Bunded areas will be constructed to contain potential spills.
- Permitting – permits will be obtained for bulk fuel storage.
- Delivery will be from Adelaide via bulk carrier.
- Records will be kept of usage to enable forecasting of delivery requirements.

Table 7-4: Typical chemicals used during construction

Substance	Storage Areas	Use
Diesel	Bunded container	Mobile plant fuel
	Fuel trailer	Refueling plant in field
	Refueling trucks, cranes and other plant	Refueling plant and heavy vehicles in field
Unleaded	Bunded container	Small petrol tools
Aviation fuel	Bunded container	Refueling helicopters
Oils	Bunded container	Maintenance, equipment and tools use
	Bunded container	Drilling, lubrication, rust
Paints	Bunded container	Painting conduits, cold galvanising steel
		Painting bases of steel work
		Mixing paints, clean up
Silicon	Flammables cupboard	Labels and sealing
Alminox	Flammables cupboard	Conductor grease
Herbicides	Bunded container	Weed management

Chemicals, oils and other waste substances will be collected, stored in designated waste storage areas for collection by an authorised contractor and disposed of off-site in accordance with EPA requirements. Waste management is further detailed in Chapter 19 Waste Management.

7.9.5. Plant and equipment

A variety of equipment will likely be used for the key construction activities detailed above.

Table 7-5: Indicative plant and equipment

Typical equipment type	Approximate number
D6 dozer	1
D10 dozer	1
Graders	2

Typical equipment type	Approximate number
Mulchers	2
Front end loaders	2
Drones	2
Cranes (ranging from 50 – 300 tonne)	3
Franna crane (20 / 25 tonne)	7
Air compressors	3
Backhoes	1
Concrete agitator	8
Generators	10
Stinging winches	8
Helicopter for tower transport (Kamov Ka-32A11BC or similar)	1 (if required)
Piling rigs	6
Pneumatic jackhammers	2 (if required)
Rollers (ranging from 10 – 15 tonne)	2
Small excavators	1 small excavator (5 t), 2 large (20 t)
Dump trucks	2
Transport truck (B doubles)	3 to 4 B-double deliveries per day. However, this can increase at peak time e.g. during reinforced steel cage deliveries, towers steel deliveries, conductor / OPGW drums deliveries etc.
Mobile concrete batching plants	2, potentially 3 in the summer (TBD in ECI)
Watercarts	4
Bob cats	6
Crawler crane with grab attachments	1
Flatbed trucks	9
Elevated working platforms	12
Scrapers	1
Helicopter for conductor stringing (Eurocopter AS350 Squirrel or similar)	1 (if required)

7.9.6. Traffic and transport

Vehicle types

Construction vehicle movements would comprise vehicles transporting infrastructure components, plant and equipment, borrow materials, spoil and waste as well as light vehicles associated with construction workers to and from construction sites.

Load deliveries to the site for large volumes are assumed to occur in the most economic vehicle type legally permitted to undertake the journey on the relevant road. For most deliveries this will be on 19 m semi-trailers. Where the quantity to be transported is much smaller than the load capacity of a semi-trailer, smaller rigid trucks or light commercial vehicles will be used. It is also expected there will be oversize loads required for the delivery of materials for the Bundey substation primary plant and control buildings.

Table 7-6 provides a summary of the anticipated vehicle types that are expected to be utilised during construction of the substation, towers and transmission line.

Table 7-6: Indicative vehicle types to be used for construction

Vehicle type	Use during construction phase
Semi-trailer (B-doubles)	Tower transport
	Transport of conductors, insulators, OPGW and other hardware
	Transport of materials and equipment for substation civil works
Cranes	General construction activities for both substation works and installation of towers and transmission lines
Concrete Truck	Supply of materials for substation and tower footings
General rigid trucks	General construction activities, including water supply, transfer of borrow pit materials and / or movement of camp supplies
Dozers	Substation civil works and transmission line construction
Graders	Substation civil works and transmission line construction
Excavators	Substation civil works and transmission line construction
Light vehicles	Trade vehicles, general inspection activity

Vehicle movements

Construction traffic will be greatest during the main earthworks and civil construction activities. Light vehicle movements associated with construction workers traveling to and from site from the temporary construction camps. In general vehicle movement will be scheduled outside peak periods wherever possible. Indicative traffic movements are summarised in Table 7-7. These vehicle movements are based on the expected typical peak construction period of the Project. These vehicle movements will be confirmed during detailed design and traffic management measures will be addressed in a Traffic Management Plan.

