SEPTEMBER 2024

Kamerunga to Woree Replacement Project

Draft Corridor and Site Selection Report

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Acknowledgement of Country

Powerlink acknowledges the Traditional Owners and their custodianship of the lands and waters of Queensland and in particular the lands on which we operate. We pay our respect to their Ancestors, Elders and knowledge holders and recognise their deep history and ongoing connection to Country.

How to provide feedback on the draft Corridor and Site Selection Report

Feedback is being sought on the recommended corridor and site selection for the Kamerunga to Woree Replacement Project. Feedback can be provided in the following ways:

In-person: Community information drop-in sessions in October 2024

Phone: 07 4034 7601

Email: **kamerunga-woree@powerlink.com.au**

Website: www.powerlink.com.au/kamerunga-woree

Our project webpage has links to an interactive map where you can add your comments within the study area. This page also features a feedback survey which we encourage you to complete. You can also sign-up for our regular project-related email updates. We are inviting feedback on the study area until **5pm Tuesday 30th October 2024.**

Executive summary

This draft Corridor and Site Selection Report (dCSSR) has been prepared by Queensland Electricity Transmission Corporation Limited, trading as Powerlink Queensland (Powerlink), for the proposed Kamerunga to Woree Transmission Line Replacement project, which includes the replacement of the existing Kamerunga Substation and associated site selection.

Powerlink has engaged JBS&G Australia Pty Ltd (JBS&G) to undertake technical, spatial and mapping analysis to support the preparation of this dCSSR.

Project background

Powerlink owns, operates and maintains Queensland's high voltage electricity transmission network, which extends 1,700 kilometres from Cairns to the New South Wales border, comprising of 15,345 circuit kilometres of transmission lines and 147 substations.

Powerlink's Kamerunga – Woree transmission line, between the existing Kamerunga and Woree Substations, provides a critical connection between the Barron Gorge power station and the transmission network, supplying power to northern Cairns.

Both the existing 132kV transmission line, and the Kamerunga Substation are reaching the end of their designed life and are scheduled for replacement. Powerlink is undertaking a transmission line replacement project for the 132kV transmission line between the existing Kamerunga and Woree Substations that will also include replacing the existing Kamerunga Substation.

Investigations into the existing easement alignment have identified that re-building within the existing easement is not a viable option, as there is insufficient easement width and a number of encroachments that impact the technical ability to rebuild on the same alignment. A new corridor is required for the purposes of replacing the 132kV transmission line.

Approach to corridor selection

Investigations into the ability to rebuild the existing 132kV transmission line within the existing easement corridor identified several technical constraints. These constraints have emerged due to a combination of high-density population growth and narrow easement width (approx. 20 meters) resulting in encroachments and/or dwellings in close proximity to the edge of the existing easement corridor. Because of these constraints, it is not possible to rebuild within the existing easement whilst allowing the continued energisation of the existing line throughout construction. Any de-energisation would create an unacceptable risk to the reliability of supply in the Cairns region.

A corridor for the replacement 132kV transmission line builds upon the earlier corridor analysis, to balance the need for the project and project objectives. The project objectives considered as part of this assessment include:

Social
To consider the use of land and the community livelihood within and adjacent to corridor options.

Environment
To consider a balanced approach to corridor selection with the least practicable impact on environment and heritage values.

Economic
To consider construction and operational factors such as cost at a preliminary level, given the scale of the project.

The methodology for the corridor selection included utilising publicly available information, as well as technical and spatial data, to identify constraints and opportunities from a social, environment and economic perspective. These constraints and opportunities were used to identify a recommended transmission corridor and substation site that, on balance, has the least overall impact.

Recommended transmission corridor and substation site

The dCSSR initially considered an overhead transmission line for the full replacement of the existing transmission line (i.e. from the existing Kamerunga substation to the existing Woree substation). Subsequent desktop spatial studies undertaken identified that, due to extensive urban development, as well as the extensive urban footprint from the suburb of Redlynch through to the existing Woree substation, an overhead transmission line would not be viable for the full replacement. Subsequently, the corridor needed to be segmented into a combination of both overhead and underground transmission infrastructure.

As such, this report identified that the preferred approach would be to:

- construct an overhead transmission line where there was minimal urban development and areas of rural land (i.e. between Kamerunga substation and the suburb of Redlynch); and
- construct an underground cable where areas were highly urbanised (i.e from the suburb of Redlynch through to the Woree Substation).

In order to transition the overhead transmission line to the underground cable, a transition site is required and a suitable location has been identified within the suburb of Redlynch.

The dCSSR also considered a new substation to replace the existing Kamerunga Substation. The existing substation is too restricted for any further expansion and therefore a greenfield site was required. A site in the suburb of Barron (east of Cairns Western Arterial Road/Kamerunga Road) has been identified as the recommended site. This site offers reduced social impacts as the greenfield site is located within a rural zoned area, away from the residential areas of Caravonica.

The recommended corridor and substation location identified within this dCSSR is shown in Figure 1.

KAMERUNGA TO WOREE CORRIDOR

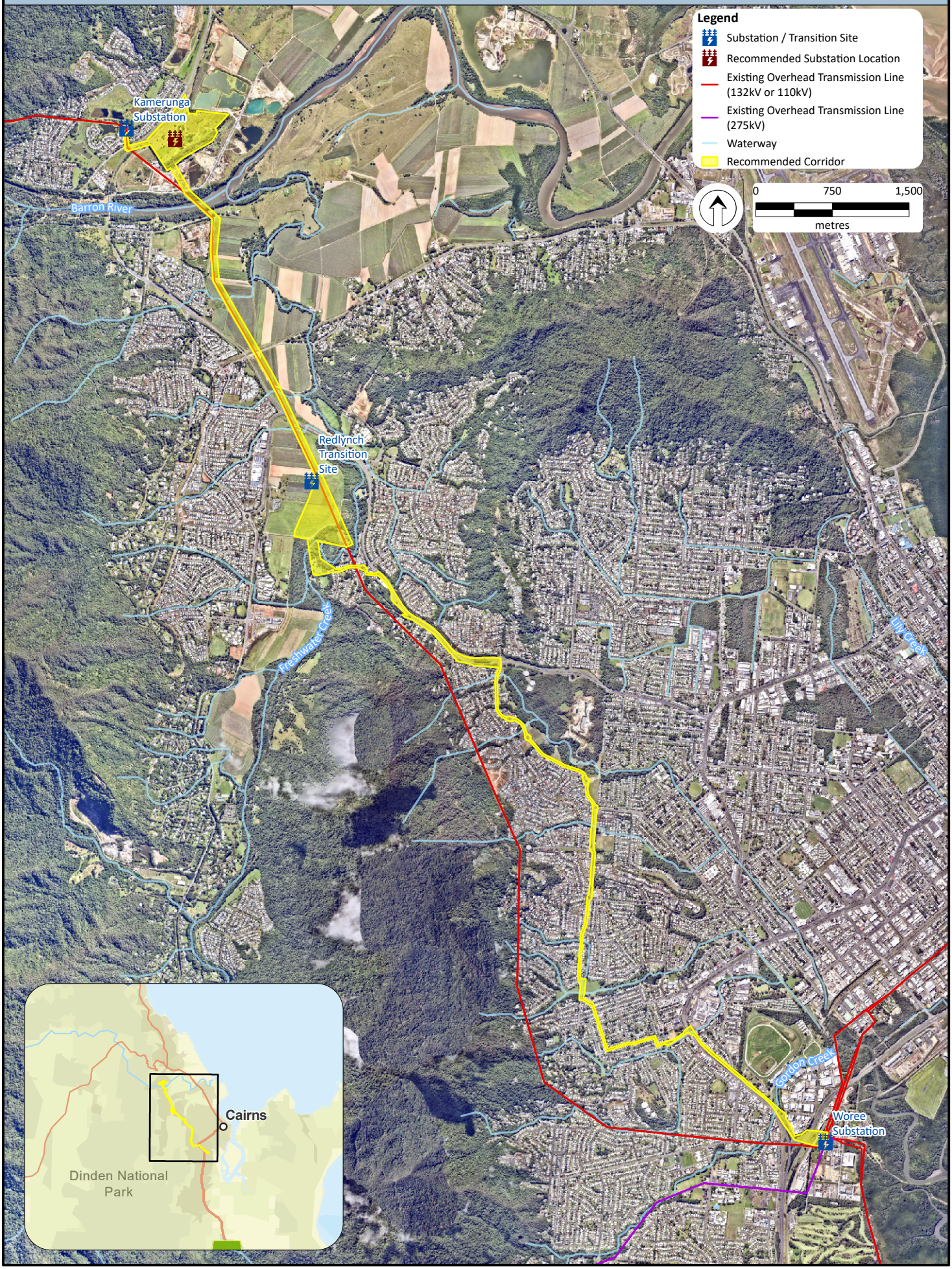


Figure 1 Recommended Corridor and Recommended Site

1.0 Introduction

1.1 Project background

Powerlink Queensland (Powerlink) is a leading Australian provider of high-voltage electricity transmission network services, providing electricity to more than five million Queenslanders, and 253,000 businesses. The network extends 1,700 kilometres from Cairns to the New South Wales border, comprising 15,345 circuit kilometres of transmission line and 147 substations.

Part of this network includes a 132kV transmission line in Cairns, Queensland, from the Kamerunga Substation to the Woree Substation. The existing Kamerunga to Woree transmission line provides a critical connection for the Barron Gorge Power Station to the transmission network while also supplying power to northern Cairns. The transmission line structures, and associated foundations were designed and constructed to have a design service life of approximately 50 years. The Kamerunga to Woree transmission line was constructed in the 1960's and although it has received life extending maintenance works, a full replacement is now required.

The existing Kamerunga Substation provides the critical service of connecting the Barron Gorge Power Station to the transmission network and providing bulk electricity supply to northern Cairns. Substations are designed and constructed to have a design service life of approximately 40 years. Similar to the Kamerunga to Woree transmission line, the Kamerunga Substation was constructed in the 1970's and whilst life-extension works have occurred over time, it is now scheduled for replacement.

In anticipation of future transmission network requirements, Powerlink strategically acquired rural land in the nearby vicinity at Stewarts Road, Barron in 2021. A review of capacity and supply of the existing substation has identified that the existing Kamerunga substation site is too restricted for any further expansion. The new greenfield substation site, located in Barron is located within a rural zoned area, away from the residential areas of Caravonica where the existing Kamerunga Substation is located.

1.2 Purpose of this report

Powerlink has prepared this draft Corridor and Site Selection Report (dCSSR) to:

- identify a recommended corridor for a transmission line between the existing Kamerunga Substation and the existing Woree Substation; and
- identify and recommend a new site for replacing the existing Kamerunga Substation.

The report identified and considered opportunities and constraints from an environmental, social and economic perspective and has confirmed the suitability of a recommended corridor and substation site for further investigations. The corridor selection approach seeks to balance the constraints and opportunities across the recommended corridor and selected substation site with the objectives identified, ultimately resulting in a recommended corridor with least overall impact.

Powerlink has engaged JBS&G Australia Pty Ltd (JBS&G) to undertake technical, spatial, and mapping analysis to support the preparation of this dCSSR.

The purpose of this report is to seek feedback from the community, landholders, Traditional Owner groups and stakeholders on the process applied to:

- identify and assess constraints and opportunities to select a recommended corridor and a substation site that has the least overall impact from a social, environmental, and economic perspective
- review and identify the planning and legislative framework applicable to the recommended transmission corridor and proposed substation site.

