Prepared for
Powerlink Queensland
ABN: 82 078 849 233

MID Proposal Report

Burdekin River Pump Station Project

28-Mar-2024
Burdekin River Pump Station Project
Doc No. 60714900

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MID Proposal Report

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Client: Powerlink Queensland

ABN: 82 078 849 233

Prepared by

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Table of Contents

Executive Summary

Introduction

AECOM Australia Pty Ltd (AECOM) have prepared the following Ministerial Infrastructure Designation (MID) on behalf of Powerlink Queensland (Powerlink) for the Burdekin River Pump Station Project (the Project). The Project site is located partially within four allotments and the Overhead Transmission Line (OHTL) extends over Ayr-Dalbeg Road and Invicta Mill Cane Rail Line (Figure 1). The allotments are formally described as Lot 22 on GS1042, Lot 33 on SP331997, 34 on SP331997 and Lot 289 on SP117630.

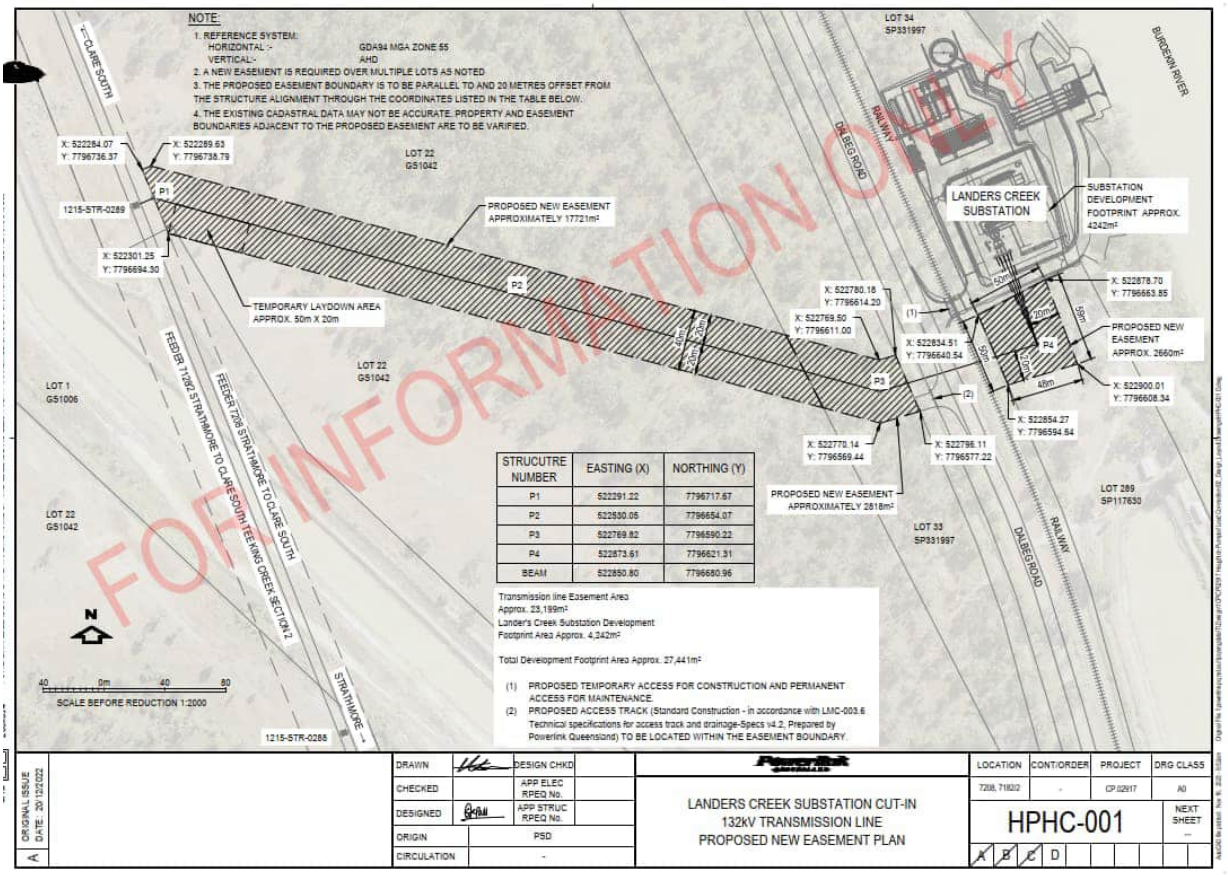


Figure 1 Proposal Plan

Project Justification and Feasible Alternatives

Townsville City Council (TCC) have submitted a connection application to Powerlink for the establishment of a 10-15 megawatt (MW) water pump load connection (Burdekin River Pump Station) associated with the Haughton Pipeline Stage 2 Project.

Powerlink is a Transmission Entity under the *Electricity Act 1994*, and owns, operates and maintains Queensland high voltage electricity transmission network. As a Transmission Network Service Provider in the national electricity market, Powerlink's primary role is to provide a secure and reliable network to transport high voltage electricity from generators to electricity distribution networks.

On the basis of the above, there are no other feasible locations to connect the Burdekin River Pump Station to Powerlink's power supply.

The Project is proposed as 'Infrastructure' assessable under the *Planning Act 2016* MID process. In order to obtain a MID, an Infrastructure Entity is required to prepare an MID Proposal Report taking into account the potential environmental, social and economic impacts associated with the construction, operation and maintenance of the Project.

This MID Proposal Report has been prepared to support MID of the Project in accordance with Powerlink's Terms of Reference to ensure a robust environmental assessment is undertaken for the Project. To demonstrate mitigation and management measures, this MID Proposal Report includes an Environmental Management Plan (EMP) for both the Overhead Power Transmission Line (OHTL) and substation.

Project Description

The Project comprises the following components and is depicted in Figure 1:

- A proposed 132 kilovolt (kV) Substation to be known as Landers Creek Substation (adjoining the approved pump station).
- A proposed OHTL to establish a 132kV single circuit tee off into the new Landers Creek Substation. The OHTL will be located within a proposed new easement within Lot 289 on SP117630, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 22 on GS1042.
- The proposed new easement is 40 metres (m) wide, being 20 m either side of the OHTL centreline, with one partial section being 50 m.

The Project is located within the Burdekin Shire Council Local Government Area (LGA).

Land

Land use in the area surrounding the Project consists of agricultural farming and cattle grazing along the upper bank of the Burdekin River. Key risks to land use associated with the Project include erosional impacts during construction and works within a property listed on the Environmental Management Register as a notifiable activity. These potential impacts will be managed through the implementation of mitigation measures detailed in Powerlink's EMPs and Annexures, which identify erosion and sediment control measures and a protocol for identifying and assessing potentially contaminated land.

Air Quality

Potential air quality impacts associated with the operation and maintenance of the Project are anticipated to be low to negligible. The activities associated with the Project's construction phase that have potential to create emissions are mostly related to vegetation management, use and maintenance of access tracks and exhaust emissions associated with vehicles and machinery. Mitigation and management measures proposed for both the construction and operation phases are in line with Powerlink's Standard Environmental Controls Specification.

Hydrology

Hydrology within the Project site was assessed as part of a Water Resources and Hydrology Technical Report. This report identifies the potential risks related to surface water and groundwater within the OHTL and Landers Creek substation. Key conclusions from this report identified that the proposed substation is located above the 1% Annual Exceedance Probability (AEP) (100 year) flood level and 0.5% AEP (200 year) flood level. As such, the substation is unlikely to cause adverse flood impacts on surrounding land uses. The Landers Creek substation bench will be designed and constructed by TCC in accordance with Powerlink Civil Design Specifications. Other impacts were identified to be minimal with no mapped wetlands, groundwater dependent ecosystems or water license holders impacted by the works.

Recommendations from the report included:

- An Erosion Sediment Control Plan (ESCP) should be developed and then implemented to ensure that potentially affected surface water from construction activities does not enter downstream surface water and ground water environments.

- A review of TCC Haughton Pipeline Stage 2 Project design documentation for the proposed Clare Weir pumpstation should be considered if available for this Project. The review may provide more certainty on the assumptions in this Report.

Protected Areas

There are no protected areas under Commonwealth or State legislation within or nearby the Project site. Management or mitigation measures for these features are not considered as a result.

Flora

Ecological values within the Project site include remnant vegetation communities that support a range of habitat values and resources for a diversity of flora species, including conservation significant flora.

Potential direct and indirect impacts to ecological values may occur as a result of the Project. However, the Project design has applied the principle of avoidance, mitigation and management to minimise environmental impacts to an acceptable level, and as a result the clearing of vegetation communities and habitats is expected to be limited to approximately 2.7 ha, plus 0.5 ha non-remnant vegetation clearing, amounting to a total clearing area of approximately 3.2 ha.

The Project is not anticipated to impact areas mapped as high-risk for protected plants, or conservation significant flora. However, one Commonwealth listed species was identified adjacent to the Project site along the bank of the Burdekin River (*Eucalyptus raveretiana,* Vulnerable). Mitigation and management measures have been developed to ensure these individuals are not impacted by the Project.

Fauna

The desktop searches identified 44 conservation significant fauna species to consider in the likelihood of occurrence assessment. Following the field validation of habitat values within the Project site, the likelihood of occurrence assessment was updated. The results of this assessment identified 15 conservation significant fauna species considered as likely, or having the potential to occur within the Project site, including four threatened birds, five mammals and six migratory birds (one of which is also threatened).

The Project's construction phase was identified as the greatest risk of potential impact on ecological values, with 2.7 ha of species habitat present within the Project site. Management and mitigation measures have been developed in addition to the Project's EMP to reduce the potential impact on these species as an Environmental Annexure for the Project. Based on the implementation of these measures, the overall impact on these species is considered to be minimal.

Matters of State Environmental Significance

Several Matters of State Environmental Significance (MSES) values were identified within the Project site, namely regulated vegetation (within the defined distance of a watercourse), connectivity, protected wildlife habitat and waterways providing for fish passage. These MSES values were subject to an impact assessment as per the MSES Significant Residual Impact Guidelines (Department of State Development Infrastructure and Planning, 2014a). After considering potential impacts, mitigation measures and the State significant residual impact criteria, the Project is considered unlikely to have a significant residual impact on MSES values.

Biosecurity

A weed survey of the Project site was undertaken by AECOM, identifying total 32 introduced flora species confirmed to occur in the Project site during field surveys, with two Weeds of National Significance (WoNS) and six species listed as Category 3 restricted matter under the *Biosecurity Act 2014.* Five species are listed as local priority weeds of varying management categories. One introduced fauna species was identified during the survey being a feral pig. Biosecurity impacts are considered most likely to occur during the construction phase as a result of weeds being transported to and from the Project site. Biosecurity risks during both construction and operation will be managed by controls outlined in the Project's EMP and Biosecurity Management Plan.

Land Use

The Project traverses four parcels of land. Land tenure arrangements are Freehold and Reserve land within the Burdekin Shire Council. The Project will connect into the existing easement located on Lot 22

on GS1042. The existing character and amenity of the Project consists of large vegetated rural allotments with cattle grazing being undertaken on Lot 22 on GS1042. Two residential dwellings are located within a 2 km radius of the Project site.

The dominant land use within the surrounding locality is agricultural land. The Project site is mapped as an Important Agricultural Areas and Class A and B land is a key component of the Agricultural State Interests under the State Planning Policy**.** Potential impacts to adjacent land use will be avoided and mitigated through the design and implementation of management measures such as biosecurity controls during construction.

Visual Amenity

Visual amenity was considered through an assessment of potential impacts to visual receptors and landscape features. The Project site is located on the upper bank of the Burdekin River and intersects the Ayr-Dalbeg Road. These two pathways are the most likely viewsheds that will impact visual receptors.

The visual impact assessment found that based on the location of the Project site between two bends of the road, sensitive receptors were only likely to be impacted by the Project for a short period of time. Furthermore, the Project's co-location with existing infrastructure (Sunwater pump station, Ayr-Dalbeg Road, Invicta Cane Rail, existing 132 kV transmission lines), further reduces the impact on visual receptors.

At a landscape scale, the Project is located in an area that is predominately used for cattle grazing and farming. Similar to the impacts to visual receptors, as the Project is co-located with existing infrastructure and will be partially hidden by remnant vegetation along the bank of the Burdekin River, impacts to landscape visual amenity are considered to be low.

Social and Economic

The Project site is located approximately 15 km south of the township of Clare, within the Burdekin Shire Council LGA. It is located nearby a sparsely populated area (210 residents) and traverses rural properties associated with cattle grazing.

Given the sparse population within the Project site, the Project is not anticipated to have a significant impact on the community. As the construction phase is temporary, and workers are not proposed to be permanently relocated to the region, elements of the community profile are not anticipated to be impacted to a noticeable level. During construction, there will be a temporary influx of workers into the region. Temporary construction camps are not required for the construction phase workforce.

The operational phase of the Project is not anticipated to have any material impact upon the demographic profile of local and regional populations. Workers will travel to the Project site during the operational phase to undertake maintenance activities, however, it is short term and temporary in nature.

While impacts are anticipated to be minimal, the Project is acting as enabling infrastructure for the Haughton Pipeline (Stage 2), which will facilitate jobs within the region during construction and will support water security for the region.

Consultation with the community is currently underway and will be a key part of the MID process Community consultation that has been undertaken to date is discussed further in Chapter 28.

Indigenous Cultural Heritage

A Cultural Heritage Survey and Impact Assessment Study for the Haughton Pipeline Project Stage 2 Upper Haughton to the Burdekin River was undertaken in November - December 2021 in conjunction with the Bindal People. The cultural heritage field survey and assessment was undertaken for approximately 28 km of pipeline alignment and ancillary work areas including the originating substation and OHTL footprint. One Aboriginal cultural site/feature was identified (Scarred Tree) which is located outside the Project site.

To align with Cultural Heritage Survey and Impact Assessment Study for the Haughton Pipeline Project Stage 2 Upper Haughton to the Burdekin River, consultation will be undertaken with the Bindal People for the revised Project footprint.

Non-Indigenous Cultural Heritage

There are no registered historical heritage places within or directly adjacent to the Project site, and so no impacts are proposed to known heritage values.

There is some potential for the Project to impact unidentified historical heritage places. Any such unidentified places are most likely to relate to the pastoral or mining history of the region.

Residual risk across the Project will be mitigated by general construction phase environmental management measures, including cultural heritage inductions and unexpected find procedures.

Transport and Traffic

A Traffic Impact Assessment was undertaken for the Project. This assessment identified the major transport routes to the Project being the Townsville Port Access Road, the Bruce Highway and the Ayr-Dalbeg Road. While no high-risk areas were identified by the Traffic Impact Assessment, medium and low risks identified were located at intersections along the three State-controlled roads. Mitigation measures proposed include clearing of vegetation to improve sight lines and designing new access points in accordance with the rural property access arrangement for articulated vehicles. With these mitigations considered, the overall impact to traffic as the result of the Project was considered to be low.

Noise and Vibration

The noise and vibration assessment identified two sensitive receptors within 2 km. The construction and decommissioning activities were assessed against the established noise limits. Construction and operational scenarios assessed were not predicted to exceed the noise limit at any sensitive receptor across all scenarios.

Vibration-intensive works are expected to take place well within safe working distances for building damage and human comfort criteria. It is recommended that these safe working distances be used to guide the plant selection for the construction of the Project.

Mitigation and management measures have been developed to further reduce the potential impacts of noise and vibration during construction and operation.

Hazards, Health and Safety

An assessment of hazards, health and safety risks associated with the construction and operation of the Project has been undertaken. Key risks for the Project are associated with the construction, with the potential risks associated with operation being lower. A range of management and mitigation measures have been developed to ensure that risks are minimised to as low as practicable.

Electric Magnetic Fields

Powerlink has not undertaken an electric and magnetic field (EMF) assessment for the proposed OHTL and substation on the basis that there are only two sensitive receptors within 2 km of the Project site.. Department of Housing, Local Government, Planning and Public Works (DHLGPPW) have confirmed that an EMF assessment is not required on this basis.

Bushfire Risk

The Project site is predominately mapped within ‘High, Medium and Potential Impact Buffer Potential Bushfire Intensity’ Bushfire Prone Areas under the State Planning Policy mapping. To reduce the risk of bushfire works will be undertaken under a Bushfire Management Plan. The Bushfire Management Plan will align with the requirements of Powerlink’s Bushfire Mitigation Plan (ASM-PLN-A3285085).

Waste Management

Potential Project waste streams have been identified for construction and operation. Proposed waste handling and storage has been developed for construction and operation detailing the measures required to remove different types of waste from the Project site.

Infrastructure

The Project site is located in a rural area with minimal infrastructure nearby. The Project is intersected by the Ayr-Dalbeg Road, a State-controlled Road and the Invicta Mill Cane Rail. Immediately adjacent

to the Project is a Sunwater Pump Station to the south and an agricultural channel to the north. The Project will tie in to a 132 kV transmission line that runs from Strathmore to Clare.

Cumulative Impacts

Based on the small scale of the Project and its co-location with existing infrastructure, cumulative impacts are anticipated to be minimal and likely only relate to traffic and potentially to conservation significant species. Standard environmental controls, as outlined in Appendix B: Environmental Management Plan – Substation and Appendix C: Environmental Management Plan – Transmission Line have been developed for the Project, while *Environmental Protection Biodiversity and Conservation Act 1999* (EPBC Act) approval conditions for the Haughton Pipeline (Stage 2) will be followed.

Environmental Management

A range of environmental constraints have been identified in the Project site. The potential impacts to these constraints have been assessed as part of this MID Proposal. To reduce the impacts to identified environmental constraints an EMP and Environmental Annexure has been developed for both the Substation and OHTL. These are presented in in Appendix B: Environmental Management Plan – Substation and Appendix C: Environmental Management Plan – Transmission Line.

Planning and Approval Requirements

As the Project is being assessed under the MID process under the *Planning Act 2016*, a range of typical approvals under this Act will no longer apply to this Project, as MID makes the development 'accepted development'.

Community and Stakeholder Consultation

Preliminary stakeholder engagement commenced in December 2023 to raise awareness of the proposed Project and to provide landholders, Traditional Owner group, the wider community and other stakeholders with an opportunity to provide initial feedback prior to the MID proposal being lodged.

The identified key stakeholder groups for the project are provided in Chapter 28, Table 43. The stakeholder groups have been informed by proposed Project activities, proximity to the Project site, and previous engagement undertaken by Townsville City Council (TCC).

Powerlink is continuing engagement activities with landholders, the Traditional Owner group, the wider community and other stakeholders as part of the public consultation process for this MID Proposal.

Conclusion

This assessment report has identified that the Project has the potential to impact a range of environmental, social and economic values in the Project site and surrounds, both positively and negatively. However, through the implementation of design mitigation and standard and Project-specific mitigation and management measures, these potential impacts can be minimised and mitigated.

1.0 Introduction

1.1 Project Overview

AECOM Australia Pty Ltd (AECOM) have prepared the following Ministerial Infrastructure Designation (MID) on behalf of Powerlink Queensland (Powerlink) for the Burdekin River Pump Station Project (the Project). The Project site is located partially within four allotments with the proposed Overhead Transmission Line (OHTL) extending over Ayr-Dalbeg Road and Invicta Mill Cane Rail Line (Figure 1). The allotments are formally described as Lot 22 on GS1042, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 289 on SP117630.

The Project comprises the following components:

- A proposed 132 kilovolt (kV) Substation to be known as Landers Creek Substation (adjoining the approved pump station for the Haughton Pipeline Project Stage 2– approximate footprint 4,242 m²).
- A proposed OHTL to establish a 132 kV single circuit tee cut into the substation. The OHTL will be located within a proposed new easement (2,660 m²) within Lot 289 on SP117630 extending into Lot 22 on GS11042 (2,818 m²).
- The proposed OHTL will be positioned within a new easement that is proposed to be 40 m wide.

1.2 Project Proponent

The Project owner, developer, operator and maintainer is:

Powerlink Queensland
33 Harold St, Virginia,
PO Box 1193, Virginia, QLD 4014
Telephone: (07) 3860 2111, Facsimile: (07) 3860 2100
Website: https://www.powerlink.com.au/

Powerlink is the registered business name of the Queensland Electricity Transmission Corporation Limited (ABN: 82 078 849 233), a Queensland Government Owned Corporation. It was established under the *Government Owned Corporations Act 1993* and is a Transmission Entity under the *Electricity Act 1994*.

Powerlink owns, operates and maintains Queensland's high voltage electricity transmission network. As a Transmission Network Service Provider in the National electricity market, Powerlink's primary role is to provide a secure and reliable network to transport high voltage electricity from generators to electricity distribution networks owned by Energex, Ergon Energy (Ergon) and Country Energy, which supply to nearly 4 million Queenslanders. Powerlink also transports electricity directly to large Queensland customers such as mines, gas producers, industrial smelters, rail network operators and to New South Wales via the NSW / QLD Interconnector.

Powerlink's operations are guided by the *Electricity Act 1994* (Electricity Act) and the *Electrical Safety Act 2002* (Electricity Safety Act). The Electricity Act sets out the requirements which all electricity industry participants must follow to ensure a safe, efficient and reliable supply of electricity. It also requires the supply of electricity to be undertaken in an environmentally sound manner. Under Section 31(b) of the Electricity Act, a Transmission Entity is required to properly take into account the environmental effects of its activities under its transmission authority.

The Electricity Safety Act seeks to prevent through regulation, the death, injury and destruction that can be caused by electricity. Accordingly, the purpose of the Electricity Safety Act is to establish a legislative framework for preventing persons from being killed or injured by electricity; and preventing property from being destroyed or damaged by electricity. The design of the Project will satisfy the requirements of the Electricity Safety Act.

1.3 Approval Framework

The Project is proposed as 'Infrastructure' assessable under the *Planning Act 2016* (Planning Act) MID process. MID is a planning process under Chapter 2, Part 5 of the Planning Act that allows the Minster to designate premises for a type of infrastructure. The process provides infrastructure entities a streamlined, considered whole-of government response on a request for infrastructure.

Three statutory instruments support the MID function, namely:

1. Planning Act, which includes provisions for making, amending, extending or repealing MIDs.
2. *Planning Regulation 2017* (Planning Regulation), which identifies the types of infrastructure that may be designated.
3. Ministers Guidelines and Rules (MGR), which includes processes for making or amending ministerial designations (Chapter 7 of the MGR).

Section 35 of the Planning Act identifies that the Planning Regulation describes the types of infrastructure that may be designated by the Minister. Schedule 5, Part 2, Item 7 of the Planning Regulation identifies 'electrical operating works', being operating works under the Electricity Act, as infrastructure which may be designated. Section 36 of the Planning Act provides criteria for making an MID, stating:

> *(1) To make a designation, a designator must be satisfied that—*
>
> *(a) the infrastructure will satisfy statutory requirements, or budgetary commitments, for the supply of the infrastructure; or*
>
> *(b) there is or will be a need for the efficient and timely supply of the infrastructure.*

The Project achieves the requirements of Section 36(1) of the Planning Act by providing efficient and timely supply of infrastructure through the following points.

- The Project will provide infrastructure connection to the Burdekin River Pump Station.
- Adjacent projects, being the Haughton Pipeline (Stage 2), will require the Project and its substation as enabling infrastructure for their success.

In order to make a designation under Section 36 of the Planning Act, the Minister must also be satisfied that adequate environmental assessment, including adequate consultation has been carried out in relation to the Project. This MID Proposal Report has been developed to address the MGR requirements prescribed under the Planning Regulation to satisfy the requirements of the Minister.

1.4 Structure of MID Proposal Report

This MID Proposal Report has considered the potential effects relating to the construction, operation, maintenance and eventual decommissioning of the Project. The scope of this MID Proposal Report has included the preparation of an Environmental Management Plan (EMP) and Environmental Annexures for the transmission line and the substation.