Table 7-7: Indicative construction traffic movements

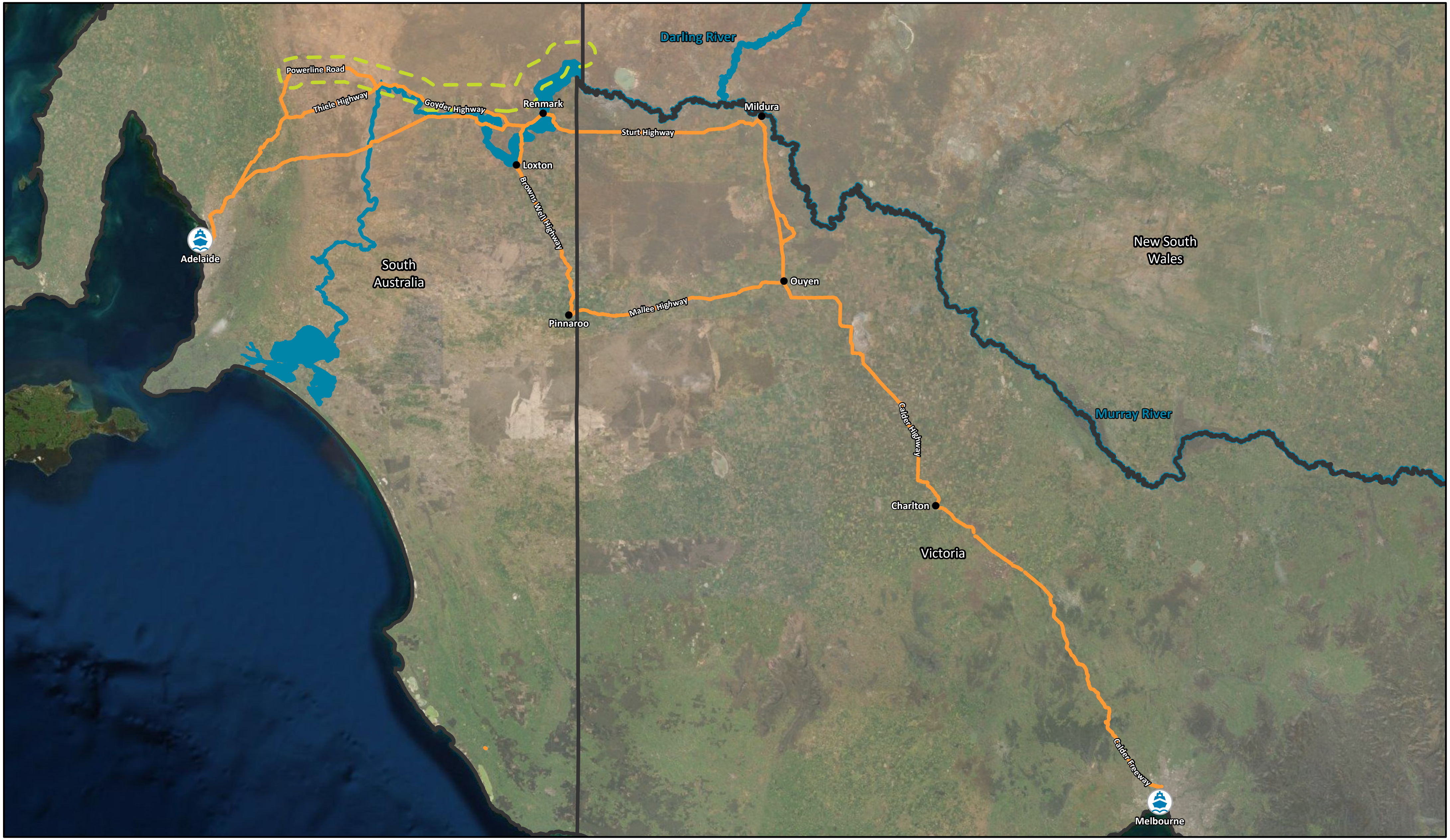
Vehicle type	Total number of loads during construction phase (assumed 18 month duration)	Expected number of movements per day on the road network (note: 1 trip = 2 movements)
Semi-trailer (for towers, conductors, insulators, OPGW, hardware etc.)	990	Up to 20 (i.e. 10 trips / day)
Crane	-	Minimal – cranes will largely move about within construction areas and along access track between tower sites
Concrete trucks	2,780 (based on a total of 450 towers which is considered extremely conservative, 6 trucks per tower and 80 trucks for the Bundey substation)	16 (assuming all footings are constructed within the first 12 months)
General rigid trucks	Approximately 10 vehicles per day	20
Dozers, graders and excavators	Movements occur within the site only; these vehicles to be transferred to and from site via semi-trailer	-
Light vehicles and buses for transportation of workers	20 – 40 per day	40 – 60