A final corridor will be published in the Final CSSR in early 2025. Subsequent phases of the project will include further engagement, detailed environmental and social impact assessment including targeted investigations, impact assessments and the development of planning, design and construction considerations.

The corridor selection approach seeks to balance the constraints and opportunities across the recommended corridor and selected substation site with the objectives identified, ultimately resulting in a recommended corridor with least overall impact.

1.3 Engagement

Powerlink commenced early engagement in 2019 with landholders, Traditional Owner groups and other key stakeholders to inform development of a new transmission line corridor for the overhead line replacement component of the project. Planning for this overhead section was paused in early 2020, due to additional investigations into associated projects in the Cairns region.

The additional project investigations focused on a potential new substation to replace the existing Kamerunga Substation and line replacement projects (overhead and underground), and the interrelationship between these projects and potential staging arrangements.

Initial discussions commenced regarding the new transmission corridor between Redlynch and Woree Substation at the end of 2019 with Cairns Regional Council, Department of Transport and Main Roads and MSF Sugar. Engagement with Queensland Rail commenced in late 2023.

Engagement will continue with impacted landholders, Traditional Owner groups, and will expand to the community and other stakeholders as the project progresses to finalise the project's corridor and reach a final transmission alignment.

2.0 Transmission line construction overview

2.1 Overhead transmission line

The overhead transmission line will be a 132kV double circuit line, constructed predominantly from steel lattice towers and some steel poles, pending constraints. The final alignment will be located on an easement, approximately 40m wide. Transmission infrastructure is generally located either at the centre of the easement or offset from existing towers when co-located with an existing transmission line.

Easements provide legal access over land to construct, operate and maintain energy infrastructure and to regulate certain activities on the easement area, allowing Powerlink to provide a safe, reliable and secure power supply. Landholders continue to own and be responsible for the land on which the easement is located, including land management and other general land maintenance activities. In some instances, rules around activities that can and cannot be undertaken on our easements are outlined in the registered easement terms and conditions on property titles, along with the rights of both the landholder and Powerlink. In addition to registered conditions, there are also other rules based on:

- safety for the public, our employees and contractors
- the risk of damage to property
- the safe operation of the overhead transmission line, underground cable or other assets
- access to the line or associated infrastructure for any future works, including maintenance, upgrading or renewal activities.

Powerlink is committed to working closely with directly affected landholders to understand how they use and manage their property. We do this to ensure we can suitably locate transmission towers within the easement and provide sufficient tower height to avoid or minimise impacts on property operations.

Due to the design and operating requirements of high voltage electricity transmission infrastructure, easements require clearing of vegetation to safely construct and maintain towers and lines. Where possible, Powerlink does not clear the entire easement but rather minimises vegetation clearing for the safe and reliable operation of transmission line. When designing the transmission line, mitigation measures such as selective tower placement and spanning to decrease the amount of required vegetation clearing will be used, particularly in sensitive environments.

Tower pads will be approximately 40m x 40m and spans between towers will be around 300m. Tower heights will be dependent on terrain, topography and land use of the final alignment with shorter towers likely on higher ground and taller towers within low points of the corridor. It is likely 132kV towers will be around 25m to 50m in height. Generally, the steps involved in building a transmission line include:

- preparing the site
- installing the foundations
- assembling the transmission towers and equipment
- stringing the transmission line
- testing and commissioning

- reinstating the site.

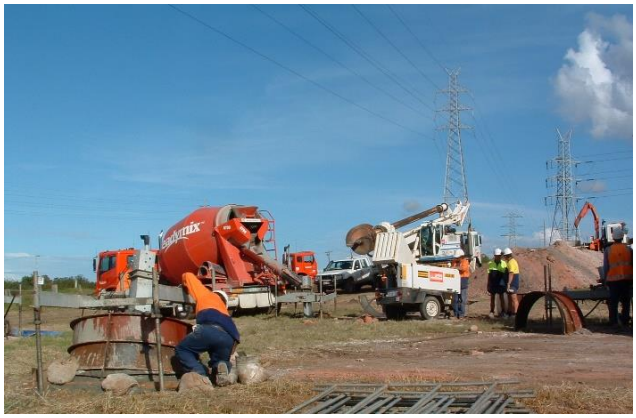
More detail on each step is outlined below.

2.1.1 Preparing the site

Following comprehensive field visits to sample or test soil, vegetation and water, and undertake other detailed investigations, the exact position of each transmission tower is marked on-ground. Vegetation clearing is then undertaken to make way for tower pads, lay-down areas and access tracks. Clearing is required to ensure the line can operate safely and reliably. Various clearing methods may be used based on existing land use, environmental considerations, maintenance requirements and landholder preferences. To minimise vegetation clearing, existing access tracks are used wherever possible. We will continue to use access tracks beyond construction activities to facilitate safe and streamlined access to towers during operation and maintenance.

2.1.2 Installing the foundations

Based on findings from geotechnical investigations completed prior to construction, the construction crew commences work to install suitable foundations at each tower site. A large boring machine is generally used to excavate foundations which can be around 8m to 12m deep. Steel is inserted to reinforce foundations and tower leg stubs are held in place, while concrete is poured into the excavation. Final steelwork is then completed, with the foundation column finishing slightly above ground level.



2.1.3 Assembling the structures and equipment

Fabricated and galvanised steel components for lattice towers are sorted and bundled ahead of being delivered to tower sites. Usually, this delivery takes place with a semi-trailer, with tower assembly work completed adjacent to a tower's final location. Specialist crews methodically piece together the towers, with smaller assembled sections lifted with a crane and bolted into place until the tower is fully erected.

2.1.4 Stringing the transmission line

Machinery such as helicopters, semi-trailers, cranes and light 4WD vehicles are on-site to string the transmission line. Normally, stringing takes place in 5km to 10km sections at a time. Prior to stringing, large drums of conductor (transmission line wires) are delivered to locations along the line route. A draw wire is run between the assembled towers and used to pull the conductor along a section of line. Helicopters may be used to pull the draw wire. The conductor is fed through the line section and tensioned from the ground using winches. Equipment is then repositioned to the next stringing section to repeat the process until the conductor is strung across all towers.

2.1.5 Testing and commissioning

After a new transmission line is assembled, strung and ready to be energised, a series of thorough inspections and commissioning tests are carried out. This ensures the line is ready to be put into service safely and reliably as it enters the operation and maintenance phase of the project lifecycle.

2.1.6 Reinstating the site

Powerlink will engage with landholders to determine site and property specific rehabilitation works following completion of construction activities. Depending on the type and level of on-ground works completed, crews reinstate the tower site area and surrounding environment to ensure appropriate rehabilitation occurs. This helps to stabilise soil and encourage vegetation re-establishment to occur, preventing erosion. This stage also includes reinstating farm infrastructure that may have been impacted during construction works, and remediating paddocks and other grazing areas to enable recommencement of farming activities. Installation of identification signs on towers and anti-climb barriers are installed for safety purposes. Access tracks are finalised to allow ongoing access for future maintenance as required.

Powerlink continues to engage with landholders once a transmission line enters the operation and maintenance phase to undertake a range of activities periodically as required, including:

- routine inspections on easements and infrastructure
- vegetation management to maintain safety clearances
- minor works for infrastructure, replacement of parts and emergency repair of damage
- access track management
- installing or replacing tower signage
- installing or replacing anti-climbing barriers on towers.

2.2 Underground transmission cable

Underground cables usually consist of two electrically separate circuits constructed within a concrete trench. An example of what the underground transmission cable will look like within the trench is provided in Figure 2-1**.**

Underground cables have solid insulation around the conductor. Overhead lines are insulated by air and supported by towers and insulator strings. Therefore, underground cables require a narrower easement when compared to overhead infrastructure. For a 132kV underground cable, we require a 12m easement (6m either side of the cable), unless the underground transmission cable is within a roadway. The narrower easement and absence of towers makes underground cables more suited to highly constrained locations such as urban areas.

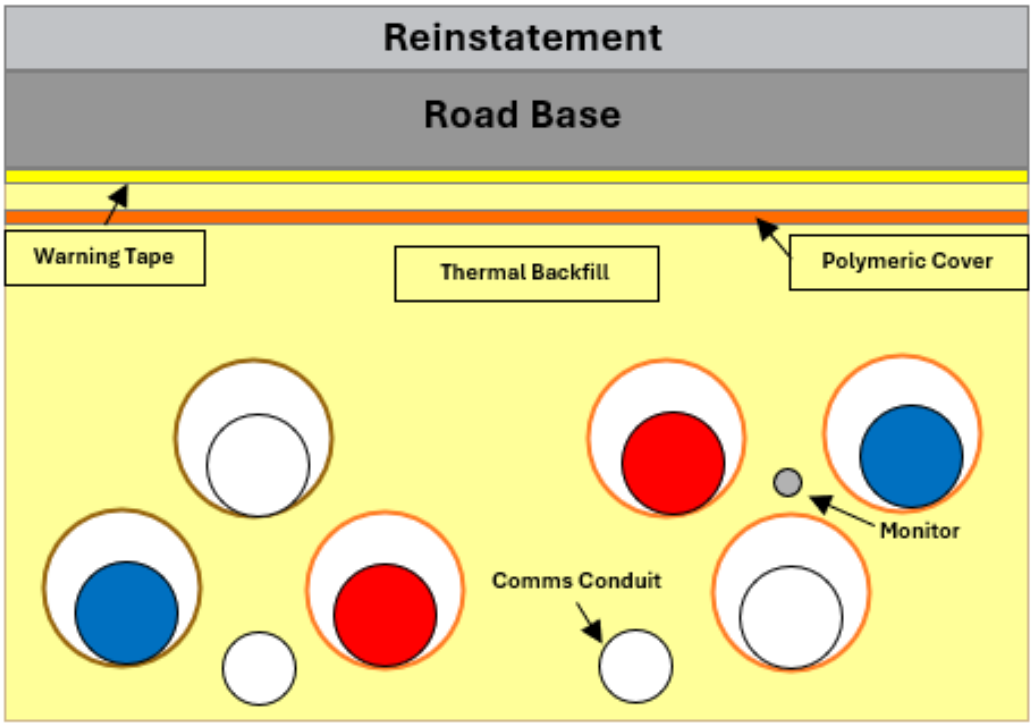


Figure 2-1 Typical trenched roadway cross section

The underground transmission cable is installed in 800-1,200m lengths. To join the lengths of cable together, joint bays are required along the final alignment. Joint bays, and adjacent link boxes, are inspected on a regular (typically annual) maintenance schedule and are positioned to facilitate access requirements. The joint bays are constructed with a concrete floor, walls and lid and are generally 13m long by 2.5m wide, depending on the voltage of the cables. The sizing of the joint bay is to allow for adequate spacing for construction, cable joining and earthing.

An example of a joint bay can be seen in Figure 2-2.

Figure 2-2 Example of a joint bay under construction

2.3 Transition sites

Transition structures facilitating the transfer of the overhead to underground infrastructure will be required wherever a conversion of overhead/underground occurs. The transition structures will look similar to a steel transmission pole in size, will be located on a raised pad and are commonly referred to as transition sites. Transition sites are typically located separate to substations, balancing electrical transmission system requirements with constructability and community expectations. An example of this structure is shown in Figure 2-3.