The structure of this MID Proposal Report is as follows.

- An Executive Summary, which contains an overview of key issues and findings.
- Chapter 1.0, which provides an overview of the Project, details of the proponent, Project scope, and the MID approvals process.
- Chapter 2.0, which details the Project justification.
- Chapter 3.0, which provides a detailed Project description.
- Chapters 4.0 to 24.0, which provide a description of the existing environmental, economic and social values, potential impacts from the Project and mitigation and management strategies to reduce impacts where possible.
- Chapter 25.0, which summarises the short, long-term and cumulative impacts of the Project.

- Chapter 26.0, which assesses the planning and approval obligations triggered by the Project.
- Chapter 27.0, which provides a summary of Powerlink's environmental record and a summary of the EMP detailing how impacts will be minimised and proposed environmental protection conditions for the Project.
- Chapter 28.0, which provides a summary of the consultation activities undertaken and issues raised by stakeholders and the community.

Additional technical studies and plans for the Project have been developed including:

- Appendix A: Project Plans
- Appendix B: Environmental Management Plan – Substation
- Appendix C: Environmental Management Plan – Transmission Line
- Appendix D: Water Resource and Hydrology Technical Report
- Appendix E: Traffic Impact Assessment
- Appendix F: Noise and Vibration Technical Report
- Appendix G: Ecology Technical Report
- Appendix H: Weed Survey Report
- Appendix I: Environmental Management Register / Contaminated Land Register.

2.0 Project Justification and Feasible Alternatives

2.1 Project Justification

Townsville City Council (TCC) have submitted a connection application to Powerlink for the establishment of a 10-15 Megawatt (MW) water pump load connection to the approved Project. The Project is associated with the Haughton Pipeline (Stage 2) project. The Haughton Pipeline (Stage 2) project will connect and extend the existing Stage 1 raw water pipeline, completed in 2020, from the Haughton River to the Burdekin River near Clare. The Haughton Pipeline is a major piece of infrastructure supporting water security by providing greater capacity to deliver raw water to the Ross River Dam, Townsville's main water supply. This Project seeks to provide a power supply to the approved Burdekin River Pump Station adjoining the Project site.

2.2 Feasible Alternatives

As this Project is providing a connection to an approved Burdekin River Pump Station which will provide water security to the Townsville region, no other feasible alternatives were available.

3.0 Project Description

3.1 Project Overview

The Project comprises the following components and is depicted in Figure 1:

1. A new 132kV Substation (adjoining the approved Burdekin River Pump Station).
2. A new OHTL to establish a 132kV single circuit tee off into the new Landers Creek Substation. The OHTL will be located within a proposed new easement within Lot 289 on SP117630, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 22 on GS1042.
3. The proposed new easement is 40 m wide, being 20 m either side of the OHTL centreline, with one partial section being 50 m.

Proposal plans are included in Appendix A: Project Plans. Table 1 depicts the Project components and associated footprints.

Table 1 Project Component

Component	Location (Lot on Plan)	Footprint Area (m²)	Easement Width (m)
Substation	Lot 34 on SP331997	4,242	-
OHTL Easement	Lot 289 on SP117630	2,660	50
OHTL Easement	Lot 33 on SP331997	2,818	40
OHTL Easement	Lot 22 on GS1042	17,721	40
Total Project Footprint		**27,441**	

3.2 Project Site

The Project site is located partially within four allotments and the OHTL extends over Ayr-Dalbeg Road and Invicta Mill Cane Rail Line (Figure 2).

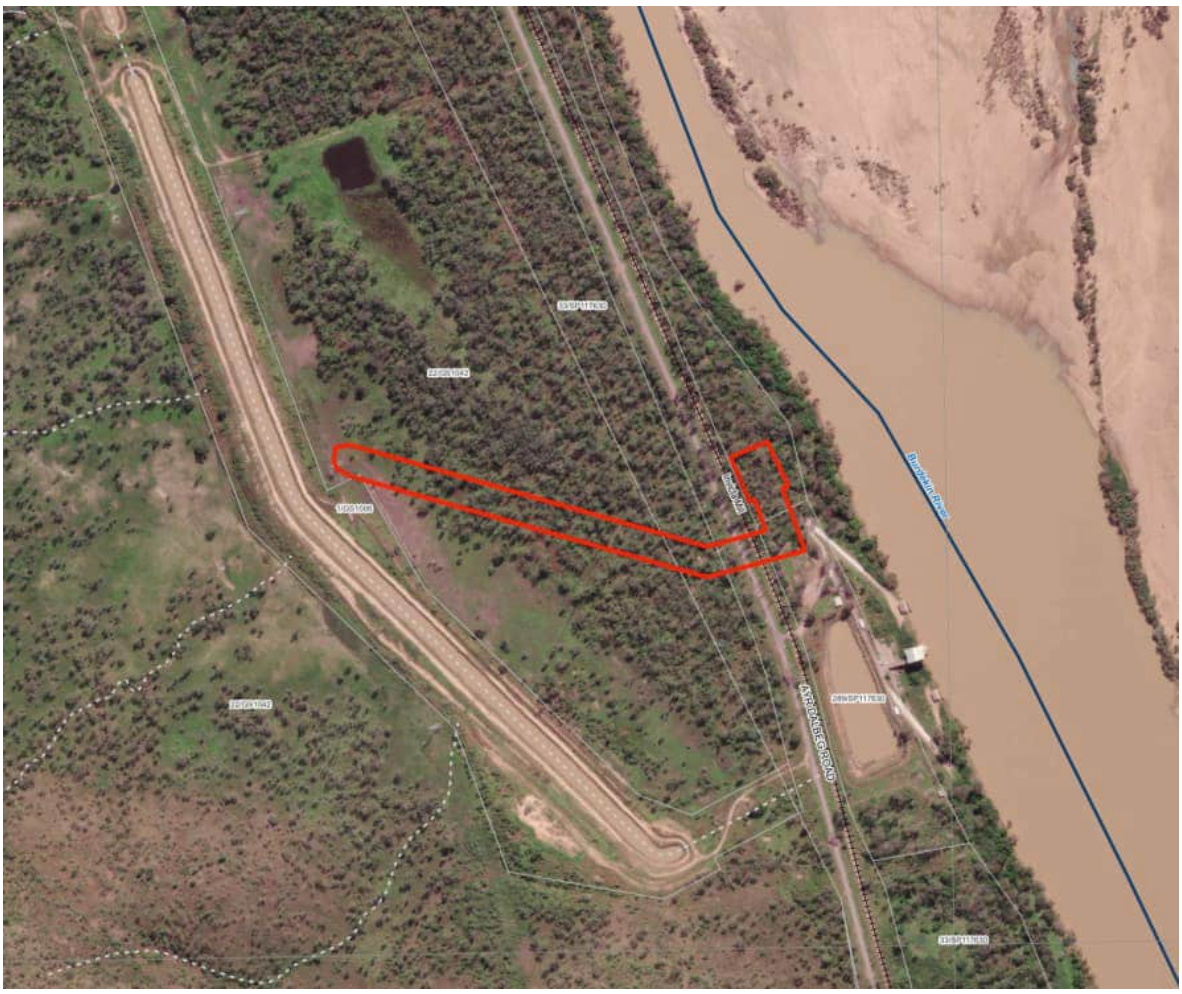


Figure 2 Project Site

Land tenure and ownership details for the Project are detailed in Table 2 below:

Table 2 Lot on Plan and Tenure Details

Lot on Plan / Location	Tenure	Ownership
Lot 34 on SP331997	Reserve	The State of Queensland (Represented by the Department of Resources (DoR))
Lot 289 on SP117630	Land Lease	Sunwater Limited
Invicta Mill – Cane Rail Line	Rail Line	Invicta Mill
Ayr-Dalbeg Road	State Controlled Road	Department of Transport and Main Roads (DTMR)
Lot 33 on SP331997	Reserve Land	Reserve for Camping and Water – Burdekin Shire Council J and S Sheahan
Lot 22 on GS1042	Freehold Easement – AGS510	J and S Sheahan

The existing environment is discussed in Chapter 4.0.

Sensitive receptors in proximity to the Project site are shown in Figure 3. Sensitive receptors have been defined through a combination of sensitive receptors under the *Environmental Protection Act 1994* (EP Act). There are two sensitive receptors within 2 kilometres (km) of the Project site being residential dwellings.

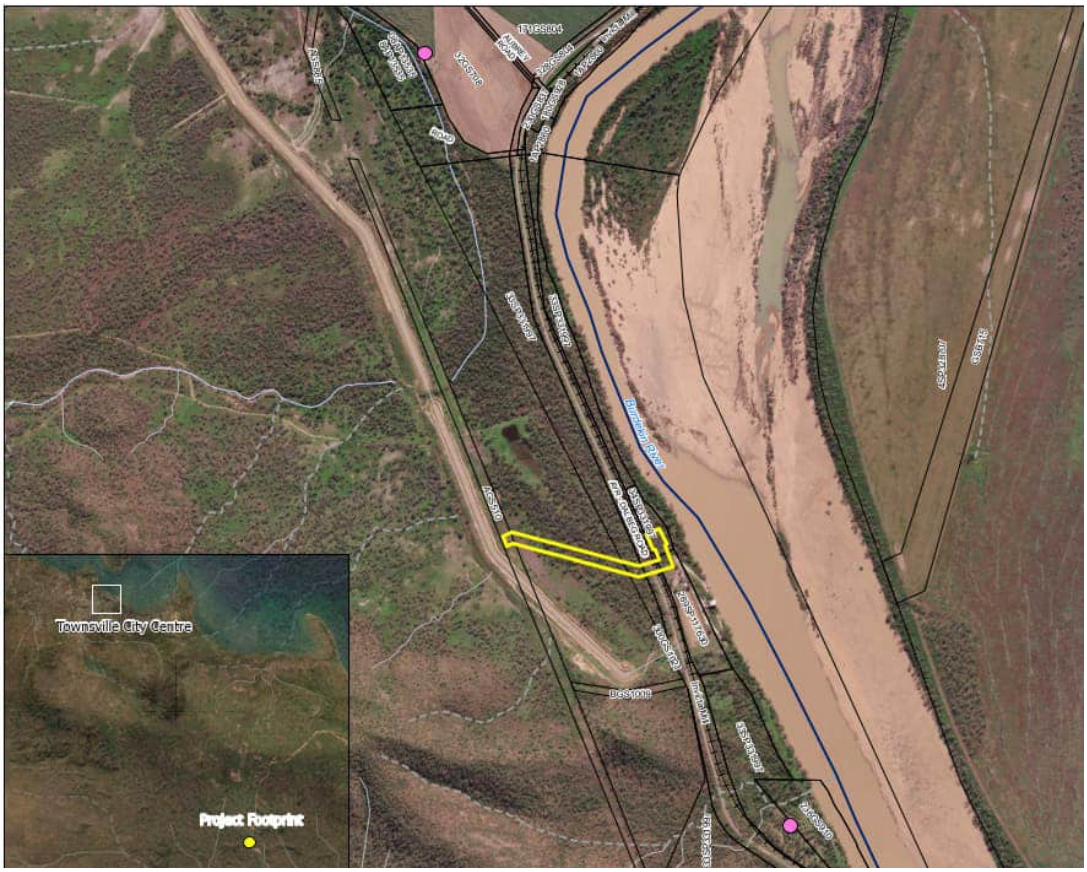


Figure 3 Sensitive Receptors

3.2.1 Environmental Management Register and Contaminated Land Register

Table 3 provides the Environmental Management Register (EMR) and Contaminated Land Register (CLR) Searches. One allotment is included on the EMR.

Table 3 EMR and CLR Search Results

Lot on Plan / Location	Results
Lot 34 on SP331997	Not on EMR/CLR
Lot 289 on SP117630	Not on EMR/CLR
Lot 33 on SP331997	Not on EMR/CLR
Lot 22 on GS1042	Included on EMR (Refer to Section 4.1.5 for further detail)

3.3 Substation Site

The Project seeks to establish a new 132/11 kV substation to facilitate single customer (TCC) connection (10-15 MW load) on land provided by TCC with the following considerations (Figure 4):

- Substation layout consists of single circuit incoming feeder bay. Single line tee-connection cut-off from existing powerline.
- Design, procure, erect and commission of a new 132 kV switching bay as follows:
  - 1 x incoming transformer ended feeder bay
  - feeder bay to include isolators, earth switches, dead tank circuit breaker three-phase capacitive voltage transformer (CVT's) and surge arrestors
  - combined current transformer / voltage transformer (CT / VT) metering units with provision for appropriate type 2 metering.
- Design, procure, install and commission 1, 150 kVA diesel generator, with a 7 day fuel tank, for back up auxiliary supplies.
- 1 x 12 MVA 132/11 kV power transformer and 1 x 11 kV feeder bay off LV side of the new 12 MVA 132/11 kV power transformer as follows:
  - design, procure, erect and commission a new combined communications & control building.

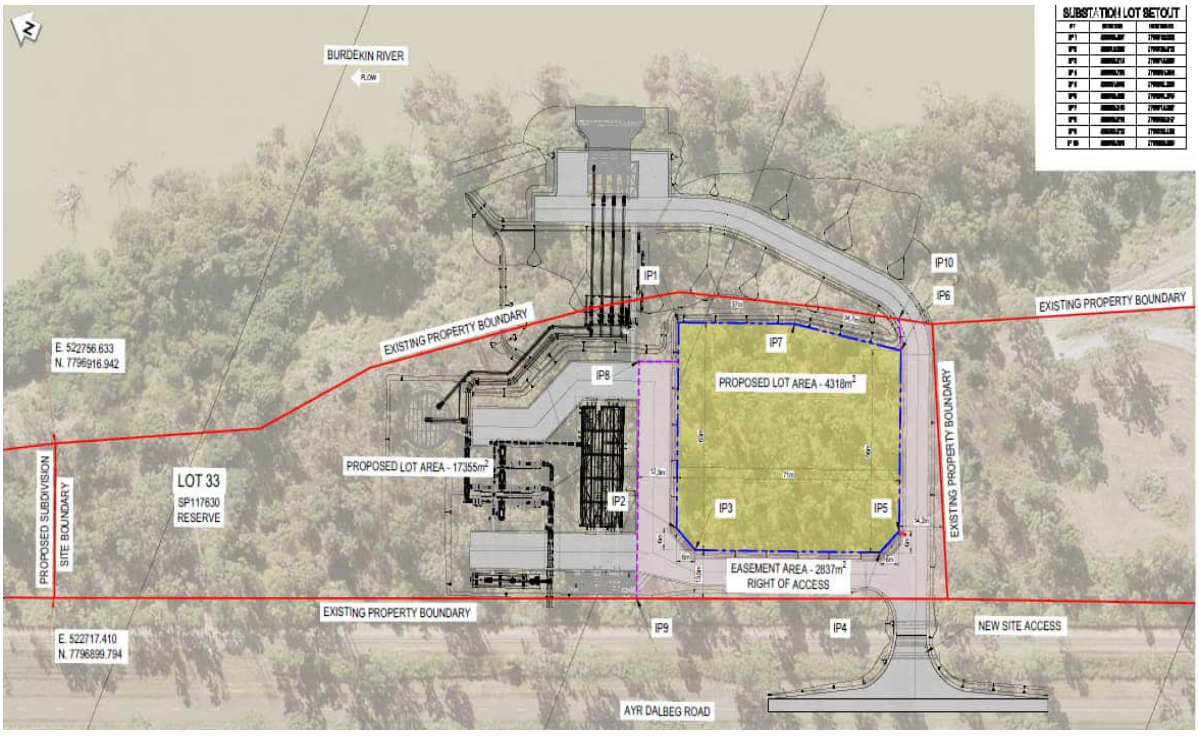


Figure 4 Substation Site Layout

3.4 Overhead Transmission Line

The configuration of the 132 kV single circuit OHTL will consist of four self-supporting steel poles. The pole details are described as follows and correspond with the locations depicted in Figure 1, Table 4, Table 5, Table 6 and Table 7.

Table 4 Steel Pole Locations

Structure Number	Easting	Northing
P1	522291.22	7796717.67
P2	522530.05	7796654.07
P3	522769.82	7796590.22
P4	522873.61	7796621.31
Gantry / Landing Beam	522850.80	7796680.96

Table 5 Steel Pole Details

Description Lot on Plan / Location	Quantity	Ownership	Details
Lot 34 on SP331997 P1 to P4	Reserve 4	The State of Queensland (Represented by the DoR)	3 Phase + Twin EW peak

Table 6 Steel Pole Parameters

Structure Type	Structure Design Duty				Expected Layout Parameters		
	Design Wind Span (m)	Design Weight Span (m)	Deviation Angle (degrees)	Ground Line Moment (kNm)	Average Span (m)	Average Pole Height (m)	Quantity (No)
P1 to P4	300	400	90° / TERMINAL	TBA	200	30	4

Table 7 Steel Pole Foundations

Structure Type	Expected Foundation Types			
	Bore Diameter (mm)	Bored Straight Sided (No)	Bored Socketed (No)	Special (No)
P1 to P4	2100	2	2	0

3.5 Construction

3.5.1 Access Tracks

Heavy vehicle access to the OHTL is required during construction and for ongoing operation and maintenance. Access will be obtained from Ayr-Dalbeg Road directly into the proposed easement. No additional access points are being proposed. The location of access tracks on each property will be confirmed closer to the construction phase in consultation with landholders.

3.5.2 Laydown & Site Office

A temporary construction laydown area has been proposed within Lot 22 on GS1042. To ensure a reduced clearing footprint, the laydown area shall be contained within the OHTL easement. The temporary laydown area will be approximately 50 m x 20 m.

A site office has been proposed to be located within the easement.

3.5.3 Timing

The construction period is anticipated to be approximately 9 months, commencing in March 2025 to avoid the wet season. Works on the substation and OHTL will be undertaken concurrently.

Construction is anticipated to occur Monday to Sunday, between 6:30 am and 18:30 pm, however Contractors may adopt working rosters to manage efficiency and fatigue.

3.5.4 Workforce

The anticipated workforce is not yet known.

3.5.5 Field Activities

Construction of the OHTL and substation involves a series of field activities which are broadly grouped as follows:

- Site set out
- Pre-clearing survey
- Mobilisation, including establishment of laydowns and office
- Installation of gates, grids, clean down bays and access tracks
- Vegetation clearing
- Tower site benching
- Foundation installation
- Structure assembly and erection
- Conductor and earth wire stringing
- Road and rail approvals
- Demobilisation.

3.5.6 Site Set Out

Following cadastral survey of the OHTL easement, the location of the OHTL within the easement will be set out. Structure sites will be marked and orientated using design information. Structure locations will be selected based on the technical characteristics of the structures and conductors, topographical constraints, landholder requirements and environmental considerations.

Easement boundaries will be identified and marked prior to vegetation clearing.

3.5.7 Pre-clearing Survey

Pre-clearance habitat surveys will be undertaken immediately prior to clearing to identify any active breeding places and where possible relocate fauna to an undisturbed location.

A weed survey has been undertaken and is presented in Appendix H, while pre-clearance surveys and spotter catcher requirements are detailed in the Project's EMP (Appendix B and Appendix C).

3.5.8 Vegetation Clearing

Vegetation clearing is proposed within the OHTL easement and substation site only. Clearing for the Project site will be undertaken in accordance with the requirements specified within the EMP and Environmental Annexures for the OHTL and substation (Appendix B and Appendix C),and in accordance with the High Risk Species Management Program and EBPC Act Referral Conditions (Approval: 2021/9133).

3.5.9 Road Crossing

The OHTL will traverse Ayr-Dalbeg Road being a State Controlled Road. Approval will be sought from the DTMR under Section 102 of the *Electricity Act 1994*.

3.5.10 Rail Crossing

The OHTL will traverse over the Invicta Mill Rail Crossing. Approval will be sought from Invicta Mill under Section 107 of the *Electricity Act 1994*.

3.5.11 Demobilisation and Rehabilitation

Powerlink will ensure that all disturbed areas impacted from construction are reinstated at the end of the Project are in accordance with the conditions of the EPBC Act Referral (Approval: 2021/9133).

3.6 Operation and Maintenance

After completion of construction and commissioning of the OHTL, the amount of activity on site decreases substantially. During operation, normal practice is for maintenance staff to carry out scheduled inspections of the OHTL, easement and access tracks every two to four years, depending on the risk of vegetation growth. These inspections (patrols) are either by vehicle or helicopter. Additional inspections may be required to perform such activities as emergency repairs.

3.6.1 Access Tracks

Maintenance of access tracks is required to ensure that vehicle access to the Project is available for inspection and structure maintenance. Techniques employed will be appropriate for the area.

3.6.2 Decommissioning

Typically, an OHTL has a 50 year operational life and after this time may:

- Be replaced with an OHTL designed for the revised environmental constraints and electrical system requirements at the time.
- If the line were no longer required, be dismantled and the easements maybe surrendered to the property owner.
- At the time when the OHTL is decommissioned, it will be de-energised, dismantled and removed.

Where decommissioning is proposed, conditions of the EPBC Act Referral (Approval: 2021/9133) will be adhered to where relevant.

4.0 Land

4.1 Existing Environment

A desktop assessment was undertaken to identify land features within the Project site, including topography, geology, soil types, acid sulfate soils (ASS), resource interests and contaminated land. These desktop databases included:

- Queensland Globe (Queensland Government, 2023a)
- Geoscience Australia Portal (Geoscience Australia, 2023)
    - Australian Soil Resource Information System (ASRIS)
    - Atlas of Australian Acid Sulfate Soils
- Department of Environment, Science and Innovation (DESI) EMR / CLR (Appendix I: Environmental Management Register / Contaminated Land Register)
- Department of Housing, Local Government, Planning and Public Works (DHLGPPW) Development Assessment Mapping System (Department of State Development, 2023)
- Burdekin Shire Council Community Maps (Burdekin Shire Council, 2023b)
- Department of Defence Where is Unexploded Ordinance (UXO) mapping (Department of Defence, 2023).

4.1.1 Topography and Geology

The topography of the Project site is generally flat with a slight decline in elevation from west to east towards the Burdekin River. The Project site sits at approximately 40 m Australian Height Datum (AHD), with little change along the area (Queensland Government, 2023a). There is a steep drop in elevation immediately adjacent to the Project site associated with the high bank of the Burdekin River which is a significant landform in the region. This area is mapped as having alluvial geology from the Holocene era, associated with undifferentiated flood plain, paleochannel, and minor terrace alluvium; delta and estuarine deposits (Queensland Government, 2023a).

Landslides in Queensland are generally caused by heavy rain on a hillside past the point where vegetation can support the soils weight against gravity (Queensland Government, 2023c). While the bank of the Burdekin River is steep, with a significant drop to the river, no landslides along the Burdekin River have been recorded in recent history.

4.1.2 Waterways

The Project site does not intersect or interfere with any water feature mapped under the *Water Act 2000* Watercourse Identification Map (WIM) or under the *Fisheries Act 1994*. The Project site is immediately adjacent to the Burdekin River, which feeds into the Great Barrier Reef (GBR).

The Project directly traverses one registered groundwater bore (RN186886); with two additional bores located immediately adjacent to the Project site (Queensland Government, 2023a).

The Project site is located immediately adjacent to the Burdekin River to the east, and an unmapped waterway to the west associated with an agricultural channel (Queensland Government, 2023). The existing environment and potential impacts on hydrology are detailed in Chapter 7.0: Hydrology.

4.1.3 Soils

The Australian Soil Classification (ASC) is the classification system currently used to describe and classify soils in Australia (Geoscience Australia, 2023). The Project site is mapped as containing Sodosols to the west and Dermosols to the east.