Construction haulage routes

A large proportion of Project components will be imported. The port location(s) which would receive imported Project components are not confirmed at this stage. These will be confirmed following detailed design and procurement process. Locations being considered include Port Adelaide and Port of Melbourne. The final long-distance haulage route from each of these locations will also be determined by the appointed EPC contractor. Expected long distance haulage routes are anticipated to include:

- **Port Adelaide** – Port River Expressway, Salisbury Highway, Port Wakefield Road, Northern Expressway, Sturt Highway, Thiele Highway, World's End Highway, Powerline Road
- **Port of Melbourne** – Calder Freeway, Midland Highway, Calder Highway, Calder Alternative Highway, Millewa Road, Werrimull North Road, Sturt Highway, Mallee Highway, Browns Well Highway, Old Sturt Highway

These long-distance haulage routes are illustrated in Figure 7-19. Local haulage routes will predominantly include Powerline Road, Lower Bright Road, Woods and Forest Road, Lunn Road, Cooltong Avenue, and the Wentworth-Renmark Road (see Figure 7-20). These preliminary haulage routes will be reviewed during detailed design and a final route assessment provided in the Traffic Management Plan.



15 km investigation corridor
Main haulage route
Main road
Watercourse
Port location

Figure 7-19
Indicative port and haulage route locations

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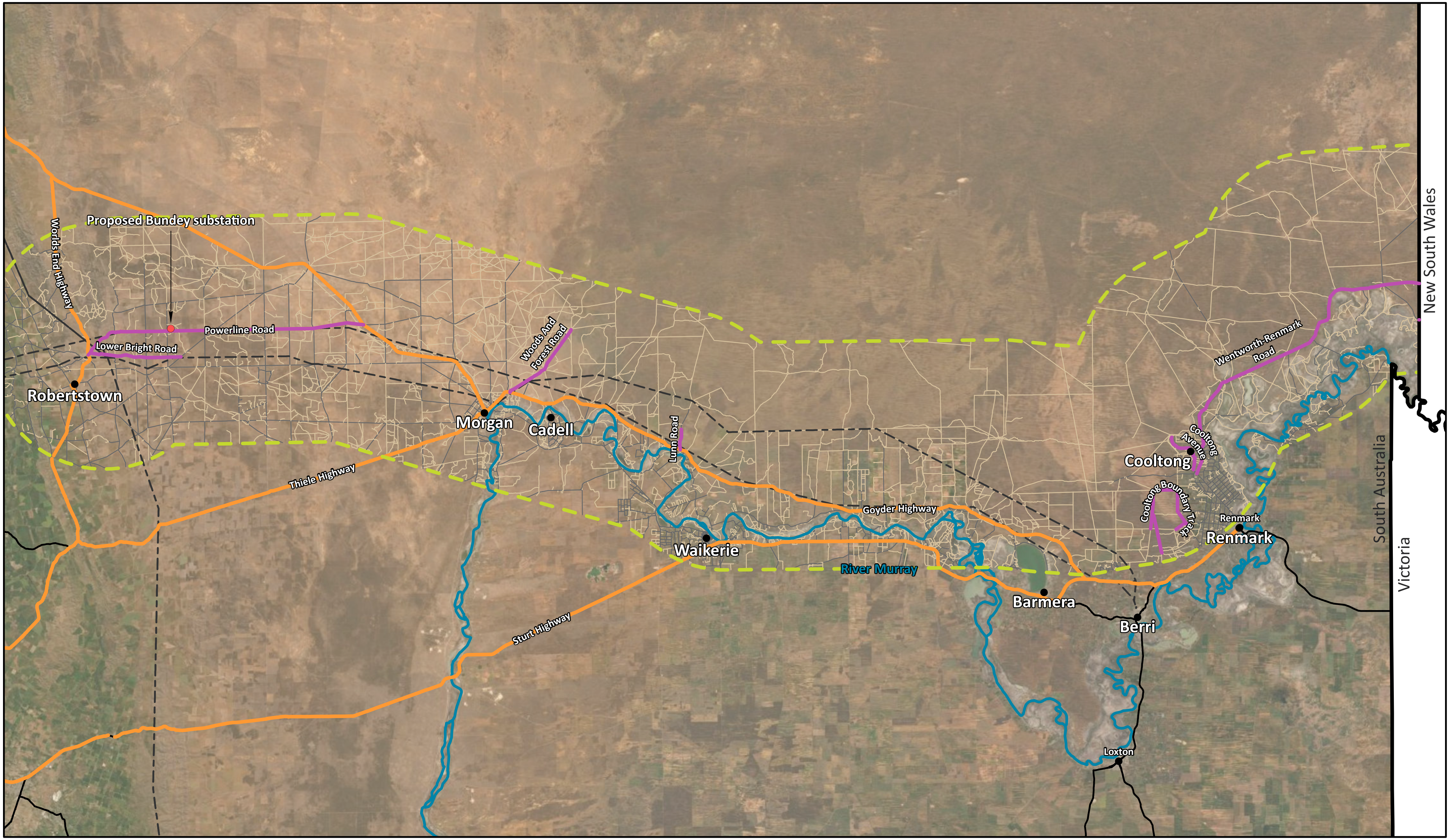

30 km investigation corridor
Local haulage route
Main haulage route
Existing ElectraNet transmission line
Main road
Road
Access track
Proposed Bundey substation

0 20
Kilometres

N

Figure 7-20
Indicative local haulage routes

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Construction parking

Construction worker parking will be provided within the temporary construction camps and within the confines of the Bundey substation, as described in Section 7.5.6.