Figure 2-3 Example of an underground to overhead structure

2.4 Substation

The role of a substation (Figure 2-4) is to monitor and control the flow, stability, quality and voltage of electricity within the transmission network. Equipment within substations is used to transform the voltage of electricity, protect the network, measure the flow of electricity, and switch electricity between the different transmission lines on the grid. A substation is not a power station and therefore it does not generate electricity. Substations may vary in size as a result of the voltage of transmission lines, as well as the number of different transmission lines that it needs to support.

For this project, a new substation will be constructed with equipment similar to that at the existing Kamerunga Substation including:

- air insulated switchgear;
- overhead transmission lines;
- transformers;
- control room;
- 22kV gas insulated switch room (managed by a distribution entity such as Ergon (Energy Queensland); and
- amenities building.

The new substation will be within a fenced area approximately 210m by 110m and will be located on a raised pad. The majority of infrastructure will be in the form of prefabricated concrete structures, transported to the substation site and assembled in situ.

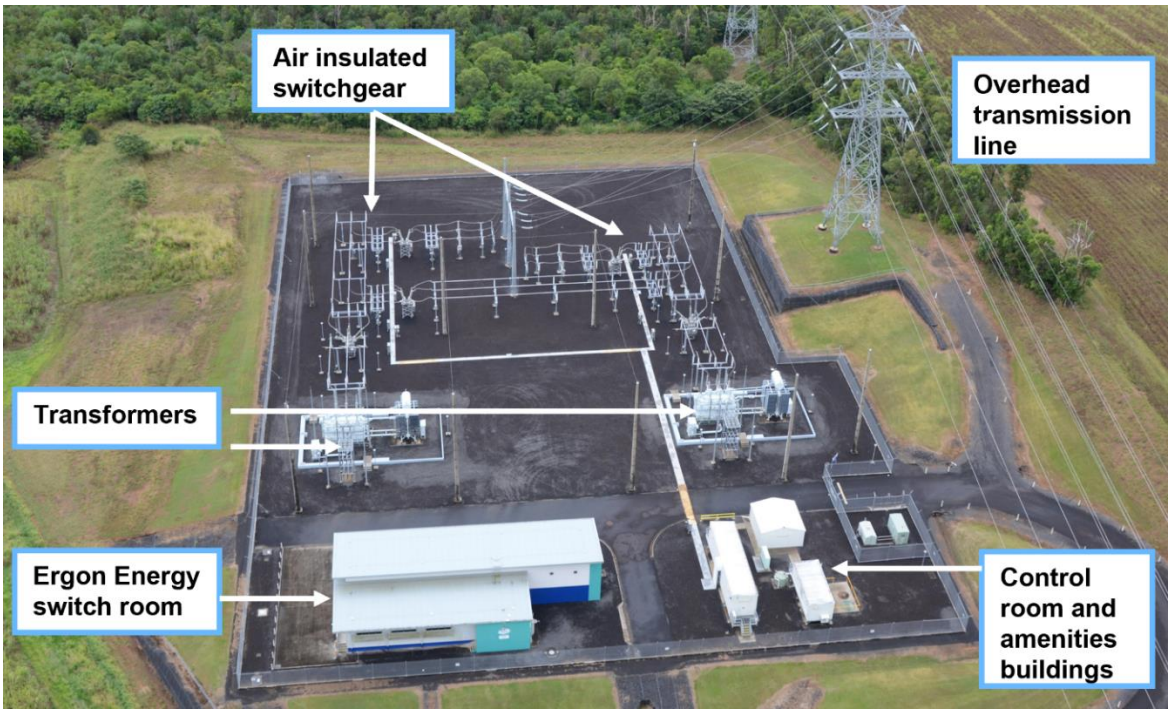


Figure 2-4 Typical substation layout

2.5 Decommissioning and removal of existing transmission line and substation

- The existing transmission line between the existing Kamerunga and Woree substations will be decommissioned and removed following the commissioning of the new transmission line and new substation.
- Removal of redundant equipment at the existing Kamerunga Substation is likely to occur a few years after decommissioning and following commissioning of the new substation at Barron. Where infrastructure has been removed, the site will be appropriately rehabilitated.
- To maintain network availability and reliability requirements, the replacement line will be constructed first, with connections at each end being made in lower electrical demand periods. The existing transmission line will then be decommissioned. Network constraints prevent a rolling replacement process along the existing easement.

3.0 Corridor selection process

3.1.1 Methodology

Planning and legislative frameworks, spatial analysis, and community and stakeholder feedback are factored into the corridor selection process. Three objectives have been used to inform the approach to corridor selection and refinement, being; social, environment and economic.

Social
To consider the use of land and the community livelihood within and adjacent to corridor options.

Environment
To consider a balanced approach to corridor selection with the least practicable impact on environment and heritage values.

Economic
To consider construction and operational factors such as cost at a preliminary level, given the scale of the project.

In addition to the preliminary investigation undertaken, the following matters have been considered to identify the least impactful location of the proposed new infrastructure:

- tenure and zoning
- key resource areas
- strategic cropping land
- watercourses/waterways and flooding
- regional ecosystems
- protected areas
- heritage values
- corridor length
- existing infrastructure

Table 3-1 shows the considerations of the abovementioned matters in relation to the assessment of the corridor.

Table 3-1 Corridor selection criteria considerations

Criteria	Measure	Applicable corridor component	
		Overhead Transmission Line	Underground cable
		Relevant to corridor component	*Relevant to corridor component*
Social To consider the use of land and the community livelihood within and adjacent to corridor options			
Criteria 1: Tenure and Zoning	Number of freehold land parcels intersected	✓	×
	Land other than rural zone intersected	✓	×
	Area within freehold land vs road reserve	×	✓
	Length of corridor within road reserve	×	✓
	Length of corridor within other land tenures	×	✓
	Length of corridor along State-controlled roads	×	✓
	Length of corridor along Local-controlled roads	×	✓
	Length of corridor along rail corridor	×	✓
Criteria 2: Key Resource Areas	Area of key resource areas	✓	✓
Criteria 3: Strategic Cropping Land	Area of strategic cropping land	✓	✓
Environment To consider a balanced approach to corridor selection with the least practicable impact on environment and heritage values.			
Criteria 4: Watercourses/waterways and flooding	Number of watercourse intersections	✓	✓
	Area within flood mapping	✓	✓

Criteria	Measure	Applicable corridor component	
		Overhead Transmission Line	Underground cable
		Relevant to corridor component	*Relevant to corridor component*
Criteria 5: Vegetation and protected areas	Area of remnant and regrowth Endangered regional ecosystems in the corridor	✓	✓
	Area of remnant and regrowth Of Concern regional ecosystems in the corridor	✓	✓
	Area of remnant and regrowth Least Concern regional ecosystems in the corridor	✓	✓
	Area of Conservation Park	✓	✓
Economic To consider construction and operational factors such as cost at a preliminary level, given the scale of the project.			
Criteria 6: Corridor length	Length of corridor	✓	✓
	Length of new corridor (away from existing transmission line)	✓	×
	Number of bend points	✓	×
Criteria 7: Existing infrastructure	Electrical infrastructure centreline intersections	✓	×
	Length of low voltage infrastructure (Ergon Energy) within corridor	✓	×
	Length of high voltage infrastructure (Ergon Energy) within corridor	✓	×
	Centreline intersections with formed roads	✓	✓
	Length of formed roads within corridor	✓	✓

3.2 Corridor selection

3.2.1 Preliminary investigations

This project is seeking to replace the existing overhead transmission line infrastructure between Woree and Kamerunga. Preliminary investigations focused on identifying a potential corridor between existing substations at Woree and Kamerunga that balanced social, environment and economic objectives. The existing Kamerunga Substation is located off Yurongi Street in Caravonica and Powerlink's existing Woree Substation is situated at 2-14 March Street, Woree.

Early high-level investigations of the broader region included parts or whole suburb areas of Kamerunga, Stratford, Whitefield, Edge Hill, Manoora, Kanimbla, Redlynch, West Court, Mooroobool, Bungalow, Portsmith, Earlville, and Bayview Heights, within the Cairns Regional Council Local Government Areas.

Within this area, key natural and built features include:

- Barron River, Freshwater Creek, Chinaman Creek, Gordon Creek, Clarkes Creek and their tributaries;
- Redlynch Bypass Road and Cairns Western Arterial Road (CWAR), Bruce Highway and Ray Jones Drive;
- Lemura Sand Co Pty Ltd (Lemura) site and sand quarrying (Lemura (co-located with landfill)), operated by Pioneer North Queensland (PNQ);
- Parkland, recreation areas and protected areas;
- Proposed Redlynch Sport and Recreation Parklands;
- Educational facilities; and
- Cane fields and associated infrastructure including the cane tram lines leading to the Mulgrave Sugar Mill.

Desktop spatial data identified further significant obvious constraints for a new transmission line corridor. This area is naturally bounded by the coastal fringe, Barron Gorge National Park in the vicinity of Redlynch, the Mount Whitfield Conservation Park to the east near Whitfield, the foothills associated with Dinden National Park between Redlynch and Woree and surrounding forested areas.

At the time the existing transmission line was constructed in the 1960s, the easement would have predominantly been over land used for sugar cane and other farming activities. Today, the areas adjacent to the existing transmission line have experienced substantial growth and development with the majority of the land use and land sizes now significantly reduced to a small house block/ high density dwellings. In addition, this area is approximately eight km north-west from the Cairns central business district and supports many local businesses and employment opportunities. Small land sizes and residential land uses present a high social constraint to the project, when compared with more open, larger land parcels used for farming or rural purposes.

Overlaying the natural land use and development constraints of the area resulted in minimal areas being suitable for a new transmission line corridor. To avoid these social constraints, longer transmission line corridor options could be identified by heading further west past Redlynch or east towards Whitfield, where the land use and sizes open up and change. However, pushing to these locations creates further substantial constraints, potential environmental impacts and increased economic impacts due to the cost associated with increased transmission line lengths and the terrain/constructability difficulties.

The conclusions of the above broader region and desktop analysis identified a highly constrained, narrow area suitable for the full replacement of the existing transmission line (i.e. from Kamerunga Substation to Woree Substation). In particular, the extensive urban development, as well as the extensive urban footprint from the suburb of Redlynch through to Woree Substation, identified that an overhead transmission line was not viable for this section of the project.

Subsequently, the corridor needed to be segmented into a combination of both overhead and underground transmission infrastructure. The preferred approach would be to:

- identify an overhead transmission line corridor where there was minimal urban development and areas of rural land between Kamerunga Substation and the suburb of Redlynch;
- identify a site suitable for a transition site to transfer the overhead transmission wires to underground cables, in the Redlynch locality; and
- identify an underground cable corridor (where areas were highly urbanised) from the suburb of Redlynch through to the Woree Substation.

3.2.2 Characteristics of the area (investigation)

Topography

Topographically, the section between the Kamerunga Substation to the Redlynch locality is within a low-lying, agricultural and residential land bounded by elevated land, including Barron Gorge National Park to the west, and conservation areas in the south-east. Location of the transmission line within these areas would also result in substantial visual amenity impacts.

The proposed Redlynch transition site to the existing Woree Substation, has similar topography with low-lying agricultural and residential lands bounded by elevated land, including Dinden National Park and Mount Whitfield Conservation Park. Construction of the project through steep mountainous land would present significant engineering challenges, along with other major constraints such as dense vegetation, conservation and heritage listings, and poor access. Therefore, viable options for investigation were limited to the coastal plain running through between the coastal fringe and the foothill areas.