A description of soil orders relevant to the Project site is provided below.

- Sodosols are texture-contrast soils with extremely low permeable subsoils due to the concentration of sodium. This soil type often has a low-nutrient status and is highly vulnerable to erosion and dryland salinity when vegetation is removed (The Australian Soil Classification, 2023).
- Dermosols do not have strong texture-contrast. They have a structured B2 horizon containing low levels of free iron. Dermosols generally have high agricultural potential with good structure and moderate to high chemical fertility and water-holding capacity with few problems (The Australian Soil Classification, 2023).

4.1.4 Acid Sulfate Soils

ASS are soils that contain iron sulfides and are generally found in low-lying coastal areas below 5.0 m AHD (ASRIS, 2013). ASS are mapped on the Atlas of Australian Acid Sulfate Soils, available on ASRIS and on local and State mapping services which predominately use elevation to denote risk of ASS occurring.

The Atlas of Australian Sulfate Soils maps the Project site as having an extremely low probability of occurrence of ASS. The Burdekin River, immediately adjacent to the Project site is mapped as having a high probability of occurrence of ASS (Geoscience Australia, 2023).

Local planning scheme mapping identifies potential ASS occurrence by the use of elevation, with areas between 0-5 m AHD presenting a higher risk, and 5-20 m AHD presenting a potential risk. The Project site is mapped at 40 m AHD, outside of this mapping, however the Burdekin Shire Council mapping identifies the Burdekin River as being within the 5-20 m contour for ASS (Burdekin Shire Council, 2023b).

4.1.5 Contaminated Land

A search of the EMR and the CLR was undertaken in November 2023 (Appendix I). No lots traversed by the Project were identified on the CLR during the search.

Lot 22 on GS1042 was identified on the EMR as a Notifiable Activity or Hazardous Contaminant being ‘livestock dip or spray race’. No other lots were identified as being listed on the EMR.

4.1.6 Unexploded Ordinance

UXO mapping is used to identify locations where past explosive material has been used by the Department of Defence that may still contain UXO. The UXO mapping service does not identify UXO as being within or immediately adjacent the Project site (Department of Defence, 2023).

4.2 Potential Impacts

Project activities that involve the disturbance of soil, such as vegetation clearing, excavation, and civil works have the potential to impact on land. Potential impacts related to topography, waterways, soil, ASS and contaminated land are discussed below.

4.2.1 Topography

Construction of the Project will involve cut and fill earthworks for the establishment of:

- Laydown areas,
- Access tracks,
- OHTL structures (4 tower sites), and
- Substation platforms.

Cut and fill earthworks will be limited to the Project’s 40 m wide corridor.

Detailed earthwork profiles will be developed during substation detailed design, involving the balance of cut and fill quantities to minimise disturbance to the surrounding existing topographic profile whilst meeting flood modelling heights.

Construction impact on the existing topography is anticipated to be negligible. No operational impacts to topography are anticipated.

4.2.2 Erosion

Activity which exposes the ground surface, such as vegetation clearing or earthworks, may potentially result in soil erosion or other soil management issues if not appropriately managed. The eastern section of the Project site intersects mapped sodosol soils, which are considered to be susceptible to erosion due to the dispersive nature of these soils. Dermosols are generally considered not to be dispersive and present a lower erosion risk to the Project during construction and operation.

Given the nature of the Project's location along the banks of the Burdekin River, alluvial soils may be present on the banks and approaches to the watercourse. Alluvial soils are generally of a loamy sand nature, and are considered to be prone to erosion when disturbed. Removal of vegetation on alluvial soils in locations nearby the bank of the Burdekin River may increase the potential for erosion.

The erosion of topsoil, considered to be the most productive part of the soil profile, has the potential to impact on the surrounding land use if not appropriately managed, which is predominately grazing. Where topsoil is lost, this may lead to a reduced ability of the soil to store water and nutrients, result in higher runoff rates, and the exposure of subsoil.

The deposition of eroded soil also has the potential to impact on local waterways through siltation and a potential reduction in water quality, as eroded soils may contain nutrients, fertilisers, herbicides or pesticides. This is particularly relevant given the Project is upstream of the GBR.

Impacts resulting in potentially increasing erosion are likely to be highest during the construction phase and minimal during operation.

4.2.3 Compaction

Soil compaction may occur during construction of the Project through increased frequency of light vehicles on access tracks, the introduction of heavy machinery during construction and the storage of materials.

Potential impacts associated with soil compaction include a decline in soil structural stability, a decrease in water entering the soil either as rain or irrigation, and subsequent issues with poor root growth, soil cultivation and seedbed preparation.

4.2.4 Contamination

Lot 22 on GS1042 is identified on the EMR for a 'notifiable activity' (activities that have the potential to cause land contamination). Landholders and occupiers of land listed on the EMR or CLR, or suspected of being contaminated, must ensure that they meet their general environmental duty under the EP Act when using the land to ensure that any risks to human health and the environment are known and managed.

Geotechnical investigations will be undertaken prior to construction which may include testing for the presence of contamination prior to excavation, or other earthworks based upon a risk assessment for site listed on the EMR and where known or suspected contamination exists.

The chemicals used during the construction, operation and decommissioning phases of the Project will include fuel (predominantly diesel), unleaded petrol, electrical equipment transformer oil, lubricants, oils, minor quantities of solvents and acids, degreasers and domestic cleaning agents.

The accidental release of these materials during storage, use or transport has the potential to result in land contamination. The management of these materials is discussed in Chapter 20.0 Hazards and Risks. Waste management, including potential impacts to land is discussed in Chapter 23.0 Waste Management.

4.3 Mitigation and Management Measures

Potential impacts to land will be managed in accordance with Powerlink's Standard EMPs (Appendix B and Appendix C). The following measures will be implemented during design and construction:

- Structures will be located above 20 m AHD, above the high bank of watercourses, where possible, to avoid areas mapped as potentially containing ASS during construction.
- Geotechnical assessments will be undertaken prior to construction to determine the appropriate foundation type for each structure and the substations. The choice of foundation type is dependent on the specific nature of the soil and rock and takes into account soil / concrete friction strength, water levels, soil bearing capacity, construction constraints, rock levels, and soil properties.
- Testing for the presence of contamination prior to excavation or other earthworks will be undertaken based upon a risk assessment for sites listed on the EMR and where known or suspected contamination exists. Excavated soil material will be reused where possible within the listed EMR Lot and any contaminated material unable to be remediated must be disposed of by an appropriately licensed waste contractor to a license waste facility. Where soil is to be removed from a site listed on the EMR a soil disposal permit is required.
- Access tracks will include established and maintained erosion and control measures (culverts, whoa boys and spoon drains), minimising vegetation clearing and disturbance to soil structures.
- Management measures for groundwater impacts will be required if water is sourced from bores for construction. This will be determined at the detailed design phase and will include consultation with landholders.
- Reinstatement will be undertaken progressively during construction, where practicable, and Powerlink will ensure that all disturbed areas impacted as a result of construction are reinstated at the end of the Project. The short-term goal of reinstatement is the stabilisation of soils to provide a suitable matrix for vegetation establishment and to aid in preventing erosion. Reinstatement also includes the replacement topsoil, and fences as well as reshaping to pre-existing topography.

5.0 Climate

5.1 Regional Climatic Conditions

North Queensland is characterised by tropical and sub-tropical climates with pronounced wet and dry seasons. The region exists within the Tropic of Capricorn belt and as a result is sometimes affected by the seasonal migration of monsoon conditions as they move across the equator.

The Bureau of Meteorology (BoM) operates a network of monitoring stations around Australia that have long-term climatic data available for analysis. Two of the nearest BoM stations have been selected for review in this chapter, to provide an understanding of regional coverage of conditions. Details of the stations selected are provided in Table 8.

The Ayr Department of Primary Industries (DPI) Research Station and Burdekin Shire Council BoM stations have been selected to assist in describing the Project site's meteorology as they are the closest available to the Project site. It should be noted that both these stations are situated in close proximity to the coast and therefore may experience greater influence from the sea-land interface and trade winds than the Project site.

Table 8 Weather Stations nearby the Project

Station	Site Number	Latitude	Longitude	Recording Commenced	Location From Project Site
Ayr DPI Research Station (Bureau of Meteorology, 2023a)	033002	-19.62	147.38	1951	40 km northeast
Burdekin Shire Council (Bureau of Meteorology, 2023b)	033001	-19.58	147.41	1886	45 km northeast

5.1.1 Temperature and Rainfall

The temperature and rainfall in the region is typically warm and rainy in the summer months from November to April, and dry and cool in the winter months from May to October. Mean maximum and minimum temperatures are displayed in Table 9 while mean rainfall is presented in Table 10. The warmest month is December (32.5 °C) while the coolest month is July (11.9 °C). Highest mean rainfall typically occurs in January (257.8 mm).

Table 9 Mean Maximum (Top) and Minimum (Bottom) Temperature Values Per Month at the Two BoM Stations (BoM, 2023)

Station	Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ayr DPI Research Station[1]	Mean maximum temperature	32.1	31.6	31.1	29.9	27.8	25.7	25.2	26.4	28.2	30.1	31.4	32.5	**29.3**
	Mean minimum temperature	22.4	22.2	21.2	18.8	15.7	13.0	11.7	12.9	15.4	18.3	20.4	21.8	**17.8**
Burdekin Shire Council[2]	Mean maximum temperature	31.8	31.6	30.9	29.6	27.6	25.5	25.2	26.3	28.2	30.0	31.2	32.1	**29.2**
	Mean minimum temperature	22.8	22.8	21.6	19.1	16.2	13.0	11.9	12.7	15.2	18.2	20.7	22.1	**18.0**

[1] Mean temperature data from 1951 to 2023 [2] Mean temperature data from 1892 to 1986

Table 10 Mean Rainfall (mm) Per Month at the Two BoM Stations (BoM, 2023)

Station	Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ayr DPI Research Station [1]	Mean rainfall (mm)	230.8	229.6	150.5	52.8	41.6	23.3	17.9	15.4	9.7	26.4	45.7	100.0	**942.7**
Burdekin Shire Council [2]	Mean rainfall (mm)	257.8	253.9	175.1	60.9	35.3	28.4	19.5	14.3	18.2	23.4	44.9	111.1	**1033.2**

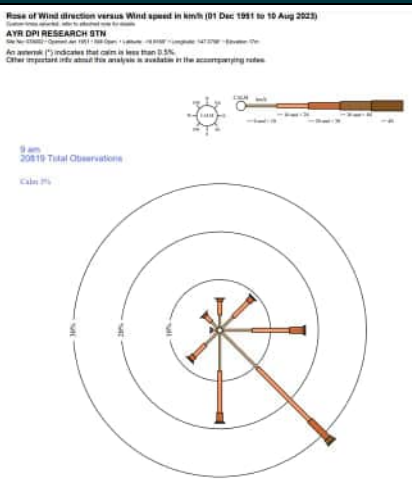
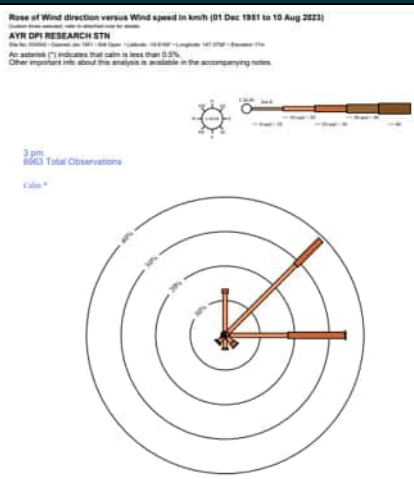
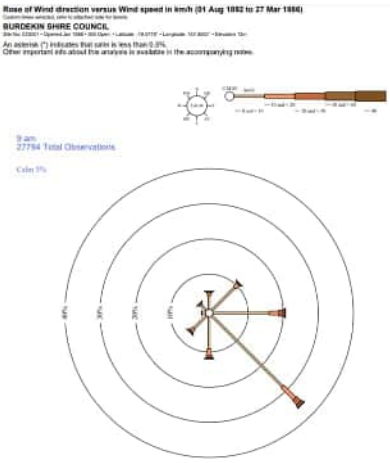
[1] Mean rainfall data from 1951 to 2023 [2] Mean rainfall data from 1892 to 1986

5.1.2 Wind Speed and Direction

Long-term annual wind roses from the BoM stations for morning and afternoon were available for review (Table 11). The most frequent wind direction is from the south east, accounting for over 30% of observations at 9 am. At 9 am winds from both stations are mostly between 10 km/hr and 20 km/hr from the south east. At 3 pm winds from Ayr DPI Research Station are predominately from the north east and easterly direction, and are stronger (Bureau of Meteorology, 2023a).

Wind speed and direction are not greatly influenced on the local scale due to the mostly flat terrain. Synoptic scale winds modified by occasional afternoon sea breezes, and valley drainage flows originating from the nearby mountain ranges at night, which affect wind speed and direction at the large scale. Due to the Project's location, these factors are unlikely to significantly impact wind flows.

Table 11 Long term wind roses (9am and 3pm)

Location	9am	3pm
Ayr DPI Research Station		
Burdekin Shire Council		Unavailable for this location

5.1.3 Terrain

Topography of the Project site is discussed in detail in Chapter 4.0 Land, and is summarised briefly below. Based on the Project's location and small size the terrain is unlikely to significantly impact the local climatic conditions.

5.2 Extreme Climatic Conditions

Extreme weather or atypical meteorological conditions have the potential to adversely affect the Project during any phase of its lifecycle. Their occurrence may result in construction and operation ceasing, damage to structures or the environment and subsequent maintenance. The history of extreme weather for the Project site is an important consideration and will allow for any risks to be identified and assessed. Key climatic conditions relevant to the Project site include floods, tropical cyclones and drought, discussed briefly below.

- **Cyclones** - In North Queensland, tropical cyclones mostly form from lows within the monsoon trough and affect the northern areas of the State. While relatively uncommon, these systems are generally formed during summer months and affect coastal areas most. Several tropical cyclones have occurred in the last two decades, including severe category tropical cyclones Kirrily (2023), Debbie (2017) and Yasi (2011).
- **Thunderstorms** - In North Queensland, thunderstorms typically occur in the high rainfall summer months. In the Project site, the average number of thunder in the local region is approximately 20 days per year (Bureau of Meteorology, 2012).
- **Flooding** - In North Queensland, flooding typically occurs in the high rainfall summer months. The Queensland Floodplain Assessment Overlay (QFAO) indicates that most of the Project site is mapped within a flood hazard area (level 1) (Department of State Development, 2023).
- **Droughts** - In North Queensland, droughts typically occur in due to low rainfall over multiple years. It is likely that during the Project's life-cycle, drought conditions will be experienced, possibly more than once.

5.3 Climate Influence on Design and Construction

It is likely that throughout the Project's lifespan it will experience some of the extreme weather conditions described in 5.2. To account for this, the electricity transmission infrastructure will be designed and constructed to reasonably withstand severe weather events, including potential cyclonic conditions near the North Queensland coast. Other impacts to be considered are those associated with flooding such as soil erosion and land degradation, which can lead to reduced or limited access to areas of the Project for construction and maintenance.

5.4 Climate Change

A changing climate has potential to impact several relevant factors during the Project's design, construction and operation. Key potential climate change impacts may include:

- Increase in annual average temperature resulting in health impacts to personnel.
- Change in seasonal average rainfall resulting in greater erosion, increased bushfire risk and increased chances of flooding.
- Increase in annual average potential evaporation resulting in increased dust and increased bushfire risk.
- Increased risk of tropical cyclone impact resulting in increased erosion and damage potential and flooding.

To reduce the risk of climate change related impacts the following mitigation measures are proposed:

- Implementation of heat stress management procedures including as low as reasonably practicable controls for workers.
- Monitoring of erosion during routine service maintenance. Emergency response procedures for bushfire.
- Dust control measures including watering of haul roads and stockpiles during construction.

- Regular routine service maintenance of vegetation for transmission line easements and substation buffers.
- Emergency response procedures for natural disasters.
- Identify flood prone areas of Project site (Chapter 7.0 Hydrology). Adaptive management as soon as practical to minimise risk.

5.5 Greenhouse Gases

Greenhouse gases (GHG) in the atmosphere trap incoming radiation from the sun, which in turn increases temperature. This process is known as the greenhouse effect. The six GHGs that are reported under the *National Greenhouse and Energy Reporting Act 2007* (Cth) (NGER Act) are:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Specified hydrofluorocarbons (HFCs)
- Specified perfluorocarbons (PFCs), and
- Sulfur hexafluoride (SF6).

For the Project the GHG species of concern are CO_2, CH_4 and N_2O.

GHG emissions are generally reported in terms of carbon dioxide equivalent (CO_2^{-e}). This is to provide a standardised unit for reporting due to different gases having varying effects on global warming impacts, known as global warming potential (GWP).

The GWP refers to the GHGs potential to trap heat in the atmosphere for a certain period (generally 100 years), relative to CO_2 (which has a GWP of one). CH_4 has a GWP of 28, which means for every tonne of CH_4 emitted, it has the same global warming effect as 28 tonnes of CO_2. As a result, GHGs such as CH_4 and N_2O have a higher potential to affect global warming.

Table 12 presents the GWP for the key GHGs that are anticipated to be emitted as a result of the construction and operation of the Project as advised by Department of Agriculture, Water and the Environment (DAWE) [1] (2021).

Table 12 GWP of Key GHGs

Gas	Chemical Formula	GWP
Carbon dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265

Reporting under the NGER Act requires that GHG emissions are separated into three categories referred to as emission scopes. This is the internationally accepted method of reporting on GHG emissions. These emission scopes are (National Grid, 2024):

- Scope 1: emissions from sources that Powerlink owns or controls.
- Scope 2: emissions that a Powerlink causes indirectly and come from where the energy it purchases and uses is produced.
- Scope 3: emissions that are not produced by the Powerlink and are not the result of activities from owned or controlled assets, but indirect assets it is responsible for up and down its value chain.

These are discussed further in section 5.6 below.

[1] Now known as Department of Climate Change, Energy the Environment and Water (DCCEEW).

5.6 Project GHG Emission Sources

Potential GHG emission sources for all phases of the Project and their corresponding emissions scope are listed in Table 13. The construction phase of the Project will generate the highest quantity of GHG emissions. Emissions from the operation and maintenance phase are expected to be significantly lower. Emissions from the decommissioning phase are also expected to be lower than during the construction phase.

Table 13 Emission Sources Associated with the Project

Project Phase	Category	Source of Greenhouse Gas Emissions
Construction	Scope 1	• Vegetation clearing • Diesel fuel consumption by site vehicles • Diesel fuel consumption by equipment and plant • Diesel fuel consumption for power generation for diesel generator sets, which will provide power to equipment and site offices
	Scope 3	• Transportation of vehicles and equipment to site • Diesel fuel consumption during transportation of transmission structures conductors and steel by sea or road. • Diesel consumption in light vehicles for transportation of workforce
Operation and maintenance	Scope 1	• Diesel consumption in light and heavy vehicles for general maintenance of transmission structures and lines • Aviation fuel consumption in helicopters for maintenance of transmission lines • Diesel consumption in light and heavy vehicles for substation facility operation and maintenance • Vegetation maintenance
	Scope 2	• Grid electricity consumption through power loss via the transmission lines
	Scope 3	• Diesel consumption in light vehicles and machinery used to maintain easements and access tracks (undertaken by 3rd party Contractor)
Decommissioning	Scope 3	• Diesel fuel consumption by vehicles, equipment and plant to support decommissioning and transport of material

5.6.1 Project GHG Emissions

As discussed in Section 5.6, construction of the Project has potential to generate GHG emissions. Emissions generated during the operation and maintenance phase of the Project are expected to be significantly lower than the construction phase, with the majority of emissions relating to fuel combustion for mobile equipment and vehicles, which will be much less than during the construction phase. At this stage, due to the timeline and available information, it is not possible to accurately estimate GHG emissions from the decommissioning phase.

Based on the small scale of the Project, GHG emissions are expected to be minimal.

6.0 Air Quality

The construction of the Project involves clearing of land, material handling and other construction activities which have the potential to generate air pollutants, primarily dust. Activities associated with the operational phase of the Project are not likely to generate significant emissions of dust or other air pollutants.

The main risk to air quality from the Project is associated with construction activities. The risk of impacts during the construction phase is assessed in this chapter. Operational phase and decommissioning phase impacts are not expected to present significant risk, but are considered at a high-level for completeness.

6.1 Pollutants of Concern

The air pollutants of concern for the construction phase of the Project that have been considered in this air quality assessment were identified through a review of the following documents:

- National Pollution Inventory (NPI) emission estimation technique (EET) manual for Fugitive Emissions v2 (Commonwealth of Australia, 2012).
- Clean Air Society of Australia and New Zealand (CASANZ) Good Practice Guide for the Assessment and Management of Air Pollution from Road Transport Projects (the Good Practice Guide) (Clean Air Society of Australia and New Zealand, 2023).

The Good Practice Guide is a recent industry produced guide, intended primarily for road projects but which contains information relevant to the assessment of construction of wider range of infrastructure projects. It is based on the methodology described in the UK Institute of Air Quality Management document, Guidance on the assessment of dust from demolition and construction (Institute of Air Quality Management, 2014), adapted for Australian conditions.

The pollutant species that have been considered are as follows:

- Particulate matter (dust)
- Nitrogen dioxide (NO_2)
- Sulfur dioxide (SO_2).

A brief discussion regarding these pollutants and their potential effects on health and the environment is provided in the following sections.

6.1.1 Particulate Matter

Particulate matter refers to the many types and sizes of particles which can be suspended in the air environment. Particle size fractions are commonly described as follows:

- Particles with an aerodynamic diameter of less than or equal to 100 micrometres (µm) are classified as total suspended particulates (TSP)
- Particles with an aerodynamic diameter less than or equal to 10 µm are classified as PM_{10}
- Particles with an aerodynamic diameter less than or equal to 2.5 µm are classified as $PM_{2.5}$.

Particulate matter can be emitted from natural sources (bushfires, dust storms and pollens) or as a result of human activities, such as from internal combustion sources (e.g. motor vehicle emissions, power generation, incineration, etc.) or from mechanical processes (e.g. excavation works, bulk material handling, crushing operations, vehicles on unpaved roads, etc).

TSP, which includes the coarser sized particulates, is generated primarily from fugitive emissions sources such as vehicle travel on unsealed roads, wind erosion from exposed areas or earthen material stockpiles and handling of earthen material. TSP is primarily associated with nuisance impacts associated with coarse particles settling on surfaces, referred to as dust deposition, and is a common cause of complaints.

PM_{10} particles tend to remain suspended in the air for longer periods than larger particles (e.g. TSP) and can penetrate into human lungs. PM_{10} can be created in high quantities through the crushing and grinding of rocks and soil. PM_{10} is also emitted from vehicle exhausts (combustion engine emissions).

$PM_{2.5}$ can travel further into human lungs than the larger particulates due to its smaller aerodynamic size and is often made up of heavy metals and carcinogens. Therefore, $PM_{2.5}$ is considered to pose a greater risk to human health than larger particle sizes (e.g. PM_{10} and TSP). However, $PM_{2.5}$ is most commonly emitted from combustion sources, which although present for construction (e.g. vehicles) are not emitted in high quantities during construction activity. $PM_{2.5}$ is not considered a pollutant of concern for the Project and has not been considered further in the assessment.

6.1.2 Nitrogen Dioxide

NO_2 is a brownish gas with a pungent odour. NO_2 is a product of combustion processes, and generally motor vehicles and industrial combustion processes are the major sources of ambient NO_2.