For the construction of the transmission line, given the transient nature of these construction works, and potentially long distances between construction camps and work sites, it is expected that workers would typically be transported by bus where possible. Where crews are smaller (3 – 4 people) light vehicles will be used. Where other light vehicles are used to access work sites, parking will generally be within 30 m of each tower location on the edge of access tracks within in cleared areas.

Emergency evacuation

An emergency response and evacuation management plan will be developed by the EPC contractor following award and prior to construction commencement. This plan will be developed in consultation with the Country Fire Service, ElectraNet and the local council (as appropriate).

7.9.7. Waste management

Solid waste

The majority of solid waste generation associated with the Project will be during construction. Sources of waste include excavated spoil, vegetation, construction materials, general waste at camps and yards / offices.

The management of waste will be in line with the Waste Management Hierarchy (EPA SA 2015) and will aim to avoid and reduce waste generation where possible. Excavated spoil will be reused on-site where appropriate, i.e. for capping of access roads and tower pads. Waste generated during construction will be separated into waste streams (such as metal, hydrocarbon, plastics, cardboard, and general waste) for later reuse, recycling or disposal to a suitable licensed facility by an appropriately licensed transport contractor, in line with EPA requirements.

Waste management is further detailed in Chapter 19 Waste Management.

Wastewater

The construction camp waste management is likely to be subcontracted out. It is likely that a collection tank will be set-up at the camp site by a professional installer then a qualified waste disposal contractor will be engaged to collect wastewater and sewage on a weekly or bi-monthly basis. An alternate option is for the sewage to be treated and then spray over the pre-approved area for disposal.