Land uses

Urban land uses from the existing Kamerunga Substation to the proposed Redlynch transition site are mostly situated on the foothills of the elevated areas within the study area, containing predominantly freehold property lots which are smaller in size than those in surrounding natural/rural areas and contain a significant number of sensitive receptors. Being mostly unaffected by other environmental constraints, land is also generally of higher economic value. Due to the high potential for social and visual impacts and the high cost associated with acquisition of land, viable corridor options were limited to predominantly rural areas or within urban land, along the existing major transport corridor, Kamerunga Road.

Residential land uses cover the majority of the area from the proposed Redlynch transition site to the existing Woree Substation. This is a major constraint for an overhead transmission line and is the main justification for this section going underground. To minimise impacts on residential properties, options were chosen that were located within road reserves (both state and local controlled).

Natural areas

While low-lying land was determined as being more suitable for implementation of the project, it still contains a range of hydrological constraints due to the presence of major waterways such as the Barron River and Freshwater Creek. These surface water features are generally of high ecological significance, being bordered by remnant vegetation. As the project is unable to avoid crossing the Barron River, investigations into the possibility of crossing at locations where clearings have already occurred are optimal. As the selected overhead corridor minimises impacts to dense vegetation, it also largely avoids land at risk of increased bushfire intensity. Despite low-lying land also being more likely to be affected by acid sulphate soils and flooding constraints, these issues may be adequately overcome during the design and construction phase. Similarly, footings can be designed to be located within most geology and soil types and do not constrain the investigations.

From the proposed Redlynch transition site to the existing Woree Substation, there are only limited areas containing environmental significance due to the area being highly urbanised. These areas are generally associated with waterways within the underground investigation areas, particularly Freshwater Creek, but also Chinaman Creek, Clarkes Creek, Gordon Creek and their tributaries.

Heritage

From the existing Kamerunga Substation to proposed Redlynch transition site, the investigations identified a number of heritage areas/sites including European and Indigenous cultural heritage. This includes places of Queensland heritage significance (e.g. Cairns to Kuranda Railway), a locally significant heritage place (e.g. Old Smithfield Cemetery) and many Indigenous cultural heritage sites concentrated mostly around the Barron River.

From the proposed Redlynch transition site to the existing Woree Substation, the investigations identified two heritage areas/sites including European and Indigenous cultural heritage. This includes a locally significant heritage place (Cannon Park Raceway) and one Indigenous cultural heritage site. Due to the highly urbanised nature of this area, majority of the underground corridor will be situated in existing road reserves. These areas have been previously disturbed and as a result, are unlikely to contain unidentified sites of cultural significance. Where the underground corridor options intersect watercourses however, there is the possibility for unidentified sites of cultural significance to be present.

Unregistered Indigenous cultural heritage sites will likely be present. Further investigations are required to determine the potential impact of the project on Indigenous cultural heritage and European heritage matters.

Existing infrastructure

Existing infrastructure is present throughout the area, particularly within land subject to urban uses. As major electricity infrastructure is limited to other Powerlink-managed assets and crossing of other electricity infrastructure presents only design issues, this was not a significant consideration. Several major transport assets including state-controlled roads and rail corridor are noted. Similar to electrical infrastructure, crossing of this infrastructure is largely a design issue and therefore did not constrain the project. Council-managed water, sewerage and drainage infrastructure is located within the area between the proposed Redlynch transition site to the existing Woree Substation. Larger underground infrastructure, such as those that are 200mm diameter and larger, present material constraints in this area also. In addition, several major transport assets extend into this area including state-controlled roads and rail corridors, including the MSF Sugar cane rail line. Major state-controlled roads are less preferable than local-controlled roads due to the volume of traffic experienced on these roads, and the construction requirement to partially close roads to undertake the installation of the underground transmission cable.

3.2.3 Recommended corridor

Taking into consideration the significant constraints identified during preliminary investigations, a Recommended Corridor was identified, encompassing both an overhead transmission line (from the existing Kamerunga Substation to the transition site in Redlynch) and an underground cable (from the transition site in Redlynch to the existing Woree Substation). The Recommended Corridor is shown in Figure 3-1.

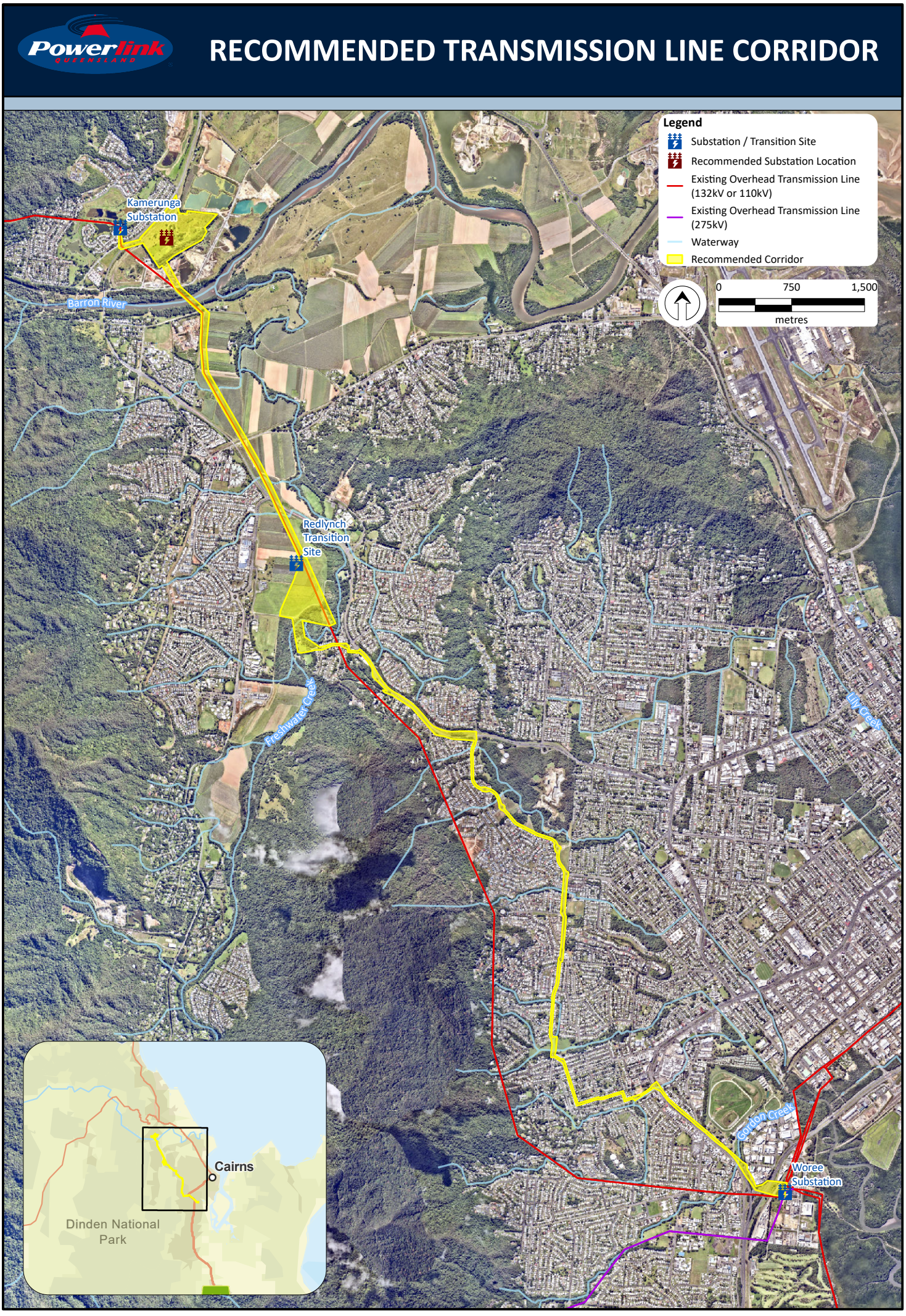


Figure 3-1 Recommended transmission line corridor

This Recommended Corridor was identified based on the following:

- the corridor provides the shortest, most direct route between the existing Kamerunga Substation and the existing Woree Substation
- the overhead transmission line is located away from urban areas, meaning:
    - the number and extent of existing electrical and road infrastructure interactions is limited
    - lower visual amenity impact
    - fewer freehold land parcels and residential properties intersected.
- the overhead transmission line is located away from Freshwater Creek, avoiding areas of natural value associated with this area
- the underground cable is located primarily in local-controlled roads, reducing impacts to State-controlled roads from a constructability perspective
- the underground cable being located primarily within road reserve, reducing impacts to other land tenure types (such as residential properties)
- the underground cable avoids impacts to MSF Sugar's cane rail line, with only two crossings required over Irene Street and Henley Street.

A summary of the quantitative criteria considered in the identification of the Recommended Corridor are identified in Table 3-2.

Table 3-2 Summary of quantitative criteria considered within the Recommended Corridor

Criteria	Overhead transmission line	Underground cable
Social criteria		
Criteria 1: Tenure and Zoning		
Number of freehold land parcels intersected (no.)	43	n/a
Land other than rural zone intersected (ha)	22.15	n/a
Length of corridor within road reserve (km)	n/a	6.34
Length of corridor within other land tenures (km)	n/a	2.98
Length of corridor along state-controlled roads (km)	n/a	0.73
Length of corridor along local-controlled roads (km)	n/a	4.50
Criteria 2: Key Resource Areas		
Area of corridor within key resource areas (ha)	6.68	n/a
Criteria 3: Strategic Cropping Land		
Area of corridor within strategic cropping land (ha)	22.57	0.52
Environment criteria		
Criteria 4: Watercourses/waterways and flooding		
Number of watercourse intersections (No.)	4	8
Area within flood mapping (ha)	52.35	4.12

Criteria	Overhead transmission line	Underground cable
Criteria 5: Vegetation and protected areas		
Category B (remnant) least concern Regional Ecosystem (RE) (ha)	n/a	0.33
Category B (remnant) of concern RE (ha)	1.56	0.58
Category B (remnant) endangered RE (ha)	0.80	0.41
Category C (high-value regrowth vegetation) RE (ha)	n/a	0.008
Category R (reef regrowth watercourse vegetation RE) (ha)	4.59	1.16
Conservation Park intersected (ha)	1.34	n/a
Economic criteria		
Criteria 6: Corridor length and bend points		
Length of corridor (km)	4.04	9.29
Length of new corridor (away from existing transmission line) (km)	4	9.29
Number of bend points (no.) (estimate only)	0.51	n/a
Criteria 7: Existing infrastructure		
Electrical infrastructure centreline intersections (no.)	27	n/a
Length of low voltage infrastructure (Ergon Energy) within corridor (km)	0.51	n/a
Length of high voltage infrastructure (Ergon Energy) within corridor (km)	3.69	n/a
Centreline intersections with formed roads (no.)	22	n/a
Length of formed roads within corridor (km)	1.47	n/a

3.2.4 Alternative corridor investigations

Overhead component of transmission line corridor

Alternatives considered were:

- a new corridor in the vicinity of the western side of the Mount Whitfield Conservation Park as this generally follows the existing transmission line corridor; and
- a new corridor further east past Mount Whitfield Conservation Park.

Further investigations identified that both alternatives contained similar constraints in terms of terrain, environmental factors, and urban impacts. However, the western corridor would result in a more direct transmission line corridor, one crossing of the Barron River and slightly less social/urban impacts. The corridor running from Kamerunga through the vicinity of the western side of Mount Whitefield Conservation Park to Redlynch locality was therefore recommended for further assessment as the overhead section of the replacement transmission line.