NO_2 can cause damage to the human respiratory tract, increasing a person's susceptibility to respiratory infections and asthma. Sensitive populations, such as the elderly, children, and people with pre-existing health conditions are most susceptible to the adverse effects of NO_2 exposure.

Damage to plants can occur in environments with high concentrations of NO_2, especially in the presence of other pollutants such as Ozone (O_3) and SO_2.

For the Project, NO_2 is considered unlikely to be a pollutant of concern for the Project. However ambient air quality monitoring data has been reviewed to determine the risk of impact for this pollutant species.

6.1.3 Sulfur Dioxide

SO_2 is a colourless gas with a sharp, irritating odour. It is formed in combustion processes through burning fossil fuel containing sulfur and also in petroleum refining and smelting mineral ores. SO_2 is an irritant gas that can cause respiratory tract infections. People with pre-existing respiratory conditions such as asthma are most sensitive to SO_2 exposure.

For the Project, SO_2 is considered unlikely to be a pollutant of concern. However, ambient air quality monitoring data has been reviewed to determine the risk of impact for this pollutant species.

6.1.4 Air Quality Legislation and Criteria

Relevant legislation and policy instruments considered in the assessment of air quality are:

- EP Act (Queensland)
- *Environmental Protection Regulation 2019* (Queensland) (EP Regulation)
- *Environmental Protection (Air) Policy 2019* (Queensland) (EPP Air)
- National Environment Protection (Ambient Air Quality) Measure (Commonwealth) (Air Quality NEPM).

6.1.5 Environmental Protection Act 1994 and Environmental Protection Regulation 2019

The EP Act regulates environmentally relevant activities (ERA) under the EP Regulation. The operation of ERAs are permitted by an Environmental Authority (EA). There are several Environmental Protection Policies (EPPs) published under the EP Act that govern the requirement for management of environmental issues such as noise, air and water. These policies determine objectives to be achieved in various environments with reference to sensitive receptors.

The EPP Air is the relevant EPP for air quality and was considered as part of this assessment.

6.1.6 Environmental Protection (Air) Policy 2019

The EPP Air seeks to enhance or protect the atmospheric environment in Queensland by providing air quality objectives. The air quality objectives set out in the EPP Air are intended to be progressively achieved over the long term.

The EPP Air protects the health and biodiversity of ecosystems, human health and wellbeing, aesthetics of the environment (including the appearance of buildings, structures and other property) and agricultural use of the environment.

6.1.7 National Environment Protection (Ambient Air Quality) Measure

NEPM outline agreed national objectives for protecting or managing particular aspects of the environment. The air quality of an environment is protected by the Air Quality NEPM as amended (2021). The Air Quality NEPM provides guidance relating to air in the external environment and does not include air inside buildings or structures (i.e. indoor air quality).

The Air Quality NEPM outlines monitoring, assessment, and reporting procedures for PM_{10}, $PM_{2.5}$, NO_2, carbon monoxide (CO), O_3 and SO_2.

The Air Quality NEPM standards are intended to be applied to air quality experienced by the general population in a region and not to air quality in areas affected by localised air emissions, such as individual industrial sources or projects.

The goal of the Air Quality NEPM is to achieve the recommended standards with the allowable exceedances, as assessed in accordance with the associated monitoring protocol. The standards are set at a level intended to adequately protect human health and wellbeing.

6.1.8 Adopted Air Quality Objectives

The EPP Air is the enforceable legislation for the Project and is therefore the source of objectives for this study. Adopted air quality objectives for the Project are presented in Table 14.

Table 14 Adopted Air Quality Objectives for Human Health and Well being (EPP Air)

Pollutant	Air quality objective		Averaging period
	µg/m³	ppm	
NO_2	250	0.12	1 hour
	62	0.03	Annual
SO_2	570	0.20	1 hour
	229	0.08	24 hour
	57	0.02	Annual
PM_{10}	50	-	24 hour
	25	-	Annual

6.2 Existing Environment

6.2.1 Ambient Air Quality Monitoring

In order to characterise the existing air quality values in the area local to the Project, a review of available air quality monitoring data was conducted. DESI has an ambient monitoring network across Queensland that monitors for controlled pollutants in areas with large population bases or heavy industry adjacent to residential areas. The nearest currently operating DESI air quality monitoring station is located in Ayr, approximately 40 km north northeast of the Project site (Bureau of Meteorology, 2023a). Additional monitoring is conducted at several sites in Townsville, approximately 80 km north of the Project site.

Queensland's compliance with the standards and goals of the Ambient Air Quality NEPM is assessed and reported annually. For the Townsville region, all NEPM reporting is based on data collected at the Pimlico and Townsville North Ward stations. The Pimlico station was decommissioned in 2016, and subsequently replaced by the Townsville North Ward station, which is located in an area representative of the population. Pollutants monitored at this station include NO_2, SO_2 and PM_{10}.

Air quality monitoring data from the last 10 years is presented below in Table 15. The table presents the annual average for each year, and the 90th percentile of 1 hour and 24 hour averages. The 90th percentile is used instead of the maximum to represent peak concentrations, as the maximum short term average concentration observed typically represents an extreme related to a local source and is not representative of general background concentrations.

The monitoring data shows that:

- Annual average and 90th percentile 1 hour average concentrations of NO_2 were well below the relevant objectives at all monitoring locations.
- Annual average and 90th percentile 1 hour and 24 hour average concentrations of SO_2 were well below the relevant objectives at all monitoring locations.
- 90th percentile 24 hour average concentrations of PM_{10} were all below the objective during the previous decade.
- Annual average concentrations of PM_{10} were generally below the annual objective during the previous decade. One exceedance was observed at Townsville Environment Park (an industry monitoring site) in 2019, which can be attributed to local sources, as other nearby monitors were well below the objective.

In general, air quality experienced in the region is good. The monitoring data presented in Table 15 is collected from sites closer to major sources than the Project site and therefore air quality local to the Project site is expected to be better.

Table 15 Summary of Ambient Monitoring Data Collected from Ayr and Townsville DESI Air Quality Monitoring Stations

Year	Site	NO_2 (ppm)		SO_2 (ppm)			PM_{10} (µg/m³)	
		Annual Average	1 hour 90th Percentile	Annual Average	24 hour 90th Percentile	1 hour 90th Percentile	Annual Average	24 hour 90th Percentile
Objective		**0.03**	**0.12**	**0.02**	**0.08**	**0.20**	**25**	**50**
2013	Ayr	-	-	-	-	-	21.1	30.2
2013	Pimlico	0.004	0.008	0.0004	0.002	0.001	15.1	22.5
2013	Stuart	-	-	0.0012	0.003	0.003	-	-
2013	Townsville Coastguard	-	-	-	-	-	21.0	32.8
2014	Ayr	-	-	-	-	-	19.9	26.0
2014	Pimlico	0.004	0.009	0.0006	0.002	0.001	15.1	20.6
2014	Stuart	-	-	0.0011	0.005	0.002	-	-
2014	Townsville Coastguard	-	-	-	-	-	18.9	26.4
2015	Ayr	-	-	-	-	-	24.0	32.6
2015	Pimlico	0.004	0.009	0.0006	0.003	0.001	17.6	24.8
2015	Stuart	-	-	0.0005	0.002	0.001	-	-
2015	Townsville Coastguard	-	-	-	-	-	19.7	26.9
2016	Ayr	-	-	-	-	-	20.4	25.7
2016	Pimlico	0.002	0.005	0.0002	0.001	0.001	17.9	23.4
2016	Stuart	-	-	0.0003	0.003	0.001	-	-
2016	Townsville Coastguard	-	-	-	-	-	16.0	22.3
2017	Stuart	-	-	0.0003	0.001	0.001	-	-
2017	North Ward	-	-	0.0002	0.001	0.001	13.6	17.9
2018	Stuart	-	-	0.0003	0.002	0.001	-	-
2018	North Ward	0.002	0.005	0.0005	0.002	0.001	16.3	22.4

Year	Site	NO_2 (ppm)		SO_2 (ppm)			PM_{10} (µg/m³)	
		Annual Average	1 hour 90th Percentile	Annual Average	24 hour 90th Percentile	1 hour 90th Percentile	Annual Average	24 hour 90th Percentile
Objective		**0.03**	**0.12**	**0.02**	**0.08**	**0.20**	**25**	**50**
2018	Townsville Lennon Drive	-	-	-	-	-	18.9	27.9
2019	Townsville Coastguard	-	-	-	-	-	20.2	25.9
2019	North Ward	0.003	0.005	0.0004	0.002	0.001	20.2	26.5
2019	Townsville Lennon Drive	-	-	-	-	-	20.5	29.1
2019	Townsville Environment Park	-	-	-	-	-	**30.3**	47.1
2020	Townsville Coastguard	-	-	-	-	-	17.0	25.2
2020	North Ward	0.002	0.004	0.0004	0.001	0.001	16.2	23.8
2020	Townsville Lennon Drive	-	-	-	-	-	17.4	27.5
2020	Townsville Environment Park	-	-	-	-	-	17.5	26.0
2021	Ayr	-	-	-	-	-	17.2	22.6
2021	Townsville Coastguard	-	-	-	-	-	15.7	22.1
2021	North Ward	0.003	0.005	0.0001	0.001	0.001	16.3	23.3
2021	Townsville Lennon Drive	-	-	-	-	-	16.1	25.6
2021	Townsville Environment Park	-	-	-	-	-	17.0	24.5
2022	Ayr	-	-	-	-	-	15.7	22.3
2022	Townsville Coastguard	-	-	-	-	-	14.4	20.9
2022	North Ward	0.003	0.005	0.0001	0.001	0.001	15.2	21.3
2022	Townsville Lennon Drive	-	-	-	-	-	15.3	23.3
2022	Townsville Environment Park	-	-	-	-	-	16.6	24.1

6.2.2 Local Emission Sources

The NPI, regulated by the Commonwealth Government, tracks pollution sources across Australia and ensures that the community has access to information about the emission and transfer of toxic substances. All facilities that meet usage or emission thresholds are required to submit annual reports of their emissions to air. The NPI covers 93 toxic substances and the sources of their emissions. These substances have been identified as important due to their possible effect on human health and the environment.

An NPI search conducted in the area surrounding the Project for the most recent reporting year (2021/2022) shows that the closest reporting facilities are the Inkerman Mill, located 36 km to the northeast, and Ravenswood Gold Operations, located 38 km to the southwest. At these distances it is unlikely that emissions from these facilities will influence the sensitive receptors near the Project.

The land use in the region is predominantly agricultural, notably sugar cane and grazing. Some low level, localised dust generation from agricultural activities is expected on an intermittent basis, while cane waste burning may lead to elevated levels of combustion emissions in the region infrequently.

6.2.3 Sensitive Receptors

A sensitive receptor is defined as a location that may be sensitive to impacts from the Project, such as residences, schools, parks or workplaces, where people are present for an extended period of time. Air quality objectives from the EPP Air are required to be achieved at sensitive receptors.

The locations of the sensitive receptors in relation to the Project site have been mapped (Figure 3, Chapter 3.0 Project Description). There are two sensitive receptors within 2 km of the Project site, with these receptors being residential dwellings.

6.3 Potential Impacts

6.3.1 Construction Phase

The construction phase of the Project will include activities that have the potential to impact local air quality. The following emission sources are expected to be associated with the construction phase:

- Site preparation including vegetation clearing, topsoil stripping, chipping/mulching, and ground surface levelling
- Foundation excavation and installation for substation and transmission structures
- Stockpiling of excavated soil
- Wind erosion from stockpiles and exposed ground
- Vehicle and equipment movements over unpaved access tracks and work sites
- Exhaust emissions from vehicle and machinery operations.

Vegetation clearing will occur to establish the substation location, the transmission line easement and new access tracks.

When construction activities occur near sensitive receptors, air quality impacts are possible due to construction dust. The risk of construction dust impacts has been assessed further in this section.

Combustion generated pollutants SO_2 and NO_2 have not been considered further in this assessment due to the low concentrations of these pollutants in the existing air shed (Section 6.2.1), the anticipated low magnitude of emissions from Project activities, and the overall characteristics of the area in respect to the absence of other significant combustion emission sources.

6.3.2 Dust Impact Assessment

A qualitative risk assessment of potential dust impacts on sensitive receptors has been undertaken for the construction phase of the Project. The assessment was based on the methodology described in the CASANZ Good Practice Guide (2023).

In accordance with the Good Practice Guide methodology, the risk of dust deposition and human health impacts due to construction dust is determined based on the scale of construction activities and proximity to sensitive receptors. The Good Practice Guide method uses a tiered process to assess construction dust impacts, as follows:

- Screening assessment based on distance to nearest sensitive receptors.

If required, detailed assessment to assess risk of dust impacts from activities based on:

- Scale and nature of the works, which determines the potential dust emission magnitude sensitivity of the area.

6.3.3 Screening Assessment

The Good Practice Guide method recommends detailed assessment of dust impacts for construction activities where sensitive receptors are located within:

- 350 m of the Project construction footprint.
- 50 m of the routes used by construction vehicles on a public road, up to 500 m from the site entrance(s).

Two receptors were identified within 2 km of the Project site (Figure 3, Chapter 3.0 Project Description). However, the closest receptor is located within 2 km from the Project construction footprint and is not located within 50 m of a public road. Therefore, the construction phase of the Project is classified as 'low potential impact' and no further assessment is recommended by the Good Practice Guide.

To minimise the potential for construction dust impacts, mitigation and management measures are recommended in Section 6.5.

6.4 Operation and Maintenance Phase

Potential air quality impacts associated with the operation and maintenance of the Project are anticipated to be negligible to low. The activities associated with the operational phase that have the potential to create emissions are related to maintenance activities and are as follows:

- Vegetation management and control of regrowth in easements to maintain safe electrical clearances.
- Access track maintenance by earth moving machinery.
- Movement of maintenance vehicles and machinery over access tracks.
- Exhaust emissions associated with the operation of maintenance vehicles and machinery.

Inspections and maintenance will require only a small workforce with a small number of vehicles and pieces of equipment. During operation, normal practice is for maintenance staff to carry out scheduled inspections of the line, easement and access tracks every two to four years, depending on the risk of vegetation growth. These inspections (patrols) are either by vehicle or helicopter. Consistent with the construction phase, potential air quality impacts associated with these activities are likely to be localised to the work area and only present for a short period of time.

Dust mitigation methods (Section 6.5.1) should be utilised whenever possible to minimise the risk of localised impacts, especially during dry periods. To minimise potential exhaust emissions, all equipment used should be well maintained and fit for purpose.

6.4.1 Decommissioning Phase

The Project infrastructure generally has a design life of approximately 50 years. After this period, it is possible that the infrastructure may be decommissioned. The following decommissioning activities have the potential to impact local air quality:

- Vegetation clearing where required for access to structures.
- Vehicle and plant movement over the easement and access tracks.
- Exhaust emissions associated with vehicle and machinery operation during works.

- Ground disturbance for the facilitation of rehabilitation of easement and transmission structure locations.

As with the construction phase of the Project, decommissioning works are expected to occur in a staged approach to minimise amount of disturbed ground at any one time. If decommissioning occurs, potential impacts to air quality are expected to be localised to work-sites and short-term. The magnitude of potential impacts is not likely to exceed those associated with the construction phase.

The mitigation measures described below in Section 6.5 will be implemented during decommissioning to minimise the potential for air quality impacts and mitigation measures have been included in the EMPs and Annexures (Appendix B and Appendix C).

6.5 Mitigation and Management Measures

The following mitigation measures are recommended for the Project. These mitigation measures align with Powerlink's Standard EMPs (Appendix B and Appendix C).

6.5.1 Dust and Particulate Matter Mitigation

The following measures are recommended to mitigate emissions of dust and particulate matter:

- Orientating material stockpiles in a direction that reduces exposed surfaces to prevailing winds.
- Watering of stockpiles (located near sensitive uses) to maintain a moisture content that minimises dust generation or alternatively temporarily cover stockpiles.
- Adequately store all bulk materials, and cover vehicles transporting materials to and from site.
- Restrict vehicle movements to within designated access tracks, and enforce speed limits (<40 km/h) where track is unsealed.
- Limit dust-producing work on windy days when possible or water down of dusty work sites to minimise dust generation.
- Limit work on days with high levels of bushfire smoke in the air and if wind is blowing towards receptors.
- Watering unsealed haul roads when required for safety, or where located near sensitive uses.
- Ensure chipping/mulching equipment have dust collection devices.
- Avoid burning cleared vegetation whenever possible; if burning obtain relevant approvals prior.
- Disturbed areas and bare earth should be stabilised or revegetated as soon as practical to minimise wind-blown dust.

6.5.2 Vehicle and Machinery Emissions Mitigation

The following measures are recommended to mitigate emissions from vehicle and machinery:

- Ensure stationary plant, construction vehicles and equipment (especially those powered by diesel motors) are working correctly and maintained as per manufacturers recommendations.
- Shut down plant and equipment idling for excessive periods (i.e. longer than 5 minutes) where possible.
- Avoid or minimise queuing in roadways approaching the worksites or adjacent to other sensitive activities.
- Minimise queuing of construction vehicles and idling for excessive periods (e.g. more than 5 minutes).

7.0 Hydrology

7.1 Existing Environment

A Water Resources and Hydrology Technical Report has been developed for the Project which has assessed the hydrological characteristics, potential impacts to surface waters and Environmental Values and provides further recommendations (Appendix D).

The Burdekin Basin which has an approximate catchment area of 130,800 square kilometres. The Project is located in the Lower Burdekin Basin. The proposed substation site is located on the top bank of the Burdekin River.

The main driver of flooding at the Project site is overflows from the Burdekin River into the Barratta Creek catchment.

The relevant surface water Environmental Values relative to the Project are provided in Appendix D.

7.1.1 Bores

The Water Resources and Hydrology Technical Report (Appendix D) shows that there are eight registered bores within proximity of the Project site in the Queensland Registered Bore Database. noting that all bores are located within the Burdekin Basin and the Burdekin Groundwater Management Area.

7.1.2 Water Resource Planning and Use

The Project is located within the Burdekin Basin Water Plan area defined by the Water Plan (Burdekin Basin) 2007. Under the *Water Act 2000* a water licence is required to take or interfere with water. Water Plans govern the allocation of water throughout each respective basin.

Given the Project will have no impact on the hydrology of natural waterways and the Burdekin Haughton Water Supply Scheme water transfer infrastructure, there will be no impact on any water licence holders.

7.2 Potential Impacts

7.2.1 Substation

7.2.1.1 Flooding

Existing ground levels at the proposed substation site are above the 0.5% Annual Exceedance Probability (AEP) flood level required by SDC-001. As such, Appendix D notes that the substation is unlikely to have an impact on existing flooding for design flood events up to an including the 0.5% AEP.

7.2.1.2 Surface Water Quality

Surface water quality impacts will be mostly limited to the construction phase, with minimal impacts during the operation phase. Without suitable controls or scheduled maintenance and repair of access tracks, there is the potential for additional sediment and potential pollutants associated with construction activities to be washed into drainage lines as a result of runoff.

7.2.1.3 Groundwater

Excavation of footings for the proposed substation poses a minor risk to ground water resources. As such, the groundwater resources are not anticipated to be impacted by the substation works.

7.2.1.4 Stormwater Drainage and Management

Stormwater and drainage management principles for the substation will be limited to the local catchment immediately surrounding the earth fill pads. Stormwater runoff will be generated from buildings/structures as well as hardstand areas. A stormwater drainage system will need to be incorporated into the facility. Mitigation measures used to minimise risks to the environment and safety resulting from spills are provided in Appendix D.

7.2.2 Transmission Line Towers

7.2.2.1 Flooding

The proposed transmission line towers are unlikely to have an impact on existing floodplain characteristics. More details on the proposed impacts are provided in Appendix D.

7.2.2.2 Surface Water

Construction activities have the potential to cause impact to riparian zones, surface water quality and flow through the clearing of access tracks, transmission line tower sites and general ground disturbance. As a result, impacts to surface water quality are primarily limited to increases in suspended sediment as a result of runoff from disturbed areas during construction.

7.2.2.3 Groundwater

The depth of groundwater in proximity the OHTL alignment is presently unknown using the available bore data in Appendix D. The available bore data does indicate that the top of the aquifer in proximity of the alignment is 7-16 m. The transmission line towers are anticipated to have a minor risk to water resources provided the excavation depth of the of footings for the OHTL towers is less than 7 m. As such, the groundwater resources are not anticipated to be impacted by the OHTL works.

7.2.3 Access Tracks

An access track from Ayr-Dalbeg Road will be required for the construction phase to move equipment and personnel along the proposed OHTL easement to each tower construction site and to undertake vegetation clearing. During the operational phase the access tracks will be used for regular inspection and maintenance activities, including vegetation maintenance along the proposed OHTL easement. Construction of access tracks has the potential for the following impacts if unmitigated.

- Increased erosion as a result of cut and fill activities in a watercourse or drainage line.
- Increased sediment movement into downstream areas.
- Affect riparian vegetation through clearing activities.

Activities associated with access tracks are not expected to have any impacts on groundwater resources or groundwater quality.

7.2.4 Water Use and Sourcing

It is anticipated that water would be sourced by agreement with Sunwater, from the nearby Burdekin Haughton Water Supply Scheme infrastructure. The Principal Contractor has been instructed to include provision for portable water during the construction phase of the Project.

7.3 Mitigation and Management Measures

7.3.1 Detailed Design

The detailed design of the Project has not yet been finalised. A number of key items should be considered during subsequent design phases. The Project should incorporate the following elements during the detailed design and pre-construction phase.

- Minimise runoff and stormwater concentration.
- Utilise existing access tracks wherever possible.
- Minimise soil disturbance when clearing vegetation along the OHTL easement.
- Implement clean water diversions around local stockpiles and exposed areas.
- Spill kits are to be kept at each work area. Ensure that all personnel are trained in the location and use of spill kits.

Further details regarding specific aspects of the Project that need to be considered during the detailed design phase are provided below.

- A stormwater drainage system is provided in all Powerlink Queensland substations in order to capture and manage stormwater runoff. Fixed plant that contain large volumes of hydrocarbons are typically bunded. Bund design criteria should generally be in accordance with AS1940:2004 (The Storage and Handling of Flammable and Combustible Liquids).
- Management measures for groundwater impacts will only be required if water is sourced from bores for construction. This will be determined during subsequent design phases and should include consultation with landholders if necessary.
- Detailed water use and souring by the Project is still currently unknown. The volumes of water required for the Project will be determined at the detailed design phase. As part of detailed design, consultation with landholders on land access should also include discussions with Burdekin Shire Council for access to water if required. It is likely that water would be either directly sourced from the Burdekin River channel or a water storage associated with the Burdekin Haughton Water Supply Scheme.
- If water is to be sourced directly from a watercourse, Powerlink Queensland will extract water in accordance with the '*Exemption requirements for constructing activities for the take of water without a water entitlement* (OSW/2020/5467 Version 4.01, updated on 5 May 2021)' or any later revision. If Powerlink Queensland cannot meet the exemption requirements of the above document, a water licence application will be submitted with Department of Regional Development, Manufacturing and Water (DRDMW).

7.3.2 Construction Activities

7.3.2.1 Erosion and Sediment Control

All construction activities have the potential to cause erosion and sedimentation through clearing and disturbance of soil. Powerlink Queensland's standard environmental controls relating to soil erosion and sediment control will minimise impacts on the receiving environment. These Standard Controls should be implemented throughout the entire Project.

7.3.2.2 Surface Water Quality

Construction works have the highest probability of having an impact to surface water quality through the mobilisation of additional sediment as a result of ground disturbance activities.