Portable toilet(s) will be serviced every week by a portable toilet supplier along the transmission line corridor.

Potential impacts associated with the management of waste are covered in more detail in Chapter 19 Waste Management.

7.10. Workforce and Working Hours

7.10.1. Workforce

The workforce engaged at any particular time is expected to vary throughout the course of the construction period and will depend on specific activities to be undertaken. The workforce may be as low as 20 during the early pre-construction phase, increasing up to approximately 160 – 250 during the later stages of pre-construction and peak construction when the full range of activities, including access and easement preparation, foundation installation, tower assembly and erection and conductor stringing are proceeding concurrently.

The workforce will include plant operators, excavators, riggers, linesman, labourers, mechanics, delivery and ancillary staff. Preference will be provided to local labour where appropriate but will depend on the availability of highly skilled workers required to fill many of the positions. Preliminary estimates for the construction crew requirements for the Project are outlined in Table 7-8.

Table 7-8: Indicative workforce numbers

Project activity	Indicative workforce (approximate)
Bundey substation	
• Enabling works	10 – 20
• Site establishment (including access track establishment)	10 – 20
• Access track construction	20 – 25
• Earthworks and civil construction	50 – 80
• Electrical works	50 – 80
• Pre-commissioning and commissioning	20 – 30
• Demobilisation	20 – 30
Robertstown to SA / NSW border transmission line	
• Enabling works	10 – 15
• Site establishment (including access track establishment)	10 – 20
• Earthworks and civil construction (foundations and earthing)	30 – 50
• Tower construction	
- Delivery	8 – 12
- Foundations and earthing	20 – 25
- Tower assembly and erection	30 – 50
- Stringing and tensioning	70 – 110
- Testing and commissioning	10 – 20
- Cleanup and reinstatement	20 – 30

7.10.2. Construction working hours

It is proposed that construction work would typically be carried out 12 hour shifts, seven days per week from 7:00 to 19:00.

The temporary workers construction camps will operate 24 hours per day, seven days per week for the duration of the construction phase.

Extended construction hours are proposed given the remote nature of the Project, distance to noise sensitive receptors and compressed construction timeframes.

These extended hours are considered acceptable as per Division 1 of the South Australian *Environment Protection (Noise) Policy 2007* (Noise EPP). The Noise EPP does not apply to construction activity related to public infrastructure, as stated in Clause 22(b).

However, where activities are proposed in close proximity to identified sensitive noise receptors (i.e. Cooltong), the hours of construction, including the delivery of materials to and from site may be as follows:

- between 7:00 am and 7:00 pm, Monday to Friday, inclusive
- between 8:00 am and 13:00 on Saturdays
- no work on Sundays and public holidays.

Depending on construction scheduling and weather conditions, some work may need to occasionally be undertaken outside these hours. For example, concrete pouring is restricted in high temperatures and conductor stringing in high winds.

7.11. Quality Assurance and Contingency Planning

ElectraNet own and manage South Australia's high-voltage transmission network. As such, ensuring the quality and reliability of its electrical infrastructure throughout its lifecycle is of paramount importance. There are several policies and procedures in place for employees, contractors, and subcontractors performing works on behalf of ElectraNet. Amongst these are the ElectraNet Safety and Sustainability Standards (ElectraNet 2020a). These Standards lay out minimum expectations of employees and contractors with respect to:

- work health safety management
- environmental operating requirements
- environmental management
- reporting and performance requirements
- audits and inspections
- corrective and preventative action plans.

Further detail on the Environmental Management Plans specific to the Project can be found in Chapter 20 Environmental Management.

Separately, ElectraNet has also developed a Quality Management Requirements document (ElectraNet 2020b) for contractors on the Project. This document requires that contractors implement an effective Quality Management System which addresses all activities related to the Project. Minimum requirements are discussed as they relate to:

- a Quality Management Plan prepared in accordance with AS/NZS 10005: Current – 'Quality Management Systems – Guidelines for Quality Plans
- Quality Assurance and Quality Control activities and personnel
- procurement control
- design control
- preparation, maintenance, protection, and preservation of quality records as per ISO 9001:2015 Quality Management Systems – Requirements.