Underground cable component of transmission line corridor

Continuing on from the identification of this corridor, studies were undertaken to identify possible underground routes for the replacement transmission line for the section between Redlynch and Woree Substation. Given this section of the Project is underground, in-ground assets and high-level constructability issues were the primary focus of corridor option identification and assessment. Refining corridor options were developed through examining:

- major underground infrastructure (mainly Cairns Regional Council water, sewerage, and stormwater);
- linear infrastructure;
- existing land use; and
- overlays of the Cairns Regional Council's Planning Scheme (CairnsPlan 2016).

Additionally, to minimise impacts on residential and commercial land, opportunities where intersections with publicly controlled open spaces, road reserves and other linear infrastructures were preferred. Investigations considered:

- State controlled and local council road reserves, including:
  - Cairns West Arterial Road (CWAR)
  - Ramsey Drive
  - Swallow Street
  - Alfred Street
  - Irene Street
  - Watson Street, and
  - Mulgrave Road
- Rail corridors considered included the MSF Sugar's Mulgrave Mill cane rail corridor, QR Main North Line and Kuranda Rail

Based on a review of constructability constraints associated with the identified road and rail corridors, a number of key constraints were identified:

- significant directional drilling under a significant stormwater drain (which is tidal influenced) along Swallow Street);
- underbore under Chinaman Creek and the Bruce Highway, which would prove difficult due to the lack of construction room available;
- congestion within Alfred Street road reserve and other State controlled roads, which would result in construction being difficult, disruptive and expensive; and
- co-location with the existing MSF Sugar Mulgrave Mill cane rail corridor that has the following constraints:
  - operational constraints associated with the rail operations (noting that access between June and December for construction would not be possible due to the rail operations)
  - narrow nature of the rail corridor

- presence of other underground services in the rail corridor
- restricted amount of room to build joint bays
- limited room available to set up and install cables.

4.0 Site selection process

4.1 Preliminary investigations and methodology

With end of service life nearing, investigations regarding options for rebuilding the Kamerunga Substation have been carried out. In 2021, an opportunity was identified to purchase a large sized, rural parcel of land on Stewarts Road, Barron in close proximity to the ageing asset, Kamerunga Substation. The property has been held in its existing state pending further assessments as to the suitability or future use of the site.

This report identifies the need to replace the Kamerunga Substation as a result of the existing substation being too restricted for any further expansion and considers the constraints and opportunities to rebuild a new substation.

A review of project objectives (social, environment and economic) combined with Powerlink's Substation Site Selection Guidelines and a review of current land available within a 1km radius of the existing substation was undertaken to confirm that further investigations should be focused on the Powerlink land parcel at Stewarts Road in Barron.

The considerations forming part of the site selection process are identified in Table 4-1.

Table 4-1 Site selection considerations

Criteria	Measure	Relevant to site selection considerations
Social To consider the use of land and the community livelihood within and adjacent to site options.		
Land use and Zoning	Option within rural zoning	✓
Property requirements	Directly affected landowners	✓
Affected stakeholders	Number of adjacent stakeholders	✓
Visual amenity	Potential for impact on the visual amenity of the area	✓
Amenity	Potential for impact on the surrounding amenity of the area from construction and change in land use	✓
Noise	Potential for impact from construction noise	✓
Traffic	Potential for impact from construction traffic	✓
Environment To consider a balanced approach to site selection with the least practicable impact on environment and heritage values.		
Contaminated land	Area of potentially contaminated land	✓
Environmental values	Potential for interaction with environmental values	✓

Criteria	Measure	Relevant to site selection considerations
Heritage values	Potential for interaction with heritage values	✓
Flooding	Location within a flood prone area	✓
Economic To consider construction and operational factors such as cost at a preliminary level, given the scale of the project.		
Construction methodology/scheduling	Length of construction and scheduling	✓
Geotechnical conditions	Current geotechnical conditions of the site	✓
Outages/disruption to the network	Requirement for outages and disruption to the network to allow construction	✓
Earth decay	Potential for earth decay impacts	✓
Electric and Magnetic Fields (EMF)	Potential for EMF impacts	✓
Operation and maintenance	Operation and maintenance access requirements	✓

4.2 Site selection

4.2.1 Characteristics of the area (investigation)

The area investigated for a substation site selection study (Figure 4-1) is located approximately 11 kilometres north-west from the Cairns central business district in the suburbs of Caravonica and Barron within the Cairns Regional Council Local Government Area and consists of a one-kilometre radius around the existing Kamerunga Substation.

There are multiple key constraints, including:

- residential dwellings, open space and lakes directly surrounding the existing Kamerunga Substation;
- conservation areas including the Kamerunga Conservation Park and the Barron Gorge National Park;
- the Barron River and Freshwater Creek;
- sand quarrying (Lemura (co-located with a landfill)), operated by PNQ);
- Old Smithfield Cemetery;
- Cairns Regional Council Planning Scheme, CairnsPlan 2016; and
- state controlled Kamerunga Road.

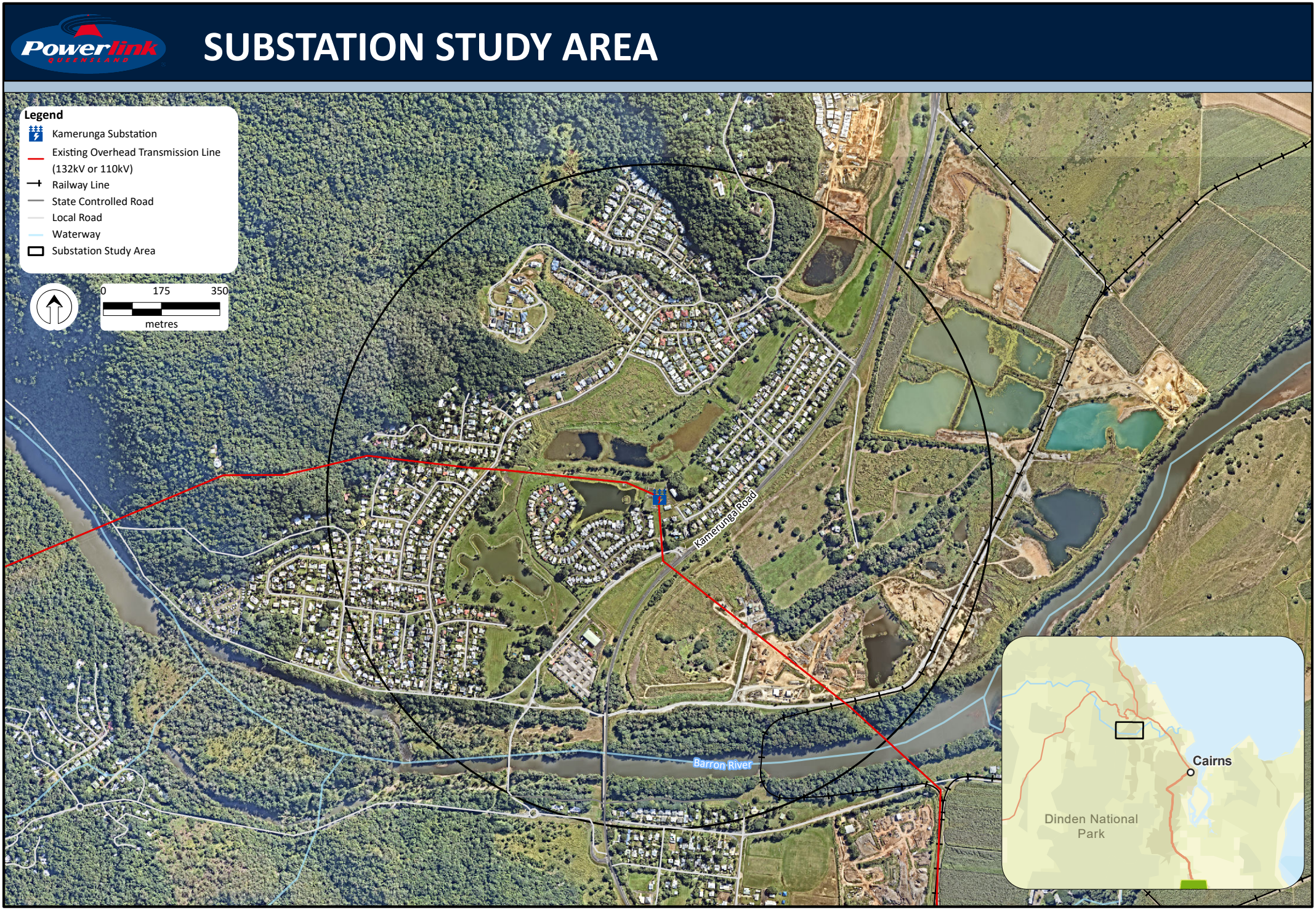


Figure 4-1 Substation study area

Land uses

The land uses within the study area vary across the two suburbs, Caravonica and Barron. Caravonica predominantly consists of residential dwellings complimented by parklands, constructed lakes and vacant tracts of land reserved for future urban development. The suburb of Barron is situated immediately south-east of Caravonica, and mainly consists of large tracts of land used for resource activities, agriculture, and other rural farming activities. The Barron River forms the southern boundary of the suburb. The zones within the investigation area are detailed within under the *CairnsPlan 2016* and include:

- low density residential
- open space
- community facilities
- special purpose; and
- emerging communities.

Natural areas

The study area contains minimal vegetation, with vegetation restricted to areas of native riparian vegetation that is largely located along the banks of the Barron River, within the Kamerunga Conservation Park. A number of small man-made lakes are located immediately north of the Kamerunga Substation within private, vacant land.

The *CairnsPlan 2016* identifies areas of vegetation in the Barron Gorge National Park and along the banks of the Barron River (to the west of Brinsmead-Kamerunga Road) as being mapped as potential to high potential bushfire intensity areas.

Heritage

Cultural heritage

A search of the Department of Treaty, Aboriginal and Torres Strait Islander Partnerships, Communities and the Arts (DTATSIPCA) Database[1] identified three cultural heritage sites within the investigation area mapped along the southern boundary of the study area. The sites are associated with the Barron River.

Historic heritage

The Old Smithfield Cemetery and the Kamerunga Lower Bridge are both listed as places of local significance under the *CairnsPlan 2016*.

Existing infrastructure

Electrical

In addition to the existing Kamerunga Substation site, major energy infrastructure within the study area includes:

[1] https://culturalheritage.datsip.qld.gov.au/achris/public/application-for-advice/home

- two existing Powerlink transmission lines which extend south from Kamerunga Substation to Powerlink's Woree Substation;
- two existing Powerlink transmission lines extending north-west from the Kamerunga Substation to the Barron Gorge Power Station;
- a single Ergon Energy substation located adjacent to the Kamerunga Substation in the north; and
- the Ergon Energy high voltage and low voltage networks extends throughout the investigation area.

Transport

Transport assets within the study area include:

- Local roads: managed by Cairns Regional Council;
- State controlled roads: Department of Transport and Main Roads (TMR) state-controlled roads including Kamerunga Road and Redlynch Bypass Road. A future upgrade is planned for the Kamerunga Road through the widening of Kamerunga Road into existing road reserve adjacent to the northern extent of the Lemura sand quarry site;
- Mulgrave Mill cane tram line: approximately 10.3 kilometres of cane lines providing local access from agricultural land in Redlynch, Brinsmead and Barron to the Mulgrave Mill;
- Cycle routes: CairnsPlan 2016 identifies a number existing and proposed cycle routes which connect centres within the investigation area including between Caravonica and Redlynch, and between Redlynch and Freshwater; and
- Ports: the extent of the Barron River located within the investigation area is identified as being within the port limits of the Port of Cairns.