Risks to water resources will decrease during the operational phase of the Project. This phase requires less ground disturbance and areas that have been disturbed during the construction phase have been rehabilitated.

7.3.3 Recommendations

The following recommendations are recommended for the Project:

- An Erosion Sediment Control Plan (ESCP) should be developed and then implemented to ensure that potentially affected surface water from construction activities does not enter downstream surface water and ground water environments.
- A review of TCC Haughton Pipeline Stage 2 Project design documentation for the proposed Clare Weir pumpstation should be considered if available for this Project. The review may provide more certainty on the assumptions in this Report.
- The volumes of water required for the Project and source locations will be determined at the detailed design phase. If water is to be sourced from a watercourse, Powerlink Queensland will extract water in accordance with the '*Exemption requirements for constructing activities for the take of water without a water entitlement (OSW/2020/5467 Version 4.01 updated 05/02/2021* or any later revision). If Powerlink Queensland cannot meet the exemption requirements of the above document, a water licence application will be required.

8.0 Protected Areas

Protected areas represent those areas protected for the conservation of natural and cultural values at a Commonwealth, State and local level. Protected areas also include areas managed for production of forest resources, including timber and quarry material. This section does not discuss Indigenous and Non-indigenous cultural heritage places. Discussion on these is provided in Chapter 16.0 Indigenous Cultural Heritage and Chapter 17.0 Non-Indigenous Cultural Heritage respectively.

A search of publicly available desktop searches identified no protected areas are located within 10 km of the Project site.

On this basis, assessment of potential impacts or mitigation measures has not been undertaken and protected areas are not discussed further in this MID Proposal Report.

9.0 Flora

9.1 Existing Environment

This chapter provides an assessment of flora values associated with the Project site and substation site. References to the Project site in this Chapter refers to the entire Project (i.e., OHTL and substation). Detailed ecology survey reports are provided in Appendix G: Ecology Technical Report and summarised within this Chapter.

9.1.1 Methodology

Flora values associated with the Project site have been assessed through a range of methodologies Described in Appendix G.

9.1.2 Bioregion and Subregion

The Project site is located within the Brigalow Belt bioregion. The bioregion is characterised by brigalow (*Acacia harpophylla*) forests and woodlands on clay soils (Sattler & Williams, 1999). Other ecosystems that are widespread throughout the bioregion include eucalypt forest and woodland, grassland, dry rainforest, cypress pine woodland and riparian communities.

The Project site is situated within the Townsville Plains subregion, which is the most northerly subregion within the Brigalow Belt bioregion.

9.1.3 Vegetation Communities

The field survey found that the DESI Queensland Herbarium RE mapping (Version 13) desktop mapping did not accurately reflect the vegetation surveyed on ground. Results of the field survey confirmed the presence RE 11.3.35 and non-remnant areas within the Project site.

The ground-truthed vegetation communities and REs within the Project site are summarised in Table 16, and the mapping is shown in Figure 4 of Appendix G.

Table 16 Vegetation Communities, REs and Conservation Status in the Project Site

Vegetation Community (RE Short Description[1])	RE	VM Act Class[2]	BD Status[3]	Condition	Project Site (ha)
1) *Eucalyptus platyphylla*, *Corymbia clarksoniana* woodland on alluvial plains	11.3.35	Least concern	No concern at present	Remnant	2.7
2) *Eucalyptus raveretiana* (sometimes emergent)*, Eucalyptus tereticornis* and *Melaleuca fluviatilis* woodland	11.3.25a	Least concern	Of concern	Remnant	-
3) Water					-
4) Non-remnant vegetation					0.5
Total					**3.2**

[1] Vegetation community description adapted from the REDD Version 13 (Queensland Herbarium, 2023)

[2] Conservation class of REs under the *Vegetation Management Act 1999* (VM Act).

[3] Biodiversity (BD) status of the RE, under the EP Act, based on an assessment of the condition of remnant vegetation in addition to the pre-clearing and remnant extent of a regional ecosystem.

9.1.4 Regulated Vegetation

The DoR Vegetation Management Report and the field survey results identified Category B (remnant) and Category X (non-remnant) vegetation associated with access tracks, roads and clearing for the adjacent pump intake site occurring within the Project site (Department of Resources, 2023b) Table 4 in Appendix G).

9.1.5 Threatened Ecological Communities

The desktop assessment identified two Threatened Ecological Communities (TECs) as potentially occurring within 20 km from the Project site, namely *Poplar Box Grassy Woodland on Alluvial Plains* TEC and *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* TEC. No TECs or analogous REs were identified during field surveys within the Project site.

9.1.6 Conservation Significant Flora

The desktop assessment identified ten conservation significant flora species as having the potential to occur within 20 km of the Project site, including nine EPBC Act listed species and one *Nature Conservation Act 1992* (NC Act) listed species.

The likelihood of occurrence assessment identified one flora species (*Eucalyptus raveretiana*) that is considered likely to occur within the Project site and known to occur immediately adjacent to the Project site based on the flora and habitat observed during the field surveys (Table 17). The species was not identified within the Project site during field survey. The complete likelihood of occurrence assessment is provided in Appendix G.

Table 17 Conservation Significant Flora Species Potentially Occurring in the Project Site

Common Name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Likelihood of Occurrence in the Project Site
Black ironbox	*Eucalyptus raveretiana*	V	LC	Known

[1] Conservation status under the EPBC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, Mi = Migratory.

[2] Conservation status under the NC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, SLC=Special Least Concern, LC=Least Concern.

9.1.7 Essential Habitat

The desktop assessment did not identify any essential habitat for NC Act listed flora species intersecting the Project site.

9.1.8 Protected Plants

The Project site is not mapped as a ‘high risk area’ on the Protected Plants Flora Survey Trigger Map. No NC Act listed threated flora species were found during the field survey. A full species list is provided in Appendix G.

9.2 Potential Impacts

The following section details the potential impacts to flora values within the Project site. The potential impacts have been considered in the following ways:

- Construction phase impacts.
- Operation and maintenance phase impacts.
- Decommissioning and rehabilitation impacts.

9.2.1 Construction Phase

The greatest risk of potential impact on ecological values from the Project will occur during the construction phase. The construction activities to support the installation of the substation, transmission towers, associated lines and access tracks will involve vegetation clearing, excavation and ground reinstatement. Direct and indirect impacts potentially associated with this phase are described below.

9.2.1.1 Direct Impacts

Vegetation clearing is a direct impact that can result in the loss of vegetation values and habitat. Potential impacts resulting from clearing native vegetation can include the following:

- Reduced patch size of vegetation communities potentially compromising the viability of the community and associated habitat.

- Loss of habitat causing a reduction of biological diversity or loss of local populations and genotypes.
- Loss of, or disturbance to, microhabitat features such as tree hollows, leaf litter, ground timber, dense shrubs and hollows.
- Loss of floristic diversity and the food resources this provides such as foliage, flowers, nectar, fruit and seeds.
- Fragmentation of habitats resulting in reduced dispersal opportunities for fauna.
- Destruction of abiotic features necessary to support vegetation communities and habitat types.

Clearing will only be completed strictly as needed and will be minimised as low as reasonably practicable. The maximum clearing extents within the Project site per regional ecosystem presented in Appendix G.

As per the State regulated vegetation mapping, Category B and Category X occur within the Project site. The significance of impacts to MSES regulated vegetation and connectivity values are detailed in Appendix G.

Due to the size and width of the Project site, direct impacts will be limited to a relatively small area within the vegetation patch. This ultimately will reduce the duration of the impact, and direct impacts are therefore considered to be predictable and known. The Project is not anticipated to impact any conservation significant species as the only species identified during surveys (black iron box, *Eucalyptus raveretiana*) is located outside of the Project site.

9.2.1.2 Indirect Impacts

The loss of vegetation and habitat alongside the activities undertaken to clear vegetation or complete construction, can potentially result in indirect or secondary impacts to the associated floristic values in the form of habitat degradation. This includes:

- Increased edge effects reducing the condition of quality of remaining vegetation communities and habitat types.
- Although exotic weeds were found to be relatively common across the Project site, further disturbance can permit the establishment and spread of exotic species that may displace native species, native habitat resources and alter fire regimes.
- Generation of dust emissions leading to excessive deposition of dust on leaves of plants suppressing photosynthesis and growth.

Conservation significant flora species are each susceptible to these indirect impacts with varying degrees.

9.2.2 Operation and Maintenance Phase

Potential impacts on ecological values during the operation and maintenance phase of the Project are likely to be low. Activity within the Project site will be limited to periodic maintenance.

Traversing maintenance vehicles may inadvertently introduce weeds, which will be mitigated through the implementation of the Project's EMP which will include specific controls detailed in Appendix B and Appendix C.

9.2.3 Decommissioning and Rehabilitation Phase

Similar to the operation and maintenance phase of the Project, rehabilitation activities are also considered to have only low and temporary impacts on ecological values. Other than for surface rehabilitation, no ground disturbance will occur as subsurface components of the Project infrastructure will likely remain in-situ.

9.3 Avoidance, Minimisation, Mitigation and Management Measures

To mitigate potential impacts to potentially occurring flora values, an EMP for the OHTL and the substation (Appendix B and Appendix C) has been developed for the Project. The following sections further describe avoidance, minimisation, mitigation and management measures.

9.3.1 Avoid and Minimise

The avoidance of ecological values and minimisation of impacts to these values has been demonstrated as follows:

- Project siting to avoid direct and indirect impacts to riparian vegetation.
- Optimising the Project site through design with consideration to clearing extent.

The location of the Project site is constrained by the location of existing and approved infrastructure, as the Project will connect the approved Burdekin River Pump Station to the existing powerline network. However, the Project site is relatively small, and all Project activities will occur within the Project site, including laydown areas and stockpiling.

9.3.2 Mitigate and Manage

To mitigate potential impacts to ecological values, an EMP has been developed for the Project (Appendix B and Appendix C). This include both general and species-specific mitigation and management measures for conservation significant flora species, including the measures provided in the subsequent sections.

9.3.2.1 Species Specific Mitigation

Mitigation measures specific to the potentially occurring conservation significant flora species black ironbox (*Eucalyptus raveretiana*) are as follows:

- Any specific populations will be identified, and the extent mapped during pre-clearance surveys, including any no-go areas. Confirmation of potential population avoidance will be completed during final scouting. Where possible the siting of infrastructure will avoid areas of known occurrence as a priority.
- Clearing will be restricted to the minimal amount necessary for construction and will not extend outside the Project site.

10.0 Fauna

10.1 Existing Environment

This chapter provides an assessment of fauna values associated with the proposed OHTL and substation site. Detailed ecology survey reports are provided in Appendix G and summarised within this Chapter.

10.1.1 Methodology

Fauna values associated with the Project site have been assessed through a range of methodologies. The methodology is provided within the full ecology survey reports in Appendix G. A significant residual impact assessment for MSES in accordance with the State criteria is discussed in Chapter 11.0 Matters of Environmental Significance.

10.1.2 Fauna Habitat Types

Two dominant habitat types were recorded across the Project site as listed in Table 18, and described in more detail in Appendix G. The fauna habitat types are consistent with the vegetation communities displayed in Figure 4 of Appendix G.

Table 18 Fauna Habitat Types and Descriptions

Habitat No.	Habitat Type	Associated RE	Project Site
1	*Eucalyptus platyphylla*, *Corymbia clarksoniana* woodland on alluvial plains	11.3.35	2.72
4	Non-remnant vegetation	Non-remnant	0.45

10.1.3 Essential Habitat

There is no essential habitat mapped within the Project site. Essential habitat for the koala (*Phascolarctos cinereus*) is mapped approximately 2 km to the west of Project site.

10.1.4 Conservation Significant Fauna Species

The desktop searches identified 44 conservation significant fauna species to consider in the likelihood of occurrence assessment.

The likelihood of occurrence assessment determined 15 conservation significant fauna species are considered as likely or having the potential to occur within the Project site including four threatened birds, five mammals and six migratory birds (one of which is also threatened), based on the fauna and habitat observed during the field surveys (Table 19).

These include 14 species listed under the EPBC Act, six species listed migratory under the EPBC Act, and 15 species listed under the NC Act. The full likelihood of occurrence assessment is provided in Appendix G.

Table 19 Conservation Significant Fauna Species Potentially Occurring in the Project Site

Common Name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Likelihood of Occurrence
Birds				
Red goshawk	*Erythrotriorchis radiatus*	V	E	Potential
Squatter pigeon (southern)	*Geophaps scripta scripta*	V	V	Likely
White-throated needletail	*Hirundapus caudacutus*	V, Mi	V	Potential (flyover only)
Black-throated finch (southern)	*Poephila cincta cincta*	E	E	Likely

Common Name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Likelihood of Occurrence
Migratory Birds				
Fork-tailed swift	*Apus pacificus*	Mi	SLC	Potential (flyover only)
Sharp-tailed sandpiper	*Calidris acuminata*	Mi	SLC	Potential
Satin flycatcher	*Myiagra cyanoleuca*	Mi	SLC	Potential
Osprey	*Pandion haliaetus*	Mi	SLC	Potential
Rufous fantail	*Rhipidura rufifrons*	Mi	SLC	Potential
Mammals				
Northern quoll	*Dasyurus hallucatus*	E	LC	Potential
Greater glider (northern)	*Petauroides minor* (syn. *P. volans minor*)	V	V	Potential
Greater glider (southern and central)	*Petauroides volans* (syn. *P. v. volans, P. armillatus*)	E	E	Potential
Koala	*Phascolarctos cinereus*	E	E	Potential
Bare-rumped sheathtail bat	*Saccolaimus saccolaimus nudicluniatus*	V	E	Potential
Short-beaked echidna	*Tachyglossus aculeatus*	-	SLC	Likely

[1] Conservation status under the EPBC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, Mi = Migratory.
[2] Conservation status under the NC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, SLC=Special Least Concern, LC=Least Concern

10.2 Potential Impacts

The following section details the potential impacts to fauna values within the Project site. The potential impacts have been considered in the following ways:

- Construction phase impacts.
- Operation and maintenance phase impacts.
- Decommissioning and rehabilitation impacts.

10.2.1 Construction Phase

The greatest risk of potential impact on ecological values from the Project will occur during the construction phase. The construction activities to support the installation of the substation, transmission towers, associated lines and access tracks will involve vegetation clearing, excavation and ground reinstatement. Direct and indirect impacts potentially associated with this phase are described below.

10.2.1.1 Direct Impacts

Vegetation clearing is a direct impact that can result in the loss of vegetation values and habitat, with the severity of impacts more pronounced in habitats that provide values for conservation significant species and communities. Potential impacts on fauna values resulting from clearing native vegetation can include the following:

- Reduced patch size of vegetation communities potentially compromising the viability of the community and associated habitat.
- Loss of habitat causing a reduction of biological diversity or loss of local populations and genotypes.

- Loss of or disturbance to microhabitat features such as tree hollows, leaf litter, ground timber, dense shrubs and hollows.
- Fragmentation of habitats resulting in reduced dispersal opportunities for fauna.
- Destruction of abiotic features necessary to support vegetation communities and habitat types.

Due to the size and width of the Project site, direct impacts will be limited to a relatively small area within the vegetation patch. This ultimately will reduce the duration of the impact, and direct impacts are therefore considered to be predictable and known. The worst-case scenario extent of clearing impacts to the potential, likely or known conservation significant fauna species are detailed in Table 20.

Table 20 Direct Impacts on Fauna Values

Ecological Value	EPBC Act Listing[1]	NC Act Listing[2]	Likelihood of Occurrence	Maximum direct impact area (ha) within the Project site
Birds				
Red goshawk	E	E	Potential	2.7
Squatter pigeon (southern)	V	V	Likely	2.7
White-throated needletail	V, Mi	V	Potential (flyover only)	2.7
Black-throated finch (southern)	E	E	Likely	2.7
Mammals				
Northern quoll	E	LC	Potential	2.7
Greater glider (northern)	V	V	Potential	2.7
Greater glider (southern and central)	E	E	Potential	2.7
Koala	E	E	Potential	2.7
Bare-rumped sheathtail bat	V	E	Potential	2.7
Migratory species				
Fork-tailed swift	Mi	SLC	Potential (flyover only)	2.7
Sharp-tailed sandpiper	Mi	SLC	Potential	2.7
Satin flycatcher	Mi	SLC	Potential	2.7
Osprey	Mi	SLC	Potential	2.7
Rufous fantail	Mi	SLC	Potential	2.7

[1] Conservation status under the EPBC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, Mi = Migratory.

[2] Conservation status under the NC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, SLC=Special Least Concern, LC=Least Concern.

10.2.1.2 Indirect Impacts

The loss of vegetation and habitat as well as the construction activities required to be undertaken to clear vegetation or complete construction, can potentially result in indirect or secondary impacts to the associated fauna values in the form of habitat degradation. This includes:

- Increased edge effects reducing the condition of quality of remaining vegetation communities and habitat types.
- Soil exposure resulting in an increased risk of erosion and sedimentation of water bodies, reducing water quality and degrading aquatic habitats.
- Increased noise and light levels affecting foraging and breeding behaviour for some fauna species or resulting in complete avoidance and displacement from habitats. Fauna will generally move away from noise and light sources as these may be perceived as a threat. Acclimatisation by some species is likely to occur over the medium to long term and many of the species identified in the Project site are known to occur in areas subject to noise, light and general activity.
- Periodic burst of elevated noise levels may startle and disorientate fauna species within proximity.
- Although the Project will not increase food resources or facilitate the movement of pests via the creation of new pathways, increased anthropogenic activity may lead to temporary increased pest levels.

Conservation significant fauna species are each susceptible to these indirect impacts with varying degrees.

10.2.2 Operation and Maintenance Phase

Potential impacts on ecological values during the operation and maintenance phase of the Project are likely to be low. Activity within the Project site will be very low and limited to periodic maintenance.

Maintenance will involve vegetation clearing (predominantly ground slashing of regrowth vegetation as needed) in areas that were cleared during the construction phase and along tracks.

Traversing maintenance vehicles may inadvertently potentially collide with ground dwelling fauna species resulting in injury or mortality. These potential impacts will be mitigated through the implementation of the Project's EMP which will include specific controls such as designated tracks and site speed limits.

Operation of the Project may also lead to an increased risk of fauna mortality at an individual level as a result of electrocution. Collision with OHTL is not a known risk to conservation significant fauna values identified as potentially occurring.

10.2.2.1 Decommissioning and Rehabilitation Phase

Similar to the operation and maintenance phase of the Project, rehabilitation activities are also considered to have only low and temporary impacts on ecological values. All works in this phase will be conducted in consultation with landholders. Other than for surface rehabilitation, no ground disturbance will occur as subsurface components of the Project infrastructure will likely remain in-situ.

Temporary and localised increases in noise and potential dust may occur but will be managed using the same methods used during construction. Traversing vehicles required to complete decommissioning or rehabilitation activities may inadvertently potentially collide with ground dwelling fauna species resulting in injury or mortality. Any impacts would be mitigated through implementation of the Project EMP as per the other phases of the Project.

10.3 Avoidance, Minimisation, Mitigation and Management Measures

To mitigate potential impacts to potentially occurring fauna values, an EMP for the OHTL and substation (Appendix B and Appendix C) has been developed for the Project. The follow sections further describe avoidance, minimisation, mitigation and management measures.

10.3.1 Avoid and Minimise

The avoidance of ecological values and minimisation of impacts to these values has been demonstrated as follows:

- Project siting to avoid direct and indirect impacts to riparian vegetation.
- Optimising the Project site through design with consideration to clearing extent.

The location of the Project site is constrained by the location of existing and approved infrastructure, as the Project will connect the approved Burdekin River Pump Station to the existing powerline network. However, the Project site is relatively small, and all Project activities will occur within the Project site, including laydown areas and stockpiling. Indirect impacts resulting from the construction of the Project will be localised and temporary, and actively managed as detailed below. Furthermore, clearing extents detailed in Section 10.2.1.1 represent a maximum area, and direct impacts to conservation significant fauna species will be minimised to as low as reasonably practicable.

10.3.2 Mitigate and Manage

To mitigate potential impacts to ecological values, an EMP for the OHTL and the substation site has been developed for the Project (Appendix B and Appendix C). This includes both general and species-specific mitigation and management measures for conservation significant fauna species, including the measures provided in the subsequent sections.

10.3.2.1 General Mitigation Measures

The key general mitigation measures are detailed below:

- Delineate exclusion areas to avoid unauthorised disturbance and access of areas of threatened species habitat.
- Movement within the Project site will be via approved access tracks only with speed limits enforced. The requirement to enter and traverse the Project will be minimised where possible and limited to those required for essential Project activities.
- All clearing will be conducted with a suitably qualified suitably qualified fauna spotter-catcher present.
- Spotter-catchers will scout the area to be disturbed for the presence of fauna species immediately prior to the commencement of disturbance and relocate the fauna to an undisturbed location.
- Exclusion zones will be established around any active breeding places identified during pre-clearance surveys and any fauna habitat features to be retained (e.g., mature trees, inactive breeding places) and appropriately marked out, where practicable. Where there is the potential an active breeding place will be tampered with, this will only be done in accordance with an approved low-risk and/or high-risk DESI Species Management Program (SMP) (depending on the species to be impacted).
- Night works within or adjacent to areas of conservation significant species' habitat will be avoided where possible. Where night works are required, lights will be directed to minimise light spill into adjacent habitats.
- Microhabitat features such as large fallen logs will be relocated to adjacent areas of undisturbed vegetation prior to vegetation clearing where practicable.
- Threat of wildfire caused by Powerlink activities will be minimised through maintenance of firebreaks around ignition sources as appropriate.

- Weed and pest management strategies to be implemented for controlling the spread of weeds and pests, particularly vehicles traversing the Project site. This includes ongoing monitoring of the Project site to identify any new incidence of weed and pest infestation.

10.3.2.2 Species-specific Mitigation Measures

Mitigation measures specific to the potentially occurring conservation significant fauna species are detailed in Table 21 below.

Table 21 Species-specific Mitigation Measures

Species	Mitigation measure
Ground-dwelling species	• During construction of the substation, any open trenches, pits or excavations will be checked for trapped fauna in the morning and at the end of the day by a site leader. If fauna are present, a spotter catcher with relevant permits should be engaged to undertake this task. • During construction of the substation, trench ladders, ramps, sticks, ropes and moist hessian sacks at regular intervals (or similar) will be utilised where trenches or excavations are anticipated to remain open for extended periods. This will help trapped fauna escape and/or survive until removed by a fauna spotter-catcher. • Covers for tower/pole excavations suitable for preventing small animals entering the excavation are to be utilized when the excavation is unattended (e.g. overnight). Covers or other suitable fauna barriers are to be utilized when steel reinforcement is placed within tower/pole foundation excavation and the excavation unattended (e.g. overnight).
Red goshawk and osprey	• Retain tall trees that contain potential raptor nests (even if abandoned), especially where located along watercourses where possible.
Squatter pigeon (southern)	• Speed limits will be enforced within the site to reduce risk of collision with wildlife. • No unauthorised off-track driving.
Black-throated finch (southern)	• Pre-clearance surveys by a spotter-catcher will be undertaken in mapped habitat areas and near water sources to ensure any potential nests are located and their location demarcated. A sufficient buffer distance will be implemented to avoid potential disturbance and displacement until the nests have been vacated.
Northern quoll	• Large hollow logs that must be removed from areas of potential northern quoll habitat will be retained and relocated to adjacent or nearby areas of suitable northern quoll habitat. • Dewatering of trenches to be conducted to prevent breeding opportunities of cane toads. Dewatering must achieve water quality objectives outline in Powerlink's EMP and HSE Specification.
Greater glider	• All hollow-bearing trees will be inspected by a fauna spotter-catcher prior to clearing to identify any denning or nesting individuals. • All hollow-bearing trees will be soft-felled during clearing activities.
Koala	• Clearing must be carried out in a way that ensures any koala present have time to move out of the clearing site without human intervention. • If a koala is located during pre-clearance surveys or during clearing activities: - the individual must not be forcibly relocated - any tree which houses a koala as well as any tree with a crown that overlaps that tree will not be cleared until the koala vacates the tree on its own volition - allow a clearing buffer surrounding the tree, equal to the height of the tree or deemed suitable by the fauna spotter-catcher - any injured koala (and fauna in general) should be transported to a vet or recognised wildlife carer. • Where deemed necessary by the fauna spotter-catcher, temporary exclusion fencing may be required to prevent wildlife from returning to work areas.

Species	Mitigation measure
Bare-rumped sheathtail bat	• A spotter-catcher must be on-site during clearing activities to identify any potential roost trees (i.e. hollow bearing trees). Any bats found to be potentially affected by the Project construction will be relocated to an alternative nearby empty hollow. • Any identified active roosting maternity colonies within or adjacent to the Project alignment will be considered during vegetation clearing with a sufficient buffer distance implemented to avoid potential disturbance and displacement until these roosting maternity colonies have moved on. • Clearing works should be staged to allow bats to leave roosting sites. • No vegetation clearing should occur at night (bright lights can interfere with bat behaviour). • Clearing of hollow-bearing trees will only occur where necessary and cleared logs/stags will be relocated to adjoining habitat that is to be retained.
Sharp-tailed sandpiper	• Prior to construction works commencing, the spotter-catcher will confirm the presence of any migratory birds that may be disturbed by the activity. If found to be present at the time of works, appropriate mitigation measures should be developed to minimise disturbance.

11.0 Matters of Environmental Significance

11.1 Matters of National Environmental Significance

A summary of Matters of National Environmental Significance (MNES) values listed under the EPBC Act that may occur within the Project site are presented in Appendix G. It is understood that that impacts to MNES will be managed under the EPBC Act Approval for the Haughton Pipeline (Stage 2) Project. These approval conditions should be followed for all Project works.

Listed threatened species and ecological communities and migratory species were identified as potentially present within the Project site, these have been assessed separately. While the impacts to MNES values have been assessed separately, the 2.7 ha impact area is considered small enough that significant impacts to MNES values are unlikely to occur.

11.1.1 Matters of State Environmental Significance

Ams assessment of MNES for the Project was undertaken in accordance with the criteria provided in the Significant Residual Impact Guidelines (Department of State Development Infrastructure and Planning, 2014b) The full Significant Residual Impact assessment is provided in Appendix G.

To avoid duplication of offset conditions 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 and the same or substantially the same matter has not been subject to assessment under the EPBC Act. As such, the MSES values presented in this section are those that have not already been assessed as MNES values as part of the EPBC Approval for the Haughton Pipeline (Stage 2) Project (Department of the Environment, 2013).

Significant residual impact assessments for protected wildlife habitat have been completed for the known, likely or potential conservation significant species that have not already been assessed under the EPBC Act policy statement ‘Significant Impact Guidelines 1.1 – Matters of National Environmental Significance’ (Department of the Environment, 2013).These assessments are presented in Appendix G.

After considering potential impacts, mitigation measures and State significant residual impact criteria, the Project is considered unlikely to have a significant residual impact on MSES values.

12.0 Biosecurity

12.1 Relevant Legislation and Policies

12.1.1 Commonwealth Government – Australian Weeds Strategy 2017-2027

The Australian Weeds Strategy provides a national framework for addressing weed issues whilst maintaining the sustainability of Australia's primary industries and reducing the impact of weeds on the environment.

A separate Weed Survey Report has been produced for this Project that discusses Weeds of National Significance (WoNS) occurring in the Project site in more detail (Appendix H).

12.1.2 State Government – Queensland Biosecurity Act 2014

The *Biosecurity Act 2014* (Biosecurity Act) is administered by the Department of Agriculture and Fisheries (DAF).

Powerlink have a general biosecurity obligation (GBO) under the Biosecurity Act to ensure they do not spread a pest, disease or contaminant. Under the GBO, individuals and organisations whose activities pose a biosecurity risk must:

- Take all reasonable and practical steps to prevent or minimise each biosecurity risk.
- Minimise the likelihood of causing a 'biosecurity event' and limit the consequences if such an event is caused.
- Prevent or minimise the harmful effects a risk could have, and not do anything that might make any harmful effects worse.

12.1.3 Local Government

The Biosecurity Act also requires every local government in Queensland to develop a biosecurity plan for their area. The local government plan relevant to the Project is the Burdekin Shire Biosecurity Plan 2020-2025 (the Plan) developed by the Burdekin Shire Council (Burdekin Shire Council, 2020).

The Plan was developed to help approach management of invasive matter (flora and fauna) within the Burdekin Shire guided by the Queensland Department of Agriculture and Fisheries' *Queensland Invasive Plants and Animals Strategy 2019 – 2024* (Department of Agriculture and Fisheries, 2019).

The Plan outlines a list of local priority alert species relevant to the Burdekin Shire. Appendix 4 of the Plan also identifies stakeholder responsibilities, which are obligations for pest management within the Burdekin Shire specific to relevant agencies and actions.

The Plan classifies the priority weed species into management objectives based on a risk matrix approach of the extent of risk against the feasibility of control. The management objectives are briefly defined below (Burdekin Shire Council, 2020):

- **Limited Action:** The species has low feasibility for control and targeted action is not likely to reduce the risk but may be targeted for control if it poses a threat of spread to higher-priority areas.
- **Asset Protection:** Aims to reduce the overall economic, environmental, and/or social impacts of the species and may include targeted management.
- **Containment:** Aims to prevent the ongoing spread of the species in the management area within identified core infestation zones and exclusion zones.
- **Eradication:** Aims to completely remove the species from the management area.
- **Prevention:** Aims to prevent a species that is not present in the area from arriving and establishing.

12.2 Existing Environment

12.2.1 Biosecurity Zones

The Project is located within three mapped biosecurity zones (Queensland Government, 2023a):

- Cattle tick area (infested). The cattle tick infested zone is where cattle ticks are endemic and will thrive if left unmanaged (Business Queensland, 2019b).
- Sugar cane pest (zone 2). These zones have been developed to stop the spread of pests between different sugarcane areas (Farm Biosecurity, 2023).
- Grape phylloxera risk zone. Phylloxera is a small yellow insect that destroys grapevines by eating and damaging the roots. This zone identifies the potential risk of Grape phylloxera, which is not known to occur within Queensland (Business Queensland, 2019a).

These zones relate to the management of farm related activities and transport of pests.

12.2.2 Flora and Fauna

An assessment of flora and fauna within the Project site is provided in Chapter 9.0 Flora and Chapter 10.0 Fauna of this report. Introduced fauna species within the Project site were identified as part of this assessment, through desktop searches and field surveys, and the fauna survey methodology has not been reproduced in this chapter.

A weed survey was conducted during the general ecology surveys on 4th and 5th September 2023 to specifically ground-truth the introduced flora species identified in the desktop search. The survey consisted of an ecologist traversing the Project site and visiting predetermined survey locations to calculate weed density in a 20 m x 20 m plot. The weed survey sites are shown in Figure 2 of Appendix H.

12.2.2.1 Introduced Flora

Table 22 lists the non-indigenous flora species identified in the Project site during the weed field survey studies, and their National, State and Local status.

A total of 34 introduced species including two WoNS were identified as potentially occurring within 20 km by the desktop assessment. 32 introduced flora species were confirmed to occur in the Project Site during field surveys, with two WoNS and six species listed as Category 3 restricted matter under the Biosecurity Act (Table 22). Five species are listed as local priority weeds of varying management categories.

Table 22 Non-indigenous flora species including WoNS or restricted matter under the *Biosecurity Act 2014*

Scientific name	Common name	WoNS list	Biosecurity Act status	Local Biosecurity Plan [1]
*Albizia lebbeck**	Indian siris	No	-	-
*Alternanthera sp.**	Joyweed	No	-	-
*Argemone ochroleuca**	Mexican poppy	No	-	-
*Argyreia nervosa**	Elephant ear vine	No	Category 3 restricted matter	-
*Basilicum polystachyon**	Basilicum	No	-	-
*Bidens pilosa**	Cobblers pegs	No	-	-
*Bothriochloa pertusa**	Indian bluegrass	No	-	-
*Cascabela thevetia**	Yellow oleander	No	Category 3 restricted matter	-
*Chamaecrista rotundifolia**	Wynn cassia	No	-	-

Scientific name	Common name	WoNS list	Biosecurity Act status	Local Biosecurity Plan [1]
*Chloris virgata**	Feathertop Rhodes grass	No	-	-
*Cryptostegia grandiflora**	Rubber vine	Yes	Category 3 restricted matter	Asset Protection
*Cucumis melo**	Muskmelon	No	-	-
*Erigeron bonariensis**	Fleabane	No	-	-
*Erigeron bonariensis**	Fleabane	No	-	-
*Gomphrena celosioides**	Gomphrena	No	-	-
*Jatropha gossypiifolia**	Bellyache bush	Yes	Category 3 restricted matter	Asset Protection
*Macroptilium atropurpureum**	Siratro	No	-	-
*Megathyrsus maximus**	Guinea grass	No	-	-
*Melinis repens**	Red natal	No	-	-
*Mesosphaerum suaveolens**	Hyptis	No	-	-
*Passiflora foetida**	Stinking passionflower	No	-	-
*Praxelis clematidea**	Praxelis	No	-	-
*Psidium guajava**	Guava	No	-	-
*Ricinus communis**	Castor oil plant	No	-	-
*Sesbania cannabina**	Sesbania pea	No	-	-
*Sida cordifolia**	Flannel weed	No	-	-
*Sporobolus sp.**	Giant rats tail grass	No	Category 3 restricted matter	Containment
*Stachytarpheta jamaicensis**	Blue snakeweed	No	-	-
*Stylosanthes scabra**	Stylo	No	-	-
*Themeda quadrivalvis**	Thatch grass	No	-	Locally declared weed
*Xanthium occidentale**	Noogoora burr	No	-	-
*Ziziphus mauritiana**	Chinee apple	No	Category 3 restricted matter	Asset protection

[1] Weed listed under the Burdekin Shire Biosecurity Plan 2020-2025 (Burdekin Shire Council, 2020)

A total of 11 weed survey sites were assessed to determine the percent cover of each introduced species in a 20 m x 20 m plot. The results are presented in Table 2 in Appendix H.

The field survey recorded the following dominant weed species:

- Guinea grass (*Megathyrsus maximus**) occurred at nine of the 11 sites, ranging from 5% to 80% cover.

- Rubber vine (*Cryptostegia grandiflora**) occurred at three sites, with a 2% to 40% cover, primarily located in the western portion of the Project site.
- Chinee apple (*Ziziphus mauritiana**) occurred at eight of the 11 sites, with a 5% to 15% cover.
- Bellyache bush (*Jatropha gossypiifolia**) occurred at 5 sites with a 1% to 15% cover, located on the eastern portion of the Project site near the Burdekin River.

Most weed species occurred within the ground and shrub stratum, except for Indian siris (*Albizia lebbeck**) which was a small tree, and rubber vine (*Cryptostegia grandiflora**) which reached the canopy in some areas.

12.2.2.2 Non-indigenous Fauna

Table 23 lists the non-indigenous fauna species identified in the Project site during field studies, and their National, State and local status.

The field survey recorded evidence of one introduced fauna species which is listed as restricted under the Biosecurity Act. Other introduced fauna species that may occur within the Project site include the fox, hare, black rat and house mouse.

Table 23 Non-indigenous Fauna Species Recorded within the Project Site

Common Name	Scientific Name	Biosecurity Act Status
Feral pig	*Sus scrofa*	Category 3,4,6

12.3 Potential Impacts

Several potential impacts of non-indigenous flora and fauna as a result of the Project activities are identified below:

- The Project will require the movement and transport of machinery, vehicles, plant and equipment. When contaminated with weed material, this movement has the potential to spread restricted matter to weed free locations or areas with minimal infestations. It also has the potential to move pest plants' reproductive material over long distances from the original source.
- Vegetation clearing for the Project creates the potential for edge effects. Edge effects are zones of changed environmental conditions (e.g., altered light levels, wind speed, temperature) occurring along the edges of habitat fragments. Clearing in remnant areas can allow invasion by introduced species specialising in edge habitats. Significant increases in edge effects are not anticipated from clearing for the Project due to presence of pre-existing disturbance in neighbouring areas associated with an existing Sunwater Pump Station and associated infrastructure.
- One non-indigenous fauna species was recorded during the field program (Section 12.2.2.2). This species is likely to be widespread within the Project site. As such, it is unlikely that the proposed works will result in further introductions of feral vertebrate species. However, habitat modification may change their movement through the Project site.
- Fauna habitat may also be degraded by the introduction or exacerbation of weeds.

12.4 Mitigation and Management Measures

Biosecurity will be managed in accordance with Powerlink's EMP (Appendix B and Appendix C).

A detailed weed survey has been undertaken within the Project site and its immediate surrounds and identifies WoNS, restricted and invasive matters, and regionally declared weed species (Appendix H).

This survey may act as a pre-construction weed survey if construction occurs within the next few months, however if construction is delayed, an updated field survey is recommended.

A Biosecurity Management Plan will be developed to support construction and operation of the Project and to achieve Powerlink's GBO under the Biosecurity Act.

13.0 Land Use

13.1 Existing Environment

The Project traverses four parcels of land. Land tenure arrangements are Freehold and Reserve land. Table 2 provides a breakdown of the lot on plan, tenure and relevant LGA. The Project also traverses over Ayr-Dalbeg Road and Invicta Rail Line which is a privately owned cane railway.

13.2 Agricultural Land

The dominant land use within the surrounding locality is agricultural land. The State Government identifies agricultural land through the State Planning Policy (SPP) by identifying Important Agricultural Areas (IAA), Agricultural Land Classifications (ALC) and supporting infrastructure such as stock routes.

IAAs are defined as “land that has all of the requirements for agriculture to be successful and sustainable, is part of a critical mass of land with similar characteristics and, is strategically significant to the region or the State” (DSDILGP, 2017). IAAs are a key aspect of the Agricultural State Interest within the SPP.

The Project site traverses the IAA and is depicted in the Figure 5 below.

Figure 5 SPP - Important Agricultural Areas (State Planning Policy Interactive Mapping System, 2024)

13.2.1 Agricultural Land Classification

The Project site is mapped under the ALC as Class A or B land and is depicted in Figure 6.

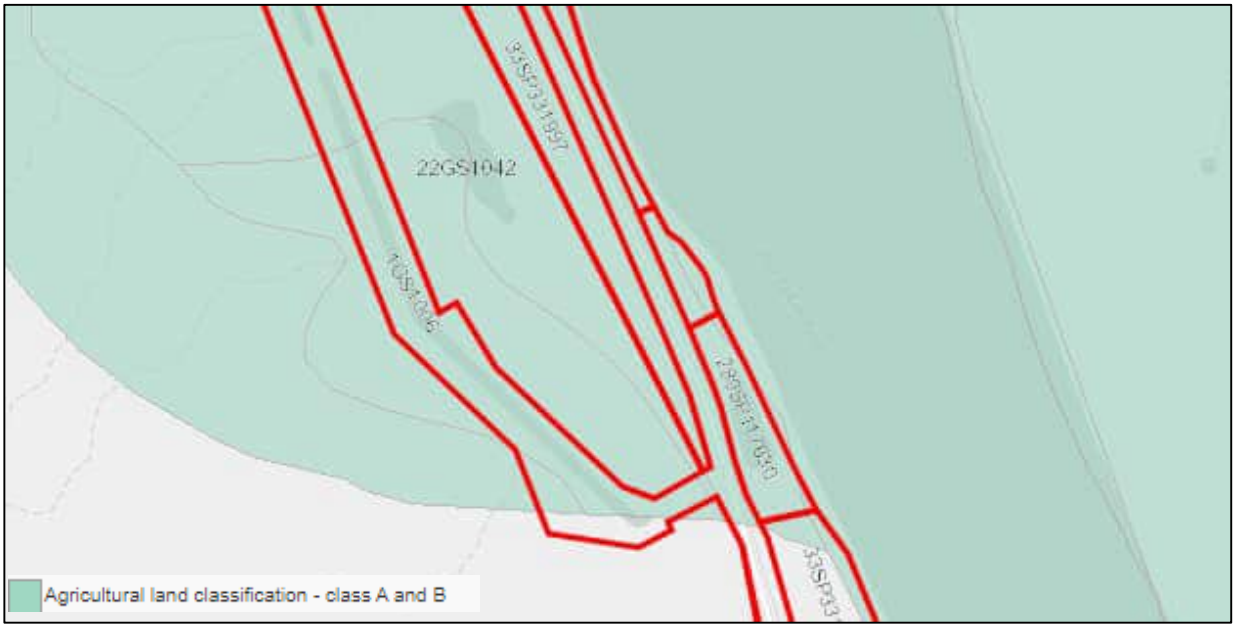


Figure 6 State Planning Policy ALC – Class A and B (State Planning Policy Interactive Mapping System, 2024)

Class A is described as – *Crop land that is suitable for a wide range of current and potential crops with nil to moderate limitations to production.*

Class B is described as – *Limited crop land that is suitable for a narrow range of current and potential crops. Land that is marginal for current and potential crops due to severe limitations but is highly suitable for pastures. Land may be suitable for cropping with engineering or agronomic improvements.*

Class A and B land is a key component of the Agricultural State Interests under the SPP. The SPP requires that Class A and Class B land be protected for sustainable agricultural use.

13.3 Existing Infrastructure

Figure 7 depicts the following existing infrastructure within the Project site as identified on the SPP Energy and Water Supply Mapping:

- Lot 289 on SP117630 consists of Sunwater pump station, reservoir facilities, pipelines and associated infrastructure.
- Lot 22 on GS1042 consists of an easement containing major electricity infrastructure for both Powerlink and Ergon.

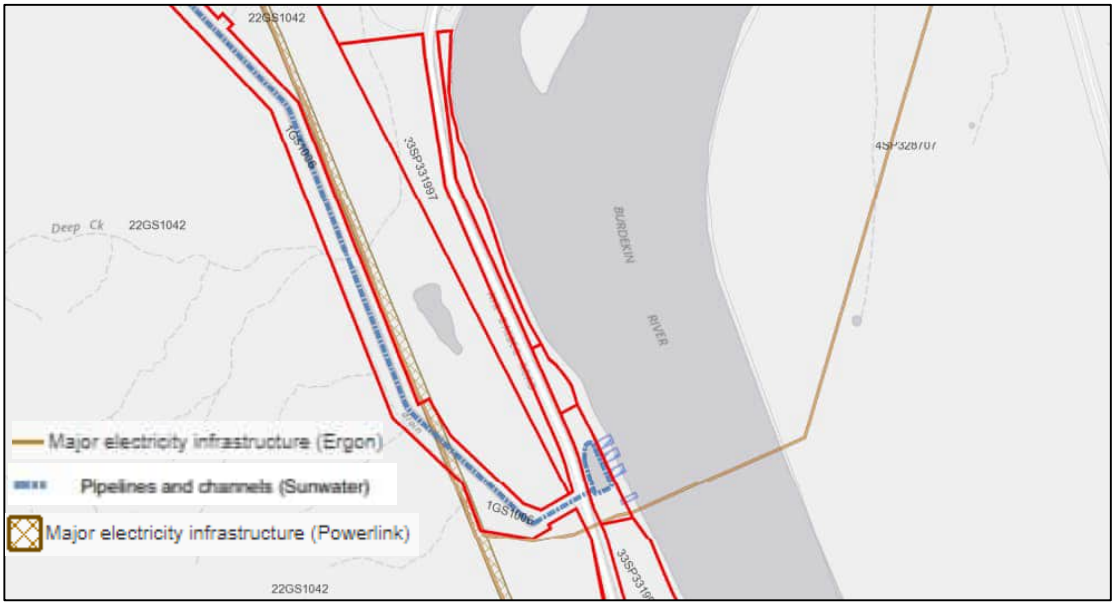


Figure 7 State Planning Policy Energy and Water Supply Infrastructure (State Planning Policy Interactive Mapping System, 2024)

13.4 Potential Impacts

Potential impacts on land use from the Project are associated with construction and maintenance activities which may include the following:

- Loss or fragmentation of agricultural land
- Disturbance to cattle grazing
- Disturbance in rural amenity values of the locality.

These impacts are discussed further in the following sections.

13.4.1 Agricultural Land and Operations

The Project has the potential to create impacts on existing farming operations as the OHTL and substation site will lead to a small loss of mapped Class A and Class B agricultural land. Grazing can continue within the OHTL easement. Although mapped as Class A and Class B agricultural land, the agricultural land environment is essentially vegetated grazing land. The Project does not directly traverse any identifiable irrigated cropping or horticultural crops.

Where the Project traverses Class A or Class B agricultural land, the OHTL footprint has been kept to 40 m wide and 600 m in length. The proposed minimisation of the footprint limits impacts on existing cattle grazing by:

- Confining vegetation clearing to one corridor through a property instead of multiple corridors,
- Using one track to access the infrastructure,
- Minimising potential for introduction and dispersal of weed and pest species,
- Minimising the requirement to reconfigure farm infrastructure, and
- Reducing fragmentation.

During the construction phase, access to work areas will be restricted to ensure personnel and cattle remain safe from injury. A traffic impact assessment has been included (Appendix E) and assessed in Chapter 18.0 Transport and Traffic.

Noise and air quality impacts associated with the Project have been assessed in Chapter 19.0 Noise and Vibration and Chapter 6.0 Air Quality respectively. It has been concluded that the separation

distance between the Project site to the closest sensitive receptors is adequate to ensure no long term adverse impacts are realised.

The existing biosecurity environment, potential impacts and mitigation measures have been discussed in Chapter 12.0 Biosecurity.

13.4.2 Rural Character and Amenity

The OHTL easement width and length is considered to minimise the impacts on the character and amenity of the area. Impacts to the surround locality are discussed in the following sections of this assessment report, being:

- Chapter 6.0 Air Quality
- Chapter 19.0 Noise and Vibration
- Chapter 14.0 Visual Amenity
- Chapter 18.0 Traffic Impact
- Chapter 20.0 Hazards, Health and Safety.

13.5 Mitigation and Management Measures

Through the infrastructure design processes, Powerlink has considered the existing land use associated with the Project to reduce and mitigate impacts where possible. Key mitigation includes the following.

- Locating the Project in close proximity to the approved substation.
- Connecting the OHTL to Powerlink's easement in the most direct alignment.
- Proposing the easement width to be as minimal as possible to accommodate the infrastructure. Thus, minimising environmental impacts and impacts upon existing site operations.
- Designated construction access tracks are planned and located in the OHTL easement to minimise disturbance to site operations.
- Property access protocols will be developed for implementation during the construction phase which will include information on access tracks, fencing, and gates that can be used as well as the need to keep gates closed for stock control.
- Where the Project access may require improvement to existing landholder infrastructure, addition or replacement will be provided for items such as gates, grids, culverts or signage to mitigate impacts on access and infrastructure to the properties.
- Weed management and vegetation clearance on the easement will also be addressed.

14.0 Visual Amenity

14.1 Existing Environment

14.1.1 Methodology

There are no established measures of significance that exist for landscape or visual impacts. The significance of impact is therefore determined by considering the sensitivity of the landscape or visual receptor and the magnitude of change expected because of the proposed development. In accordance with the Guidance Note for Landscape and Visual Assessment (Australian Institute of Landscape Architects, 2018) the following is defined:

- Sensitivity is defined as the capacity for a landscape or receptor to change without losing its valued attributes.
- Magnitude is defined as the extent of change that will be experienced by receptors. This change can occur as both positive or negative. Factors that could be considered in assessing magnitude can include the type, extent, size of the change or the rate, contrast or duration of the impact.