4.2.2 Recommended site

No alternative sites were identified within this radius that were suitable for a substation site. This assessment has validated the Powerlink-owned land at Stewarts Road, Barron as the Recommended Site that offers the least overall impact across the project's corridor and site selection methodology. This site was identified as the Recommended Site based on the following:

- further investigations into the potential use of the vacant land at Stewarts Road, Barron analysing the site against the general principles for substation site selection. This included the ability to position the infrastructure as far as is reasonable from built up areas and places of assembly in which children will remain for extended periods of time, such as schools or childcare centres;
- limits the number of land titles affected by the proposed development;
- locates the proposed development to minimise and/or avoid the impact on sensitive ecological and Aboriginal cultural, and heritage sites and areas; and
- minimises the risk of bushfire induced multi-circuit outages of the infrastructure by avoiding, where possible, high bushfire severity areas or taking other precautionary measures.

As this parcel of land is within a rural area at some distance from the residential community it is likely to only impact on the small number of dwellings located on the site. The available space allows for better design, construction and operational outcomes noting the requirements for connections back to the

transmission line and the existing substation. There are some key issues that require further consideration such as flooding implications, screening opportunities and design considerations to avoid impact to the identified heritage site, Old Smithfield Cemetery.

The proximity of the Recommended Site to the existing substation enables the corridor selection and associated investigations to continue at the existing Kamerunga Substation and doesn't interfere with the transmission line corridor selection process. Overall, the Recommended Site offers lower stakeholder and engineering risks than rebuilding at the existing Kamerunga Substation site. The detailed design stage of this Project will see the final corridor designed to exit the existing Kamerunga Substation and connect into the new substation located in Barron, before continuing along the Recommended Corridor to the existing Woree Substation.

A summary of the considered criteria for site selection is provided in Table 4-2 for the Recommended Site.

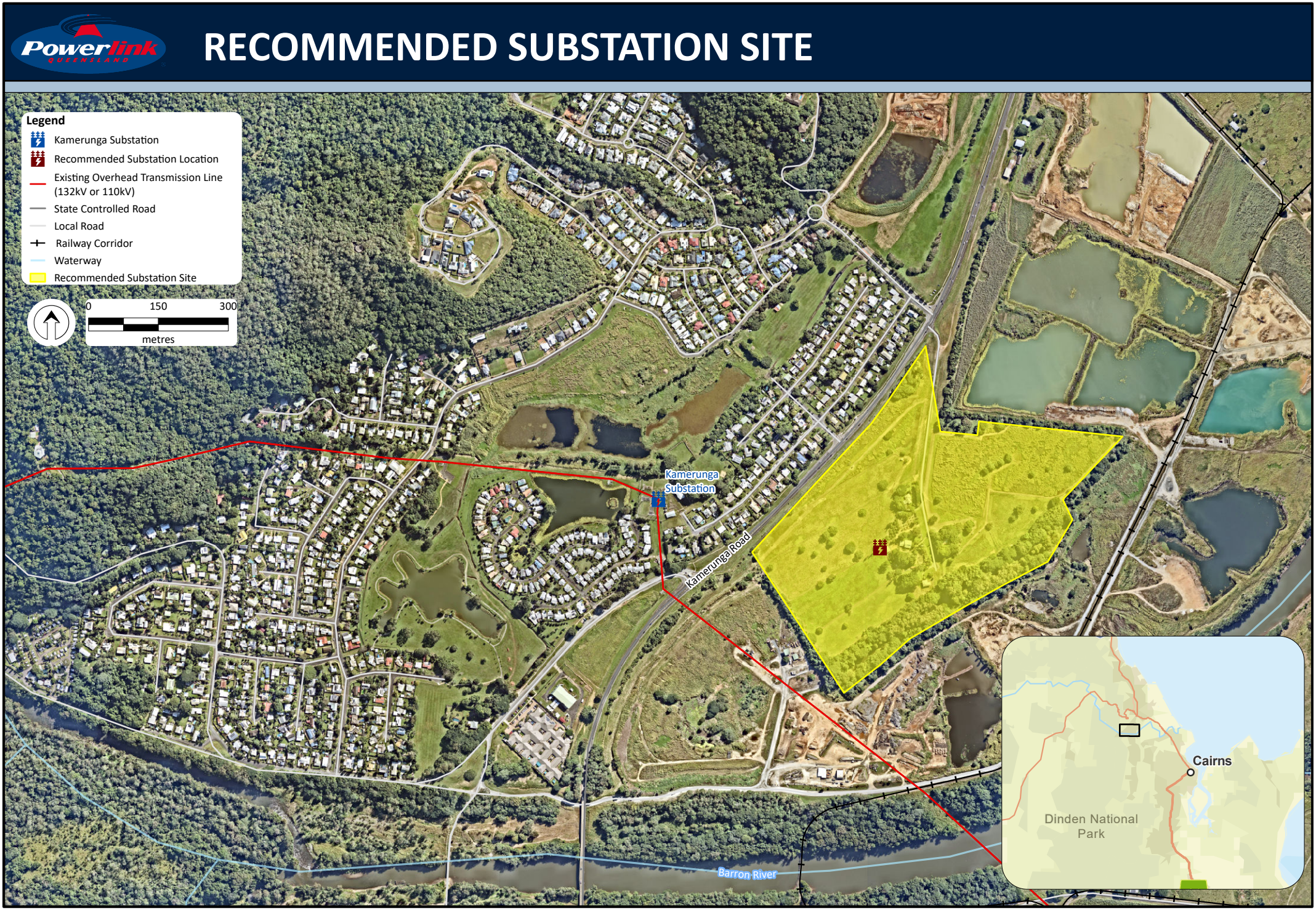


Figure 4-2 Recommended substation site

Table 4-2 Summary of considered criteria associated with the recommended site

Assessment Criteria	Proposed Stewarts Road Site (Recommended Site)
Social	
Land use and zoning	The recommended site is located within the Rural Zone under the *CairnsPlan 2016*. The placement of a substation within rural zoning is more preferential to the placement within residential or open space zoned land as a result of the social impacts resulting from land acquisition within a residential zoned area and amenity impacts associated with changing open parkland to a substation.
Property requirements	The Recommended Site is located on Powerlink-owned land and as such, has no directly affected landowners.
Affected stakeholders	The Recommended Site is in a rural area where there are no directly adjacent residences. The closest dwelling is located approximately 100m west of the Recommended Site, to the west of Kamerunga Road.
Visual amenity	The Recommended Site impacts minimal receptors due to its location. Methods to reduce visual amenity impacts are considered in the design component of the project.
Amenity	The Recommended Site will result in an operational amenity change from a rural nature to a substation. However, the surrounding land adjacent to the Recommended Site is currently used for activities associated with the sand quarrying operations. Additionally, the Recommended Site will result in a reduction in construction impacts and amenity to residential properties compared to if the existing Kamerunga Substation was to be upgraded.
Noise	The closest residents being located to the west of Kamerunga Road/CWAR, so the Recommended Site will have minimal noise impacts. The residents west of Kamerunga Road/CWAR already have increased background noise levels through traffic movements along the road. The Recommended Site will result in fewer construction impact compared to options that considered upgrades to the existing Kamerunga Substation. The existing Kamerunga Substation is in a residential area and construction traffic travelling from Kamerunga Road (state-controlled road) to Yurongi Street (local road with residential properties) to the existing Kamerunga Substation, would result in significant noise impacts to these residents.
Traffic	Similar to the noise impacts, the Recommended Site was chosen as it will result in fewer construction impacts to the road network, with construction access via Stewarts Road. Land along Stewarts Road is owned entirely by Powerlink and as such, there will be limited impacts to surrounding road users from the use of Stewarts Road by construction vehicles. The existing Kamerunga Substation is located in a residential area and construction traffic travelling from Kamerunga Road to Yurongi Street to the existing Kamerunga Substation, would result in significant traffic impacts for these residents.

Assessment Criteria	Proposed Stewarts Road Site (Recommended Site)
Environment	
Contaminated land	The Recommended Site has no known contaminated land constraints. The Recommended Site will require consideration of acid sulfate soils management during construction, however this is not a constraint that differentiated the site from other site options, as all options in this area would require similar management of acid sulfate soils.
Environment values	The Recommended Substation Site has been chosen, in accordance with the Ecological Assessment Report, due to its location within a rural zoned area that has undergone historical clearing. This means there are minimal Commonwealth or State legislated environmental matters present that will be impacted by the proposed development. Site investigations undertaken to date validate the desktop assessments.
Heritage values	The Old Smithfield Cemetery, which is listed as a place of local significance under the *CairnsPlan 2016*, sits directly north of the recommended site. This heritage place has however, been avoided. Based on the DTATSIPCA cultural heritage search undertaken, there are no known cultural heritage values identified in proximity to the Recommended Site. However, further consultation and engagement with the Traditional Owners will be undertaken by Powerlink.
Flooding	The Recommended Site is located in an area with adequate space to enable construction achieving the required flood immunity (being above 0.5% Annual Exceedance Probability (Q200)). The Recommended Site is not located directly adjacent to any residential properties. Further flood modelling will be undertaken to inform the final substation design and arrangement.
Economic	
Construction methodology/scheduling	The construction at the Recommended Site will likely be in the order of 24 months and will involve construction in a greenfield site. The construction of the substation can occur whilst retaining the functionality of the existing Kamerunga Substation until which point it is switched over (detailed below in outages and disruption to the network), as it is in a greenfield area.
Geotechnical conditions	The Recommended Site is located on a greenfield site with limited geotechnical data available. Further geotechnical investigations are required to inform the design; however, this was not considered a constraint to site selection.
Outages/disruption to the network	Outages would be required for final connection from the existing transmission lines to the new transmission lines. Moving to a greenfield site allows for substantial completion of works with outages only required for final cutover to the new substation and bridge out of the existing Kamerunga Substation. Under this approach, Barron Gorge would remain connected, maintaining system security, until the substation works were substantially complete and ready for the final re-configuration.

Assessment Criteria	Proposed Stewarts Road Site (Recommended Site)
Earth decay	Earth decay describes the voltage gradient which may occur around a substation in the event of an earth fault. If not properly managed, the resulting voltages pose a potential risk to people within the vicinity of the substation due to contact with fences, metallic structures or services (water pipes). Earth decay is affected by system conditions as well as the overall impedance of the substation earth grid (inversely proportional to the substation area) and the proximity of other buildings or buried metallic services to the substation. The Recommended Site would employ a larger substation layout then the existing Kamerunga Substation which would reduce the earth grid resistance for the new site. The proposed location will allow a buffer zone between the perimeter fence and the nearest property.
EMF	Electric fields occur around high voltage equipment while magnetic fields occur around equipment carrying high currents. Electric and/or magnetic fields will be encountered around high voltage substations as well as power lines and underground cables. The influence of the field falls rapidly as distance from the equipment increases. Electrical equipment is designed and installed such that the resulting EMF values are below Australian Radiation Protection and Nuclear Safety Agency Guidelines. Typical values encountered are frequently a small fraction of recommended exposure limits. The Recommended Site is located within a greenfield site with suitable clearance to the closest residences, allowing for the control of EMF within the substation perimeter.
Operation and maintenance	All the above options are assumed to be constructed at the existing substation bench level and may therefore be subject to access restrictions due to flood events. All equipment and buildings will be raised above the Q200 flood level. To access this equipment, fixed access platforms will be provided. Equipment design and layout would be to existing Powerlink standards and should not be subject to operational restrictions.