To assess the Project's potential impacts the existing character of the location has been assessed to develop an understanding of visual receptors and the landscape. Visual and landscape amenity were then assessed based on the Project's built form (Chapter 3.0) to develop an understanding of the magnitude of change. Table 24 describes the criteria used for the assessment of visual and landscape amenity impacts.

Table 24 Visual and Landscape Amenity Impacts

Severity / Magnitude Matrix						
		Magnitude				
		Minor	*Moderate*	*High*	*Major*	*Critical*
Sensitivity	*Critical*	Medium	High	High	Severe	Severe
	Major	Low	Medium	High	High	Severe
	High	Low	Medium	Medium	High	Severe
	Moderate	Low	Low	Medium	High	High
	Minor	Low	Low	Low	Medium	High

Factor	**Sensitivity**		**Magnitude**	
	Landscape	**Visual Amenity**	**Landscape**	**Visual Amenity**
Critical	A highly protected landscape known for its National value or significant features or value at a large scale.	Significant impacts a large number of viewers in a well-used or popular location.	Significant change in the landscape affecting a large area fundamentally changing its character.	Severe widespread change of environmental landscape features evident from long distances away (2 km or more) or obstructing significant amounts of the view from close by.
Major	A protected landscape with occasional	Medium density of viewers impacted with	Major loss of environmental amenity	Major loss of environmental landscape features evident from moderate

Factor	Sensitivity		Magnitude	
	Landscape	**Visual Amenity**	**Landscape**	**Visual Amenity**
	significant landscape features present.	some interest in their environment.	restricted to a certain area.	distances away (500 m or more) or obstructing large amounts of the view from close by.
High	A valued landscape with regional importance or protections under State designations with few or occasional disturbance present.	Low density of viewers impacted with some interest in their environment.	Substantial instances of loss of landscape features that could be reversed with intensive efforts.	Substantial instances of environmental landscape change only evident from moderate distances away (100 m or more) or obstructing moderate amounts of the view from close by.
Moderate	A landscape with limited values and presence of similar / other disturbance.	Isolated impacts to a small amount viewers with a low interest in the environment.	Isolated but substantial instances of landscape character impact that could be reversed with intensive efforts.	Isolated but substantial instances of environmental landscape change only evident immediately within the local environment.
Minor	A landscape with limited value or lacking scenic quality with other disturbance present.	Minor impacts to a few individual viewers over a small duration.	Minor incident of impacts to landscape character that can be reversed.	Minor incident of environmental landscape that is proposed to be reversed.

14.1.2 Settlement and Infrastructure

The Project site lies in a rural area adjacent to the Burdekin River. The Project's location is currently used for cattle grazing while immediately adjacent to the Project site is a Sunwater pump station, which is cleared and contains pump infrastructure predominantly made from concrete. Surrounding the Project site is remnant vegetation along the banks of the Burdekin River. To the west of the alignment the land is predominantly used for agriculture, with an agricultural channel running north to south.

The Project site is intersected by the Ayr-Dalbeg Road, a State Controlled Road and the Invicta Mill Cane Rail Line. There are very few settlements in the wider area, which typically consist of farmsteads.

14.1.3 Landform, Hydrology and Rural Land Use

Land use surrounding the Project site is discussed in Chapter 4.0 Land and Chapter 13.0 Land Use.

Landforms within the Project site are consistent throughout the wider area. Positioned on the upper bank of the Burdekin River, the Project is situated on generally flat (40 m AHD) remnant eucalypt vegetation. The Burdekin River is the main watercourse near the Project site to the east, while an agricultural channel is present to the west. Neither are intersected by the Project.

Existing land uses within the Project site include grazing (cattle), powerline infrastructure and agricultural channel in the western Lot of the alignment. A road and rail corridor intersecting the centre of the alignment and a Sunwater pump station to the south of the Project site. These are presented in Figure 8.

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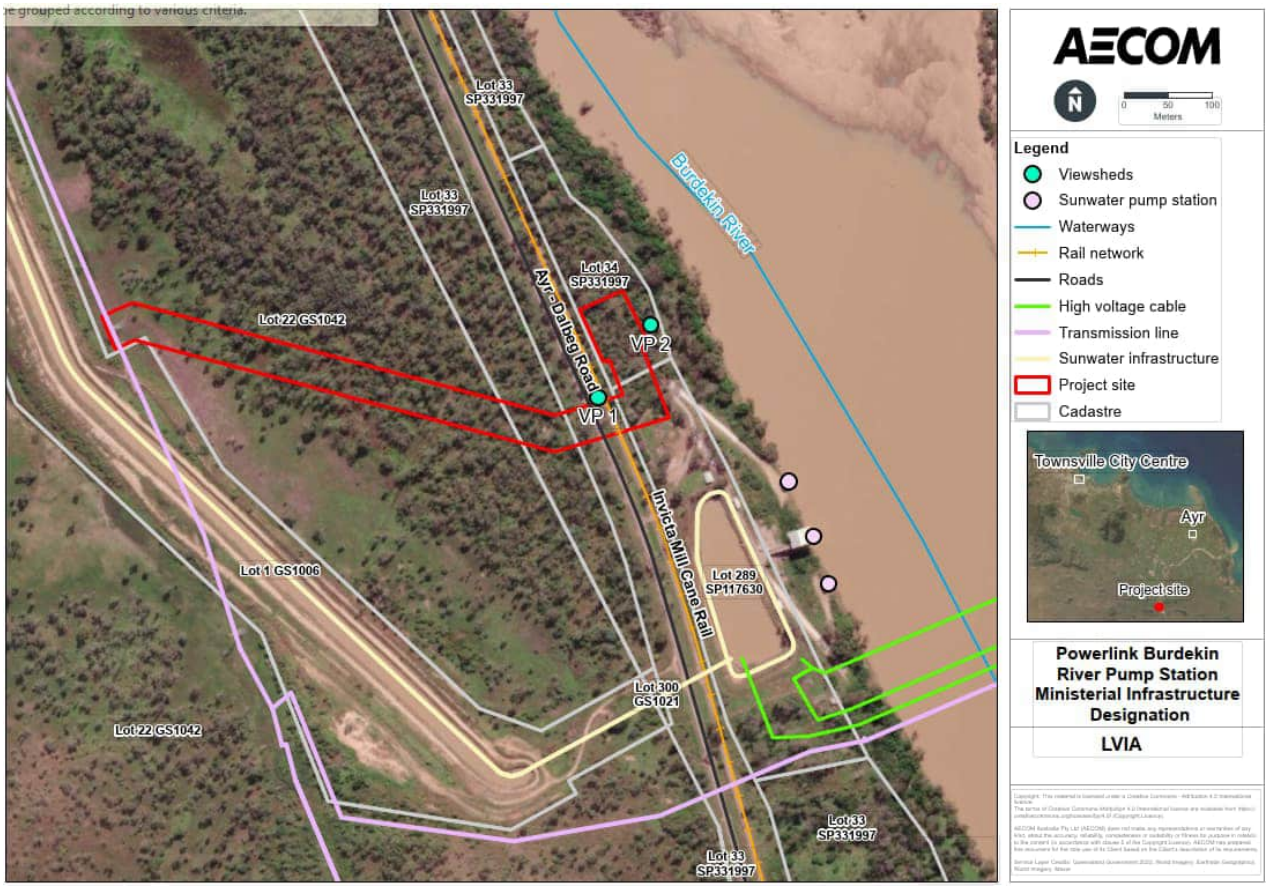

Figure 8 LVIA

14.1.4 Landscape Character

One character type has been identified as present, being rural alluvial plains, which encapsulates the Burdekin River and its wider floodplain upon which the Project sits on.

14.1.5 Visual Receptors

There are currently very few residents living in this rural area. Visual receptors potentially experiencing views of the Project are likely to include:

- Residents on rural settlements and properties on the farmland surrounding the Project site.
- People working in the countryside (farmers, Sunwater employees).
- Recreational users on the Burdekin River, noting that flows may only navigable during the wet season.
- Travellers using the Ayr-Dalbeg Road intersecting the Project site.

Based on these visual receptors, two representative viewpoints were assessed in detail to provide an indication of the potential visual impact of the Project:

- Viewpoint 1: Ayr-Dalbeg Road looking north / south.
- Viewpoint 2: Ayr-Burdekin River looking west.

These locations and relevant photographs are displayed in Figure 8.

14.2 Potential Impacts

14.2.1 Landscape Amenity

An evaluation of the overall potential impacts on landscape amenity was based on the sensitivity of the existing landscape to change and the magnitude of change resulting from the Project's development (Table 25). The assessment determined that the Project would not have a significant impact on the landscape character in the area.

Table 25 Landscape Assessment Summary

Landscape Character Type	Sensitivity	Magnitude	Significance
Rural alluvial plains	Low	Low	Minor (Not Significant)

14.2.2 Visual Amenity

The likely visual impact of the OHTL anticipated during the operation of the Project is along the Ayr-Dalberg Road (Table 26). Viewsheds from the road and the Burdekin River were considered as part of the assessment, however access to the Burdekin River and opposite bank was unavailable during survey and has been assessed via aerial imagery. All other view sheds are unlikely to be occasionally exposed to visual receptors based on the presence of remnant vegetation and access constraints.

Construction visual impacts were considered to be temporary and considered to be a low significance.

Table 26 Visual Impact Assessment Summary

Viewpoint	Sensitivity	Magnitude	Significance
VP 1: Ayr – Dalberg Road	Low	Low	Minor (Not Significant)
VP 2: Burdekin River	Low	Low	Minor (Not Significant)

14.2.3 VP 1: Ayr-Dalberg Road

Ayr-Dalbeg Road is the main viewshed for visual receptors likely to be impacted by the Project, predominantly as receptors drive past (Plate 1 and Plate 2). The road has two key bends to the north and south of the Project site, as it follows the Burdekin River. The area to either side of the road is vegetated, containing mature eucalypt species. The substation will be setback on the opposite side of the Invicta Mill Cane Rail Line and remnant vegetation, reducing the impact on this view point.

The key impact to this location will be the transmission towers and crossing over Ayr-Dalbeg Road which will be visible to road users. Due to the short length of road between bends (approximately 2.7 km), the duration of which the Project will be visible to receptors in this viewshed is minimal. Furthermore, the Project's location is adjacent to the existing Sunwater pump station, which has cleared nearby vegetation for access. The co-location with existing impacts reduces the sensitivity of the landscape to disturbance.

Plate 1 VP 1: Ayr-Dalberg Road Viewshed: View of the substation (looking north)

Plate 2 **VP 1: Ayr-Dalberg Road Viewshed: View of the road corridor (looking north)**

Plate 3 **VP 1: Ayr-Dalberg Road Viewshed: View of the crossing location including railway line and remnant vegetation (looking north east)**

Plate 4 **VP2: Remnant vegetation along the Burdekin River to be retained nearby the substation location (looking east)**

14.2.4 VP 2: Burdekin River

The Project's substation will potentially be visible from the Burdekin River to visual receptors undertaking boating activities during times of flow. As discussed in Section 14.2.3, there is a bend in the Burdekin River to the north and the south, reducing the duration of which the Project will be visible to sensitive receptors (Plate 4). Furthermore, the Project's location is adjacent to an existing Sunwater pump station, which has cleared the adjacent bank of vegetation for access.

The co-location with existing infrastructure reduces the sensitivity of the landscape to disturbance. This is relevant along the bank of the Burdekin as the Project will not require clearing of the river bank with mature vegetation along the river bank anticipated to be retained, further reducing exposure of the substation to visual receptors.

The structures associated with the substation and transmission towers will form a visible element of the viewshed within the local environment however this will not be a defining part of the landscape. There will be a noticeable change particularly along Ayr-Dalberg Road, whilst the structures will be evident, they will not change the fundamental visual character of the landscape and will blend with the existing infrastructure to a considerable extent. This is due to the combination of existing built form in the surrounding area such as the road, Invicta Cane Rail Line and Sunwater pump station paired with the short duration receptors will be exposed to the feature due to the alignment of the road.

14.3 Mitigation and Management Measures

The Project site currently receives screening by existing vegetation, however due to the size of typical structures, it is not possible to fully 'screen' or 'hide' the transmission structures or associated infrastructure within the landscape. The measures outlined in Table 27 could assist in reducing the Project's visual footprint, particularly when viewed from the road.

Table 27 Description of Measures to Minimise Landscape and Visual Effects

Mitigation Category	Measure
Facilities siting and design – detailed design	• The natural line of the landscape will be used wherever practicable to reduce visibility and assist integration of the Project infrastructure. Particularly when it comes to clearing native vegetation, which should be retained where practicable. • Transmission line height will be reduced to as low as practicable, while the spacing of the transmission structures will be maximised where possible to minimise impacts above the vegetation layer.
Landscape strategy to hide/screen the substation and other elements	Retain existing vegetation, where possible, around the corridor or associated with roads and properties near the corridor to the greatest extent compatible with safety.
Construction management and rehabilitation	An EMP has been developed for the OHTL and substation site that includes measures that seek to manage vegetation, dust, waste and other elements that have the potential to impact landscape and/or visual amenity and has been included in Appendix B and Appendix C.

15.0 Social and Economic

15.1 Existing Environment

The Project site is located approximately 15 km south of the township of Clare, within the Burdekin Shire Council LGA. The Project site is within a sparsely populated area and traverses rural properties associated with cattle grazing. Clare is the nearest population centre, with Ayr located approximately 40 km to the north.

The Burdekin Shire Council LGA represent the regional community of interest. While the Project site falls within the Mulgrave State Suburb described by the Australian Bureau of Statistics (ABS) (Australian Bureau of Statistics, 2021a), this area has 19 individuals. As the nearest town, Clare, is located in close proximity and has a higher proportion of residents potentially impacted by the Project (Australian Bureau of Statistics, 2021b), this State Suburb profile has been used to develop regional economic and social characteristics.

Relevant stakeholders (local and regional) and consultation activities are detailed in Chapter 28.0 Community and Stakeholder Consultation.

15.1.1 Regional Social Characteristics

State Suburb level figures have been provided for high level indicators including population, dwellings and household incomes across the Project site. The population nearby the Project is predominately located in Clare, the demographic of which is characterised by a sparsely populated ageing population with low median weekly household incomes compared to Queensland. The population of Clare has decreased from 310 individuals to 201 between 2011 and 2021 a decline of approximately 33%.

Table 28 Project Site Profile Based on State Suburb Data (Australian Bureau of Statistics, 2021b)

State Suburb (SSC) area	2016 Population	Male (%)	Female (%)	Median Age	No. Private Dwellings	Median Weekly Household Income ($)
Clare	196	55.4	44.6	41	96	1,547

15.1.2 Regional Economic Characteristics

There are a total of 87 private dwellings within Clare, with an average of 2.2 people per household and a median weekly household income of $1,625 and a median mortgage repayment of $1,300. A total of 107 individuals (65.2 %) of the population are employed in the labour force, of which 71 individuals (66.4 %) are employed full time and 27 individuals (25.2 %) work part time (Australian Bureau of Statistics, 2021b).

The highest occupation roles are managers (36 individuals), labourers (22 individuals) and machinery operators / drivers (14 individuals). Sugar cane growing employs the majority of people (45 individuals) with other industries suppling a small portion of the workforce being primary education (8 individuals), sugar manufacturing (6 individuals), beef cattle farming (4 individuals) and physiotherapy (4 individuals) (Australian Bureau of Statistics, 2021b).

15.2 Potential Impacts

Given the sparse population within the Project site, the Project is not anticipated to have a significant impact on the community. As the construction phase is temporary, and workers are not proposed to be permanently relocated to the region, elements of the community profile are not anticipated to be impacted to a noticeable level. During construction, there will be a temporary influx of workers into the region. Temporary construction camps are not required for the construction phase workforce.

The operational phase of the Project is not anticipated to have any material impact upon the demographic profile of local and regional populations. Workers will travel to the Project site during the

operational phase to undertake maintenance activities, however, it is short term and temporary in nature.

15.2.1 Local and Regional Benefits

During operation, Powerlink employees will be required to travel to the Project site for regular maintenance activities. Powerlink employees are likely to stay with the region at existing accommodation facilities, as well as spend money for food, fuel and a range of other potential services. During both construction and operation, there is a potential for a direct benefit to the local community, in employment and provision of local services.

Due to the Project's small footprint, local and regional financial benefit is likely to be relatively minor. However, as the Project is enabling infrastructure for a larger project, this will support large infrastructure upgrades for the wider region including the facilitation of jobs associated with the Haughton Pipeline (Stage 2). This Project is anticipated to assist in securing Townsville's potable water supply.

15.2.2 Lifestyle and Amenity

There is the potential for the following temporary impacts during construction:

- Management of cattle stock in proximity of the transmission line.
- Noise emissions from the operation of machinery.
- Dust emissions associated with earthworks.
- Traffic disruptions.

These impacts are discussed further in Chapter 13.0 Land Use. Powerlink will continue to work closely with landholders prior to and during the construction period to ensure they are aware of the type, location and timing of construction activities on their properties and to minimise construction impacts where possible.

The transmission line and substation will introduce a new permanent structure into the visual landscape. Visual impacts and potential mitigation measures are addressed in detail within Chapter 14.0 Visual Amenity. It was concluded that the overall impact on visual amenity is anticipated be low.

OHTL noise is not expected to be audible at any residence, nor will any property owners be affected by any noise or vibration generated by the substation. Noise and vibration impacts and mitigation measures will be considered by Powerlink and are addressed in Chapter 19.0 Noise and Vibration. Maintenance checks will be conducted regularly on the infrastructure.

15.3 Mitigation and Management Measures

The Project is unlikely to have significant adverse impacts on the socio-economic profile of the area during the construction or maintenance/operational phases of the Project. The development of this Project will assist and support the region to develop and prosper through the benefits of job creation and water security associated the Haughton Pipeline (Stage 2).

Powerlink will continue working closely with affected landholders to ensure they are informed of upcoming Project activities.

The following mitigation and management measures have been considered:

- **Population and Community** – construction and maintenance workforce will be temporary and will not significantly influence the existing community profile. As such, no specific management or mitigation measures are considered relevant.
- **Economic Effects** – Powerlink and TCC have commenced negotiations with landholders to voluntarily acquire easements for the proposed OHTL and substation site. Powerlink will make a one-off lump sum compensation payment at the conclusion of compensation negotiations. This is consistent with compensation practices across the industry.

- **Construction Phase** – Site rehabilitation will be undertaken progressively during construction where practicable and Powerlink will ensure all disturbed areas impacted from construction are rehabilitated at the end of the Project. All works will be in accordance with the requirements specified in the Projects EMP (Appendix B and Appendix C) and relevant Powerlink policies.
- **Operational Phase** – the existing cattle grazing can continue within the OHTL easement. The amount of activity on site will decrease substantially. During operation, normal practice is for maintenance staff to carry out scheduled inspections of the transmission line, substation, easement and access tracks on average twice per year. All operational activities will be carried out in accordance with relevant Powerlink policies. All works will be in accordance with the requirements specified in the Projects EMP (Appendix B and Appendix C) and relevant Powerlink policies.

16.0 Indigenous Cultural Heritage

16.1 Cultural Heritage Database Searches

A Cultural Heritage Survey and Impact Assessment Study for the Haughton Pipeline Project Stage 2 Upper Haughton to the Burdekin River was undertaken in November - December 2021 by Michele Bird in conjunction with the Bindal People.

As part of the Cultural Heritage Survey, searches of the Indigenous Cultural Heritage Database and Register were undertaken in 2021. The search stated the following:

- *The cultural heritage party for the area is the Bindal People #2*
- *The cultural heritage body for the area is Gudjuda Reference Group Aboriginal Corporation*
- *There are no Aboriginal cultural heritage site points recorded in the specific search area*
- *There are no cultural heritage management plans recorded for the specific search area*
- *There are no Designated Landscape Areas (DLA) recorded in the search area*
- *There are no Registered cultural Heritage Study Areas recoded in the search area.*

In addition, Federal and State cultural heritage databases and register were searched resulting in no significant Aboriginal cultural heritage sites, places or values listed within the search area.

16.2 Cultural Heritage Field Assessment

The cultural heritage field survey and assessment was undertaken for approximately 28 km of pipeline alignment and ancillary work areas including the originating substation and OHTL footprint (Figure 9).

Figure 9 demonstrates that the Project site has been amended since the cultural heritage field survey was undertaken.

Figure 9 Cultural Heritage Survey Area

One Aboriginal cultural site/feature was identified (Scarred Tree) which is located outside the Project site.

16.2.1 Mitigation and Management Measures

To align with the Cultural Heritage Survey and Impact Assessment Study for the Haughton Pipeline Project Stage 2 Upper Haughton to the Burdekin River, additional consultation will be undertaken with the Bindal People to discuss the amended Project footprint.

Therefore, the revised Project site will need to undergo further consultation with the Bindal People prior to commencement of works.

17.0 Non-Indigenous Cultural Heritage

17.1 Historical Background and Past Development

17.1.1 Non-Indigenous Historical Background

The first known exploration of the now-Burdekin Shire was by the explorer Ludwig Leichardt, who travelled along the Burdekin River and its tributaries from February to May 1845. He visited the Burdekin River approximately 54 km south-west of the Project site in early April 1845, and described the landscape as 'ridgy, openly timbered, stony and sandy' with areas of 'more level, more open and better grassed'. While he noted animals, including kangaroos, ducks, and native dogs in the area, he did not encounter any Aboriginal people (Leichardt, 1847).

Following Leichhardt, the explorer Augustus Charles Gregory explored the region in late October 1856. He noted that the Ravenswood area consisted of 'bloodwood, ironbark, Moreton-Bay ash, and poplar gum, with a few pandanus'. Again, no Aboriginal people were encountered in this area (Gregory & Gregory, 1884).

The Burdekin Shire was opened for free settlement as part of the Kennedy pastoral district in 1860, and the Project site was taken up as part of the Woodhouse Run by 1905 (Government Engraving Office, 1868; Queensland Survey Office, 1905). Gold was discovered on the Ravenswood run to the south-west in 1868, sparking a gold rush which brought an influx of prospectors and settlers to the area (Government Engraving Office, 1868; Kerr, 1990). An unnamed, very small, and now abandoned goldmine (Unnamed 230958) was established 730 m south of the Project site at the eastern edge of Mount Dalrymple. It is unknown when this mine was opened or closed, but it was likely part of the late 19th century Ravenswood rush (Kerr, 1990).

As numbers of settlers in the Burdekin region increased, so did conflict with Aboriginal people. A special branch of the colonial police service, the Native Mounted Police (NMP), was dispatched to the area to quell the discord. The NMP Kirknee Creek Camp (also spelt Kirknie or Kirkney) was set up 11.8 km south-east of the Project site at the junction of the Bogie and Burdekin Rivers. The camp was established in 1872 and existed for seven years, servicing the surrounding area (Burke & Wallis, 2019).

From the late 19th century, sugar began supplanting cattle as the main industry in this part of the Kennedy district. Sugar mills were established throughout the region, and the Clare area was divided up for solider settlement following WWII (Centre for the Government of Queensland, 2018).

However, all available mapping and historical aerials suggests that the Project site remained largely uncleared apart from the road, which was originally constructed prior to 1943 as a one-traffic stream road suitable for light motorised vehicles and horse transport. In the early 1980s the private Invicta Mill railway was built through the Project site, and the Ayr-Dalbeg Road underwent a series of upgrades. It was also at this time that the irrigation channel, dam, and pump station in the Project site were constructed as part of the Burdekin-Haughton irrigation scheme. A transmission tower was constructed in the 1990's to aid in communications in the area (Figure 10 to Figure 13).