5.0 Legislative and approval requirements

There are a number of potential legislative and approval requirements in order to progress the Project. Some of the Local, State and Federal Government approval frameworks are discussed in this section. Potential approvals are subject to final corridor refinement, actual infrastructure disturbance locations and further ecological and cultural heritage investigations, however, may include:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) Referral and potential approval for significant impact on Matters of National Environmental Significance (MNES);
- Ministerial Infrastructure Designation under the *Planning Act 2016* (Qld) for electricity operating works;
- Clearing permit for the clearing of protected plants under the *Nature Conservation Act 1992* (Qld); and
- Species Management Program (SMP) under the *Nature Conservation (Animals) Regulation 2020* (Qld) for the tampering of active breeding places where impact cannot be avoided (Low Risk SMP required for impact to Least Concern species/High Risk SMP is required for impact to colonial breeders, near threatened, Vulnerable, Endangered and Critically Endangered species).

Prior to the future construction of the project, further assessment of the project's potential legislative obligations should be undertaken once the corridor is further refined and once additional desktop and field investigations have been undertaken.

A full list of legislative considerations and other obligations required for the project is provided within Appendix A.

6.0 Conclusion and next steps

This dCSSR has been prepared by Powerlink, for the proposed Kamerunga to Woree Replacement Project, which includes the replacement of the existing Kamerunga Substation.

Powerlink's Kamerunga – Woree transmission line, between the existing Kamerunga and Woree substations, provides a critical connection between the Barron Gorge power station and the transmission network, supplying power to northern Cairns.

Both the existing 132kV transmission line, and the Kamerunga Substation are reaching the end of their designed life and are scheduled for replacement. Powerlink is undertaking a transmission line replacement project for the 132kV transmission line between the existing Kamerunga and Woree Substations that will also include replacing the existing Kamerunga Substation.

Investigations into the existing easement alignment have identified that re-building within the existing easement is not a viable option, as there is insufficient easement width and a number of encroachments that impact the technical ability to rebuild on the same alignment. A new corridor is required for the purposes of replacing the 132kV transmission line.

The dCSSR considered an overhead transmission line for the full replacement of the existing transmission line (i.e. from Kamerunga Substation to Woree Substation) however, desktop spatial studies undertaken identified that due to extensive urban development, as well as the extensive urban footprint from the suburb of Redlynch through to Woree Substation, an overhead transmission line would not be viable for the full replacement. Subsequently, the corridor needs to be segmented into a combination of both overhead and underground transmission infrastructure.

As such, this report identified that the preferred corridors for:

- construction of an overhead transmission line where there is minimal urban development and areas of rural land between Kamerunga substation and the suburb of Redlynch; and
- construction of an underground cable where areas are highly urbanised from the suburb of Redlynch through to the Woree Substation.

In order to transition the overhead transmission line to the underground cable, a preferred transition site is also identified within the suburb of Redlynch.

The dCSSR also considers a new site for the replacement and relocation of the existing Kamerunga Substation. The existing substation is too restricted for any further expansion and therefore a greenfield site was required. A greenfield site in the suburb of Barron (east of CWAR/Kamerunga Road) was identified as the recommended site due to its reduced social impacts as a result of being located within a rural zoned area, away from the residential areas of Caravonica.

6.1 Future studies and engagement

Further investigations are required to support the approval process for the Project under state legislation. These additional investigations will assist with the continued refinement to avoid and/or minimise impacts to landholders and surrounding community areas, as well as environment, cultural values and agricultural areas through siting and design.

Social

- Landholder and community consultation - further engagement with stakeholders, particularly impacted and surrounding landholders and Traditional Owner groups, on the Recommended Corridor and Recommended Site to understand use of land, proximity to homes and potential impacts to properties.
- Social and economic impact assessment – further assessment to identify potential social and economic impacts from the construction and operation of the Project.

Environment, heritage, and planning

- Ecology – further assessment, including targeted field surveys of the Recommended Corridor and Recommended Site for the substation, to identify areas that contain habitat for threatened flora and fauna species, or threatened ecological communities. The assessment will also determine the potential impact to habitat for threatened flora and fauna species.
- Biosecurity matters - further investigation into the potential biosecurity risks will be undertaken prior to construction.
- Heritage studies - further investigations are required to identify any potential risk to Aboriginal and Non-Aboriginal heritage values.

Economic

- Land, geology and soils - contaminated land, acid sulfate soils or dispersive soils can pose construction issues due to the need to implement specialist management or design practices and/or treatment. Field investigations including sampling and analysis will be undertaken as part of geotechnical investigations.
- Poor ground conditions - further geotechnical investigations to identify problematic soils and geology such as hard rock, which can pose constructability difficulties, or substantially increase project costs due to specialist design required and/or additional construction materials and foundations, as well as access and easements to be provided.
- Flood potential - further investigation into the potential for flooding within the corridor will be required to understand the risk to the project both during construction and operation.
- Crossings and bends - further investigation to confirm the minimum number of interfaces for the corridor with other infrastructure such as roads, rail, pipelines and other identified values is required to understand where these asset types are located and options for the final alignment. The number of potential bends and associated impacts to the project can be assessed and further refined during the next phase.

In addition, community-based engagement sessions are planned to discuss the Recommended Corridor and associated corridor and site selection process. These sessions will be held throughout the local region, to help facilitate feedback. Further information is available on our website www.powerlink.com.au/ . Feedback is open until 5pm 30 October 2024.

7.0 References

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Appendix A

Summary of legislative considerations

A summary of legislation potentially applicable to the project is provided below in Table D-1 below. Further design and detailed investigations and assessment will be required to confirm the appropriate approval pathway for the project.

Table D-1 Summary of legislation

Legislation	Summary
Commonwealth legislation	
Environment Protection and Biodiversity Conservation Act 1999	The *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act) (Cth) is the centrepiece of Commonwealth environmental laws. It provides a legal framework to protect, and manage nationally, and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as MNES. MNES include: • The world heritage values of a declared world heritage property; • The national heritage values of a declared national heritage place; • The ecological character of a declared Ramsar wetland (wetlands of international importance); • Listed threatened species and ecological communities; • Listed migratory species; • Nuclear actions (including uranium mining); • Commonwealth marine areas; • The Great Barrier Reef Marine Park; and • A water resource, in relation to coal seam gas development and large coal mining development. The EPBC Act is administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) and establishes a process for environmental assessment and approval of proposed actions that have, will have, or are likely to have a significant impact on MNES. If a project may cause a significant impact on an MNES, the project must be referred to DCCEEW for assessment of the potential impacts. The Minister will decide whether the project is: • Not a controlled action: the project does not need to be assessed further; • Not a controlled action 'particular matter': the project does not need to be assessed further, providing the action is completed in accordance with conditions that are supplied with the decision; and • A controlled action: the project will need to be assessed against the EPBC Act, through one of several processes available. Ecological investigations and subsequent significant impact assessment will be completed to understand the presence of, and potential impacts on, MNES. Outcomes of these investigations

Legislation	Summary
	will determine the requirement for referral to the Commonwealth Minister for the Environment.
Native Title Act 1993	The *Native Title Act 1993* (Native Title Act) (Cth) establishes a national framework for the protection and recognition of Native Title, including by conferring on Indigenous people who hold (or claim to hold) Native Title rights and interests in respect of any land or waters, the right to be consulted with and in some cases to participate in decisions about activities proposed to be undertaken. The recommended corridor and site intersect two native title claims: • Djabugay Nation Native Title Claim Area (QC2016/008); and • Gimuy Walubara Yidinji People Claim Area (QC2012/017). Under the Native Title Act (Cth), native title cannot be claimed on freehold land as it is extinguished over the area. Where the corridor intersects roads that were declared as roads on or before the 23 December 1996, native title is extinguished and is not required to be considered. On land where native title exists, Powerlink must comply with the requirements of the Native Title Act (Cth) to secure an easement for the transmission line. Construction of the transmission line is covered by processes under section 24KA or possibly by an Indigenous Land Use Agreement. Section 24KA validates future acts that consist of the construction, and operation of public infrastructure and suspend the native rights over the land for the duration of the easement. Therefore, the legislative requirements under the Native Title Act (Cth) are low risk to the project.
State legislation	
Aboriginal Cultural Heritage Act 2003	The *Aboriginal Cultural Heritage Act 2003* (Qld) is administered by DTATSIPCA and aims to provide effective recognition, protection, and conservation of Aboriginal cultural heritage. It establishes the processes for managing activities that may cause potential harm to Aboriginal cultural heritage, which is identified through the Aboriginal Cultural Heritage Database, and Register and the Cultural Heritage Duty of Care Guidelines. Should the project be considered to pose a high risk to Aboriginal cultural heritage, engagement with the relevant cultural heritage parties for the area is likely to be required. It may also necessitate preparation of a cultural heritage management plan or cultural heritage management agreement. Activities which pose a high risk to Aboriginal cultural heritage which may apply to the project include: • Works in, or within proximity to registered Aboriginal cultural heritage sites or places; • Works in areas with little or no previous ground disturbance; and • Works in proximity to water features. Powerlink are in the process of undertaking engagement with the relevant parties to discuss the project and its potential impacts.
Acquisition of Land Act 1967	The *Acquisition of Land Act 1967* (Qld) is administered by Department of Resources (DoR) and sets out the processes for compulsory and voluntary acquisition of land for a public purpose by a constructing authority. Powerlink may acquire freehold land or register an easement over land for the transmission line. Land may be acquired either by voluntary agreement for

Legislation	Summary
	easements or other tenures required or, where agreement cannot be reached, by compulsory resumption of land.
Biosecurity Act 2014	The *Biosecurity Act 2014* (Biosecurity Act) (Qld) is administered by the Department of Agriculture and Fisheries (DAF) and provides a biosecurity system framework which aims to minimise biosecurity risk, and facilitate responses to biosecurity impacts, to ensure the safety, and quality of agricultural inputs, and to align the state's management of biosecurity risk and other requirements for plant and animal responses to biosecurity risk with federal and international obligations. The Biosecurity Act also aims to manage emerging endemic, and exotic pests, and diseases as well as the transfer of diseases between humans and animals and contaminants in carriers. Under the Biosecurity Act, a general biosecurity obligation is placed on all persons to undertake all reasonable and practicable measures to prevent or minimise biosecurity risk. Additionally, the movement of biosecurity matter must comply with movement restrictions associated with each relevant biosecurity zone, and biosecurity instrument permits are required for the movement of biosecurity matter which cannot comply with movement restrictions.
Environmental Offsets Act 2014	The purpose of the *Environmental Offsets Act 2014* (EO Act) (Qld) is administered by Department of Environment, Science and Innovation (DESI) and is to counterbalance the significant residual impacts of particular activities on prescribed environmental matters through the use of environmental offsets. Prescribed environmental matters are described under the EO Act (Qld) as a MNES, MSES and MLES. An environmental offset may be required as a condition of development approval, where following consideration of avoidance and mitigation measures, a prescribed activity is likely to result in a significant residual impact on a prescribed environmental matter. Once the administering authority has decided that a prescribed activity is required to provide an offset, the environmental offset is required to be delivered in accordance with the EO Act (Qld), the *Environmental Offsets Regulation 2014* and the Queensland Environmental Offsets Policy. The desktop assessment has identified that MNES and MSES are potentially present within the Study Area, however this will need to be confirmed during future phases of the project through field surveys. To avoid duplication between jurisdictions, state and local governments can only impose an offset condition in relation to a prescribed activity if the same, or substantially the same impact, or substantially the same matter has not been subject to assessment under the EPBC Act (Cth). It is important to note that advice from Queensland Treasury is that the EO Act (Qld) does not apply to the designation of premises for development of infrastructure, however the designation decision can still apply compensatory measures/requirements akin to an offset.
Electricity Act 1994	The *Electricity Act 1994* (Qld) is administered by the Department of Energy and Climate, requires that all electricity industry participants must ensure a safe, efficient, and reliable supply of electricity, as well as ensure that the supply of electricity is carried out in an environmentally sound manner. Section 31 of the *Electricity Act 1994* (Qld) states that the transmission entity must properly account for the environmental effect of its activities under the transmission authority.

Legislation	Summary
	Powerlink hold a transmission licence in Queensland and is required to develop its network to meet the security, and reliability standards of the National Electricity Rules, the *Electricity Act 1994* (Qld) and the terms of its transmission licence. The legislative requirements of the *Electricity Act 1994* (Qld) are standard to Powerlink projects and pose a low risk to the construction and operation of the transmission line.
Electrical Safety Act 2002	The *Electrical Safety Act 2002* (Qld) is administered by the Department of State Development and Infrastructure and seeks to regulate electricity works to prevent death, injury or destruction caused by electricity. The transmission line must be designed in compliance with the requirements outlined under the *Electricity Safety Act 2002* (Qld). These requirements are standard to Powerlink processes and are considered to have a low risk to the project.
Environmental Protection Act 1994	The *Environmental Protection Act 1994* (EP Act) (Qld) is administered by DESI and aims to protect Queensland's environment, while allowing for development that improves the total quality of life, both now and in the future. The EP Act regulates activities that will or may have the potential to cause environmental harm and prescribes several mechanisms to ensure that objectives are met. The two primary environmental duties that apply to everyone in Queensland are: • General environmental duty – a person must not carry out any activity that causes, or is likely to cause environmental harm, unless all reasonable and practicable measures to prevent or minimise the harm have been taken. Environmental harm is defined in Section 14 of the EP Act (Qld) as any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value and includes environmental nuisance. • Duty to notify of environmental harm – a person must inform the administering authority and landowner or occupier when an incident has occurred that may have caused or threatens serious or material environmental harm that is not authorised. The EP Act (Qld) also provides the power to administering authorities to order the actions to be taken to improve environmental performance, conduct audits, and environmental evaluations of activities, approve environmental management programs and impose penalties or prosecute persons for non- compliance with the requirements of the EP Act (Qld). The EP Act (Qld) is supported by the following subordinate legislation: • *Environmental Protection Regulation 2019 (EP Regulation);* • *Environmental Protection (Air) Policy 2019 (EPP (Air));* • *Environmental Protection (Noise) Policy 2019 (EPP (Noise)); and* • *Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP (Water and Wetland Biodiversity*)).
Fisheries Act 1994	The *Fisheries Act 1994* (Fisheries Act) (Qld) is administered by DAF and governs the management of fisheries, declared fish habitat areas and marine plants. Works which may cause disturbance to 'waterways' as defined under the Fisheries Act (Qld) can be subject to assessable operational work for waterway barrier works, unless construction complies with the conditions under the 'Accepted development requirements for operational work that is constructing or raising waterway barrier works.

Legislation	Summary
	Should any works within a waterway not comply with the Accepted development requirements, a development permit is ordinarily required under the Planning Act (Qld). However, if the project is granted an Infrastructure Designation, operational work for waterway barrier works will be considered accepted development and will not require a development permit.
Land Act 1994	The *Land Act 1994* (Qld) is administered by the DoR and governs the allocation and management of land for development. The *Electricity Act 1994* (Qld) provides exemptions to the *Land Act 1994* (Qld) for works by transmission entities. Transmission entities are entitled to take necessary action in publicly controlled places (such as unallocated State land) to provide or supply electricity under section 101 of the *Electricity Act 1994* (Qld), as well as undertake works on road reserves through written agreement from the road authority under section 102.
Nature Conservation Act 1992	The *Nature Conservation Act 1992* is administered by DESI and is the primary legislation governing the protection and management of native wildlife, habitat and protected areas in Queensland. The protected plants flora survey trigger map identifies high risk areas for protected plants to occur and must be used to determine whether a targeted flora survey is required for a particular area. High risk areas are those in which endangered, vulnerable, threatened or near threatened flora is known or likely to exist. Where clearing is required in an area containing a protected plant species, a clearing permit must be obtained from DESI.
Planning Act 2016	The Planning Act (Qld) is administered by the Department of Housing, Local Government, Planning and Public Works and establishes a system of land use planning and development assessment prescribed under the Planning Regulation 2017 (Planning Reg). The proposed project is considered 'Electricity Operating Works', which is considered 'infrastructure' and therefore prescribed development under the Planning Reg. Under the Planning Act (Qld), the Planning Minister is the only minister with the power to designate land for infrastructure. The 'Minister's Guidelines and Rules' outlines the process for making a ministerial designation. An approval for a ministerial designation will require submission of an environmental assessment report that includes requirements about works for the infrastructure (such as the height, shape, bulk, landscaping, or location of works), the use of premises including access and ancillary uses, or lessening the impact of the works or use (such as environmental management procedures). Under section 44 of the Planning Act (Qld), infrastructure that is designated is considered accepted development and will not require further approvals under the Planning Act (Qld); with the exception of building work approval under the Building Act 1975 (Qld). A MID will be required for construction of the transmission line.
State Planning Policy	The State Planning Policy (SPP) identifies matters of State interest requiring protection and enhancement. The SPP is at the top of the planning hierarchy in Queensland and is the overarching policy for all other regional and local planning instruments. The SPP States that the SPP applies to the extent relevant, when designating premises for infrastructure under the Planning Act and development applications.

Legislation	Summary
Transport Infrastructure Act 1994	The *Transport Infrastructure Act 1994* (Qld) is administered by TMR and regulates the management of state-controlled road networks across Queensland. Under section 50 of the *Transport Infrastructure Act 1994* (Qld), construction, maintenance, and operation of ancillary works and encroachments within State-controlled roads (e.g. placement of a transmission line over the road) can only be completed where written approval has been granted from TMR. Under section 33 of the *Transport Infrastructure Act 1994* (Qld), written approval is required from the DTMR to carry out road works on a State-controlled Road (SCR) or interfere with a SCR or its operation. This may include where road works to a Council Road interferes with a SCR or its operations. Under section 62 of the *Transport Infrastructure Act 1994* (Qld), written approval is required from DTMR to locate a permitted access on a SCR. A decision of access approval may include conditions or restrictions on the location or use of the permitted road access, type or number of vehicles to use the permitted road access location. Under the *Transport Infrastructure (Rail) Regulation 2006* permission from the railway manager (Queensland Rail) is required to take over dimensional road loads across Queensland Rail infrastructure (e.g. rail level crossings and rail bridges).
Vegetation Management Act 1999	The *Vegetation Management Act 1999* (VM Act) (Qld) is governed by the DoR and seeks to manage native vegetation across Queensland. Regulated Vegetation Mapping identifies categorised areas of remnant vegetation in Queensland and is used to establish whether clearing of native vegetation is considered assessable development requiring a permit. Clearing of any relevant remnant or regulated regrowth vegetation constitutes operational work under schedule 10 of the *Planning Regulation 2017*, which will require development approval unless a vegetation clearing code or exemption applies. Under Section 22A of the VM Act (Qld), an application for operational work, including applications where DoR is a concurrence agency, cannot be accepted as properly made unless the Chief Executive is satisfied that the development is for a relevant purpose. Exemptions exist for electricity infrastructure were associated with an infrastructure designation. Any infrastructure designation or development application will need to demonstrate that Powerlink has sought to reduce the impacts of vegetation clearing through the hierarchy of avoid, minimise and mitigate. Where a significant residual impact remains, an offset, or compensatory measures may be required.
Water Act 2000	The *Water Act 2000* (Water Act) (Qld) is administered by the Department of Regional Development, Manufacturing and Water, and provides a legislative framework for the sustainable use, allocation, and management of water resources in Queensland and regulates activities occurring within designated watercourses under the Water Act (Qld). The Watercourse Identification Map categorises water features as either a designated watercourse, drainage feature, downstream limit of a watercourse or lake and is used to determine the assessment requirements for undertaking activities within a watercourse. Activities including excavating, filling, or destroying native vegetation within a watercourse may require approval under the Water Act (Qld) in the form of a riverine protection permit. Powerlink is an approved entity exempt from requiring a permit if the self-assessment guidelines under DoR's 'Riverine protection permit exemption requirements' are followed.

Legislation	Summary
Regional Plans	The recommended corridor and site are subject to Far North Queensland Regional Plan 2009 – 2031. The plan was implemented in 2009 as a statutory plan to guide and manage the region's development, addressing key regional environmental, social, economic and urban objectives. The transmission line and substation are consistent with the intent of the plan, to provide continued distribution capacity for the region.
Local Laws	The project is located within Cairns Regional Council Local Government Area. Local Government Areas are subject to individual Local Planning Instruments under the Planning Act (Qld), as well as a range of local laws under the *Local Government Act 2009* (Qld). Local laws under the *Local Government Act 2009* (Qld) are used to regulate matters specific to LGAs, particularly relating to pests and weeds, use of local government roads and nuisances such as noise and dust. While the approvals framework for this project gives rise to legislative and regulatory exemptions, the local laws imposed by the relevant LGAs will still apply and may trigger permits required to be obtained for certain activities. The local laws that may apply to the project are provided as follows: • Local Law No. 3 (Community and Environment); and • Local Law No. 11 (Local Government Controlled Areas and Roads). Once the land becomes designated as part of the MID process, development relevant to the designation becomes accepted development under the local planning scheme, and, further planning approval is not required. However, the Minister may have regard to the local government assessment framework and decisions may be influenced by zoning, land-use intent, and local ordinances and by-laws. Additionally, the local council will be consulted with during the MID process with regards to impacts on local government-controlled roads, prior to the commencement of construction.

Appendix B

Acronyms in dCSSR

CWAR	Cairns Western Arterial Road
DCCEEW	Department of Climate Change, Energy, the Environment and Water
dCSSR	Draft Corridor and Site Selection Report
DESI	Department of Environment, Science, and Innovation
DoR	Department of Resources
DTATSIPCA	Department of Treaty, Aboriginal and Torres Strait Islander Partnerships, Communities and the Arts
EMF	Electric and Magnetic Fields
EO Act	*Environmental Offsets Act 2014*
EP Act	*Environmental Protection Act 1994*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Ergon Energy	Energy Queensland
Fisheries Act	*Fisheries Act 1994*
JBS&G	JBS&G Australia Pty Ltd
NC Act	*Nature Conservation Act 1992*
OH	Overhead Line
Planning Act	*Planning Act 2016*
PNQ	Pioneer North Queensland
Powerlink	Powerlink Queensland
RE	Regional Ecosystem
SCR	State-controlled Road
SMP	Species Management Program
TMR	Department of Transport and Main Roads
UG	Underground
UGOH	Underground to Overhead
VM Act	*Vegetation Management Act 1999*
Water Act	*Water Act 2000*