17.1.2 Past Development

The Project site has been subject to vegetation clearance and earth moving works during the construction of roads and the transmission tower and lines.

Analysis of historical maps and aerial imagery shows:

The 1943 Clare 1 Inch Series Sheet No. 133 Zone 7 shows the Project site within an area of scattered timber, with the original one-traffic stream road suitable for light motorised vehicles and horse transport located along the Burdekin River (Figure 10).

- The earliest historical aerial imagery from 1969 indicates that some ground disturbance and vegetation clearance had occurred in the eastern extent of the Project site from the construction of the original Ayr-Dalbeg Road prior to 1969 (Figure 11).
- By 1971, Ayr-Dalbeg Road had some minor upgrades.

- By 1982, an access track had been built in the western extent of the Project site and another access track had been built to the west of Ayr-Dalbeg Road. The Invicta Mill Private railway had been built by 1982 directly to the east of the Ayr-Dalbeg Road.
- By 1986, Ayr-Dalbeg Road had further upgrades, and access tracks had been constructed to the east of Ayr-Dalbeg Road. Vegetation had been cleared in the western extent of the Project site to facilitate the construction of an irrigation channel and roads located 50 m west of the Project site, and vegetation was cleared in the southern portion of the eastern extent to facilitate the construction of a dam located 110 m south of the Project site (Figure 12).
- Vegetation clearance occurred between 1994 and to construct the transmission tower and line located in the western extent of the Project site (Figure 13).
- Further road upgrades to Ayr-Dalbeg Road have occurred between 2003 and present day (Figure 10).

Figure 10 1943 Clare 1 Inch Series Map

Figure 11 1969 Aerial

Figure 12 1986 Aerial

Figure 13 2003 Aerial

17.1.3 Heritage Register Searches

A search of relevant Commonwealth, State and Local heritage registers was conducted on 18 October 2023. These searches indicated that there are no registered historical heritage places within the Project site (Table 29).

Table 29 Summary of Historical Heritage Register Searches of the Project Site

Register	In Project site
World Heritage List	None
Commonwealth Heritage List	None
Queensland Heritage Register	None
Local Heritage Register	None
On Statutory Heritage Sites	None

17.1.4 Historical Heritage Due Diligence Assessment

Historical heritage places are protected by inclusion on heritage registers at the Commonwealth, State, or Local level. The *Queensland Heritage Act 1992* also provides protection for places that are not currently listed on the Queensland Heritage Register but meet the threshold for inclusion, and for archaeological finds that have the potential to provide information about an aspect of Queensland's history.

The following assessment of historical heritage risk is provided for the Project site (Table 30).

Table 30 Historical Heritage Due Diligence

Question	Answer
Will the activity impact any federal, state, or local heritage places?	No. There are no federal, state, or local heritage places located in or adjacent the Project site.

Question	Answer
Are there any other places, features, items, or objects which have not been registered but which may be of heritage value?	No. Powerlink is not aware of any other places, features, items, or objects which have not been registered but may be of heritage value within the Project site. There is little to no potential for surface and subsurface historical archaeological deposits to be present within the Project site.

17.2 Potential Impacts

17.2.1 Impacts to Known Heritage Values

There are no registered historical heritage places within or directly adjacent to the Project site, and so no impacts are proposed to known heritage values.

17.2.2 Impacts to Unknown Heritage Values

There is some potential for the Project to impact unidentified historical heritage places. Any such unidentified places are most likely to relate to the pastoral or mining history of the region.

17.3 Mitigation and Management Measures

Historical archaeological potential for the Project site is assessed as low, based on the key assessment findings summarised below:

- No previously recorded statutory or non-statutory historical heritage places, or other places, features, items.
- No objects of heritage value are located in the Project site (which have not been registered).
- Ground disturbance has occurred in the Project site from the construction and upgrades of Ayr-Dalbeg Road, private railway, irrigation channel, and various access roads, and the construction of the transmission line and tower.

Based on the above findings, the following recommendations are made:

- Project works may proceed within the Project site under the guidance of an Unexpected Finds Procedure.
- Cultural heritage inductions for all Project personnel engaged in ground-breaking works.
- Implementation of procedures in the case of unexpected finds.
- Cease all works in the vicinity of the find.
- Inform supervisor or cultural heritage coordinator.
- A qualified archaeologist will make an assessment and recommend management measures.

18.0 Transport and Traffic

18.1 Methodology

The Traffic Impact Assessment was undertaken through the assessment of Project transport routes and an understanding of Project related activities. The Traffic Impact Assessment has been included in Appendix E. This chapter summarises the potential impact of the Project on existing transport infrastructure on road networks (State-controlled roads and local authority roads), aerodromes and flight paths, and railways.

The methodology used in the Traffic Impact Assessment including key assumptions and limitations of this assessment are described in Appendix E: Traffic Impact Assessment.

18.2 Existing Environment

18.2.1 Road networks

Road networks utilised by Project traffic are likely to consist of State-controlled Roads including:

- Bruce Highway
- Townsville Port Road
- Ayr-Dalbeg Road.

All three State-controlled Roads are located within the DTMR Northern District. Two of the roads are located within the TCC while one is located within the Burdekin Shire Council.

The Project site will intersect the Ayr-Dalbeg Road, which runs north – south crossing over the road.

18.2.2 Rail networks

The Project site intersects one railway line being the Invicta Mill Cane Rail. The railway line runs adjacent to the Ayr-Dalbeg Road.

18.2.3 Aerodromes and Flight Paths

A search for existing aerodromes and flight paths conducted via the Queensland Spatial Catalogue website and Queensland Globe. No certified aerodromes or flight paths were found within the or nearby the Project site. Activities such as aerial crop spraying, recreational flying and aerial mustering may exist in close proximity to the Project site. These activities will be confirmed by Powerlink during consultation with local landholders.

18.3 Potential Impacts

No high risk impacts were identified by the road safety assessment, with low and medium risks described below (Appendix E):

- Low risk
  - increase in turning movements at the Bruce Highway/Ayr-Dalbeg Road intersection.
- Medium risk
  - increase in vehicle movements across the existing rail level crossings on Ayr-Dalbeg Road.
  - increase in vehicle numbers on sections of the State-controlled road network, in particular Ayr-Dalbeg Road.
  - two new site access points on Ayr-Dalbeg Road.
  - Existing roadside vegetation is noted to restrict potential sightlines to/from the proposed site access locations on Ayr-Dalbeg Road.

These risks have the potential to lead to increased vehicle conflicts at these locations and/or increase in road link operation/capacity of the link.

18.4 Mitigation and Management Measures

To address the potential risks identified in Section 18.3, the following management and mitigation measures are proposed:

- As part of the Project works it is proposed that the two new site access points will be constructed generally in accordance with the rural property access arrangement for articulated vehicles (Type C) outlined in TMR Standard Drawing 1807.
- Based on the current restrictions to sightlines to/from the proposed access points, it is recommended that roadside vegetation clearing be undertaken to open up/provide suitable sight distances. In addition, it is also recommended that advanced warning signage be provided on both Ayr-Dalbeg Road approaches to provide further delineation of the access points to motorists and highlight the potential for vehicle movements entering and exiting at these locations.
- Provision of give way control to the new level crossing of the Invicta Mill Cane Rail Line approximately 15m to the east of Ayr-Dalbeg Road as part of the proposed site access arrangements for the Project's substation area.

In general the Traffic Impact Assessment identified that the additional traffic generated by the construction and operations phases of the Project would likely have a minor impact on the condition and operation of the surrounding road network and recommended that the Project be approved from a traffic engineering viewpoint.

19.0 Noise and Vibration

A Noise and Vibration Assessment was undertaken for the Project. The assessment is provided in Appendix F: Noise and Vibration Technical Report. This chapter summarises the noise and vibrational impacts from the Project.

19.1 Existing Environment

19.1.1 Noise Sensitive Receptors

Residential receptors with the potential to be affected by the Project exist to the north and south of the site, with the closest receptors located approximately 1 km to the south-east and 2 km to the north of the Project site (Figure 3). These receptors are classified a rural residential dwelling.

The noise and vibration assessment only considered the nearest residential receptor to the south of the site. Compliance at this receptor implies compliance at residential receptors located further from the Project site.

19.2 Potential Impacts

19.2.1 Construction / Decommissioning Noise and Vibration

The construction and decommissioning activities have been assessed against the established noise limits. Compliant setback distances have been calculated based on these. The construction scenarios assessed are not predicted to exceed the noise limit at any sensitive receptor across all scenarios.

Vibration-intensive works are expected to take place well within safe working distances for building damage and human comfort criteria. It is recommended that these safe working distances be used to guide the plant selection for the construction of the Project.

19.2.2 Operational Noise and Vibration

The Noise and Vibration Assessment concludes that all of the noise-sensitive receptors in the area are beyond the predicted operational noise setback distances from the Project and comply with the most stringent operational noise limits across the Project.

Setback distances around the substation at which the noise limits can be achieved have also been calculated.

The cumulative noise impacts from the Burdekin River Pump Station and the Project have been considered, and the noise contribution of the Project to the Burdekin River Pump Station receptors are predicted to be negligible, therefore cumulative noise impacts are unlikely to be an issue.

19.3 Mitigation and Management Measures

19.3.1 Construction Noise Mitigation Measures

The contractor should, where risk assessment deems necessary apply best-practice noise mitigation measures including the following.

- Appropriate plant and equipment to be selected for each task to minimise the noise contributions.
- Plant to be turned off when not in use.
- Plant is to be regularly maintained, and repaired or replaced if it becomes noisier.
- Emphasis should be placed during driver training and site induction sessions on the potential adverse impact of reversing alarms and exhaust brakes and the need to minimise their use.
- Wherever feasible, turning circles to be created at the end points of vehicle work legs, which should allow trucks to turn and avoid the need for reversing.
- Non-tonal reversing alarms to be used where practicable.

- It is recommended that works which generate substantial noise should commence from 7 am as to not encroach on the night-time period. It is recommended that the operation of all significant noise generating equipment is restricted to this time period.

19.3.2 Operational Noise Mitigations Measures

All operational activities associated with the Project will be subject to the standard noise mitigation measures described in Powerlink Queensland's *Standard Environmental Controls – Specification Document* which has been listed above (Section 19.3.1).

Mitigation measures proposed include:

- Appropriate plant and equipment to be selected for each task to minimise the noise contributions.
- Plant to be turned off when not in use.
- Plant is to be regularly maintained and repaired or replaced if it becomes noisier.
- Emphasis should be placed during driver training and site induction sessions on the potential adverse impact of reversing alarms and the need to minimise their use.
- Non-tonal reversing alarms to be used where practicable.

It is recommended that works that generate substantial noise should commence from 7 am as to not encroach on the night-time period. Maintenance works between 6:30 am and 7 am should include setting up site, toolbox talks and any other works that do not generate a significant level of noise.

20.0 Hazards, Health and Safety

This chapter describes the environmental conditions and values within the Project site and how hazards associated with the Project and local environment interact. Potential impacts from hazards are described and mitigation measures are provided to minimise the risk through the construction, operation and decommissioning phases of the Project.

This chapter provides a preliminary risk identification for the Project, including:

- Identification of potential Project hazards (e.g. accidents, spillages, fire and abnormal events) during construction, operation and decommissioning.
- Identification of potential natural hazards (e.g. cyclone, flooding, bushfire, landslide) and the implications of climate change.
- Discussion of potential mitigation measures, including the development and implementation of an emergency management plan.

The term hazards and risks are defined as follows.

- **Hazards**: A source of potential harm or an existing situation with a potential to cause loss, harm to people or damage to property and environment.
- **Risks**: The chance of something happening that will have an impact on objectives. A risk is often specified in terms of an event or circumstance and the consequences that may flow from it. Risk is measured in terms of a combination of the consequence of an event and its likelihood.

Assumptions and Limitations

This chapter has been carried out based on information available at the time of preparation of the assessment report, including research and information from the Project and technical team.

Further investigation and development of design may lead to the identification of additional hazards and associated risks, or changes to the identified risks. The Project will continuously monitor the identified risks and conduct risk assessments to identify and assess emergent risks throughout the Project lifecycle. Additional mitigation measures will be developed and documented throughout the Project as required.

Emergency management response plans for the Project will be developed in accordance with Powerlink Queensland's Emergency Management Procedures and incorporated into the Project Safety Management Plan. The Project emergency response plan discussed in this Chapter is described based on existing information and capability of the emergency crew with regards to the possible emergency events that could occur during Project construction, operation and decommissioning.

20.1 Existing Environment

There are hazards and associated risks in the existing environment (in the absence of the Project), such as natural events and some infrastructure. Existing risks and hazards may potentially be increased by the Project and an understanding of these risks enables the Project's risk contribution to be analysed.

Hazards in the existing environment include the following and have been discussed in the corresponding sections of the MID Proposal Report:

- **High voltage line** – Chapter 3.0 Project Description.
- **Contaminated land** – Chapter 4.0 Land.
- **Landslides** – Chapter 4.0 Land.
- **Flooding** – Chapter 7.0 Hydrology.
- **Cyclones** – Chapter 5.0 Climate.

- **Road and rail infrastructure** – Chapter 18.0 Transport and Traffic
- **Bushfire** – Chapter 22.0 Bushfire Risk.

20.2 Risk Identification

20.2.1 Methodology

The approach identifies the risks associated with identified hazards. For health, hazards and safety, the approach takes into account the location of population centres, population densities and activities conducted within and around the Project site. This provides a basis for the identification of risks and preparation of safeguards to manage and mitigate risks that might arise from the Project.

Risk identification comprises hazard identification and identification of the potential consequences of exposure to the hazard for sensitive receptors identified nearby the Project site.

20.2.2 Risk Identification Approach

The potential health, safety, and environmental hazards associated with high voltage electricity infrastructure have been identified. Sensitive receptors that may potentially be exposed to hazards associated with Project have been identified through desktop study. Sensitive receptors identified are shown on Figure 3.

Risk identification involves hazards and impacts identification. Risk treatment will then be applied to reduce the risk profile.

- **Hazards Identification**: The risk identification phase identifies hazards and their potential sensitive receptors during the lifecycle of the Project, including construction, operation and decommissioning. Receptors are not restricted to individuals or communities, and include sensitive environments such as land, water, flora and fauna.
- **Risk Treatment**: Mitigation measures and safeguards will be established to minimise the risk to the community, property, and environment. All risks will be managed through Powerlink management plans and risk management framework and procedures. Consideration will be given to the full lifecycle of the Project including construction, operation and decommissioning of the substation and transmission line.

20.2.3 Data Sources

Relevant data sets and sources for this assessment are provided in Table 31. This includes relevant risk assessments and disaster management plans that have been undertaken by Burdekin Shire Council.

Table 31 Data Set and Sources

Relevant Data	Sources
District Disaster Management Plans	Townsville (Northern District) (Queensland Government, 2023d)
Local Disaster Management Plan	Burdekin Shire Council (Burdekin Shire Council, 2023a)
Planning Scheme	Burdekin Shire Council (Burdekin Shire Council, 2023b)
Assessment Report Chapters	Chapters 4 – 25 of this Assessment Report.
Powerlink Policies, Plans, Strategies and Public Information	Functional Policy for Substation Site Selection, EMP, Emergency Response Plan, Asset Management Strategy, Powerlink Homepage
Climate Data	Bureau of Meteorology (Bureau of Meteorology, 2023b, 2023a)

20.2.4 Preliminary Risk Identification

The risk identification presented in this section is a desktop study evaluating the key Project risks. Technical studies undertaken as part of this assessment report have been incorporated into this assessment where applicable.

This risk identification documents only significant or high risk interactions between the Project and aspects of health, safety and environment during construction, operation and decommissioning.

The Project will comply with the Electricity Safety Act*, Work Health and Safety Act 2011* (WHS Act) and *Work Health and Safety Regulation 2011* (WHS Reg). For the purpose of the risk identification, the lifecycle of the Project is defined in the following phases:

- Construction – All activities up to the commencement of OHTL and substation commissioning.
- Operation – All aspects from the commencement of commissioning through to and including operation of the OHTL and substation.
- Decommissioning – All activities associated with dismantling and removal of the infrastructure and environmental rehabilitation.

Some hazards are only found in a specific location within the Project site. Therefore, the Project site has been divided into broad categories within which the characteristics and those of the surrounding environment are uniform.

The key hazards and risks identified during the preparation of the preliminary risk assessment are presented in Table 32 (location specific) and Table 33 (non-location specific). The pre-mitigated risks are assessed at this stage and during detailed design the construction risk assessment will be undertaken to identify critical controls to mitigate risks and maintain residual risk to acceptable levels.

This preliminary risk assessment forms part of the larger risk management process which will continue throughout the lifecycle of the Project and has sought to identify hazards which may presently exist prior to construction. The Project will be continuously monitored identify risks and conduct future risk assessments to identify and assess emergent risks throughout the Project lifecycle.

Table 32 Location Specific Hazards

Location	Hazards	Potential Health, Safety and Environmental Impacts
Ayr-Dalbeg Road and Invicta Mill Cane Rail Line OHTL Crossing	Contact with high voltage electricity	• Injuries, e.g. cardiac arrest, electrical shock • Fatality
Upper bank of the Burdekin River	Landslide	• Instability of substation • Significant failure of infrastructure and service delivery • Change of construction plan • Injuries or fatality, e.g. struck by moving rocks
Lot 22 on GS1042	Contaminated land	• Excavation of contaminated land from sites listed on EMR/ CLR and further potential contamination, including landfill, petroleum oil storage • Contamination to watercourses • Disposal of contaminated material and/ or on site remediation of contaminated soil
Upper bank of the Burdekin River	Flood	• Transmission line damage and loss of service delivery • Damage to electrical assets • Loss of access to infrastructure • Inundation of construction laydown areas
Intersection with existing transmission line	Electric and Magnetic Fields	• Perceived health impacts • Induction on adjacent metal objects • Electrical shock or electrocution (from contact with objects with induced current)

Table 33 Non-Location Specific Hazards

Hazards	Life Cycle	Potential Health, Safety and Environmental Impacts
Spread of animal or plant disease (e.g. via vehicles and mobile plant and equipment)	• Construction • Operation (maintenance) • Decommissioning	• Potential stock losses or quarantines impacts agricultural industry • Loss of biodiversity • Changes to irrigation requirements • Possible health hazards to animals
Waste (e.g. waste concrete, timber, plastic packaging)	• Construction • Decommissioning	• Offensive odour • Impact on visual amenity, e.g. temporary stockpile • Cross contamination of hazardous materials with general waste polluting soil
Sewerage	• Construction • Decommissioning	• Offensive odour • Pollution to watercourses • Increase nutrients and risk of disease in event of accidental release
Bushfires	• Construction • Operation (maintenance) • Decommissioning	• Asset-initiated bushfire – damage to neighbouring infrastructure and properties • Transmission line structural failure and loss of service delivery • Potential for flammable goods to escalate risk of encroaching bushfire • Injuries or fatality
Dangerous Goods and Hazardous Substance Storage and Handling	• Construction • Operation (maintenance) • Decommissioning	• Loss of containment • Pollution to stormwater and soil • Potential fire from flammable goods • Health impacts • Escalate the risk of bushfire
Dangerous Goods and Hazardous Substance Transportation	• Construction • Operation (maintenance) • Decommissioning	• Loss of containment • Pollution to stormwater and soil • Potential fire from flammable goods • Escalate the risk of bushfire
Contact with underground services	• Construction • Operation (maintenance)	• Injuries, e.g. cardiac arrest, electrical shock • Fatality
Contact with high voltage electricity	• Operation	• Injuries, e.g. cardiac arrest, electrical shock • Fatality

Hazards	Life Cycle	Potential Health, Safety and Environmental Impacts
Overhead equipment and transmission line collision, e.g. overhead cranes, low flying helicopters patrols	• Construction • Operation • Decommissioning	• Dropped loads • Injuries, e.g. fracture, concussion • Contact with live electricity • Fatality • Livestock loss • Property damage
Hot work and machinery use	• Construction • Operation (maintenance) • Decommissioning	• Risk of fire or explosion from ignition of flammable contaminants. • Sparks act as catalyst for bush fire, live electricity near bushfire transmission line escalate the risk
Dust e.g. from roadworks, clearing of land, installation	• Construction	• Poor visibility • Residential complaints • Respiratory irritation
Public vehicle interaction	• Construction • Decommissioning	• Injuries e.g. fractures, bruises, cut • Increase of traffic volume through local roads, traffic congestion • Increase in road wear
Noise and vibration	• Construction • Decommissioning	• Nuisance and disturbance to residential
Fatigue	• Construction • Operation (maintenance) • Decommissioning	• Public roads traffic accidents • Fatality
Vandalisms, e.g. security breach	• Construction • Operation • Decommissioning	• Compromising infrastructure security • Contact with live electricity

20.2.5 Mitigation and Management Measures

Proposed controls will be considered during detailed design and through the construction risk assessment process. The controls will be based on existing Powerlink safety management systems. Powerlink will have ongoing liaison with landholders on hazards and risks associated with construction and operation of the Project. The management strategies practiced by Powerlink will be in place for the duration of the Project and are not limited to the control measures discussed in the proposal report.

20.2.6 Natural Hazards and Environmental Management Plan

The Project site traverses potential bushfire, cyclone and landslide prone regions. The design and implementation of the Project has considered the impacts of potential natural hazards and will manage these hazards to minimise impact to the health, safety and environment to so far as is reasonably practicable. The environmental values that have the potential to be impacted throughout the Project lifecycle will be managed in accordance with *Powerlink Standard Environmental Controls Specification* and relevant Australian Standards to ensure compliance with the legislative requirements, such as the EP Act.

20.2.6.1 Bushfire

Powerlink has an established policy for bushfire management which will be applied throughout the Project lifecycle. Ground patrols are carried out to assess vegetation clearance and the condition of transmission lines and access tracks.

Vegetation around substation buffer zones and directly adjacent to security fencing is kept to a minimum. Based on growth rates or special requirements, Powerlink will remove unsafe vegetation as necessary, which can include the use of approved herbicides and removal or trimming of incompatible vegetation.

Monitoring of weather and identification of severe weather events in areas of operation will be undertaken.

The design of the Project site will ensure adequate emergency service access. Consideration will be given to the provision for first response firefighting, accessible and sufficient water supply for firefighting purposes and the development of safe evacuation plans.

For further information, refer to Chapter 22.0 Bushfire Risk.

20.2.6.2 Flood and Cyclones

The substation is required to be installed above the 0.5% AEP water level in accordance with the *Planning for stronger, more resilient electrical infrastructure guidelines* (Queensland Reconstruction Authority, 2012) . Flood assessment, conducted in Chapter 7 Hydrology, show the substation is located above the 0.5% AEP flood envelope.

Foundations are generally designed to AS7000:2010 (Overhead Line Design) and AS2159:2009 (Piling – design and installation). The transmission lines themselves will be designed to be well above large to rare flood levels.

The location of access tracks for construction and maintenance of the Project avoid watercourse crossings and will be designed and constructed to avoid impeding surface water flow velocities and volumes.

For further information, refer to Chapter 4.0 Climate and Chapter 7.0 Hydrology.

20.2.6.3 Landslide

Landslides in Queensland are generally caused by heavy rain when rain saturates the soil on hilly terrain, and the Great Dividing Range which the Project site traverses, has been identified as a landslide prone region (Geoscience Australia, 2018).

The construction of tower and substation structures will consider a set back from the banks of watercourses to minimise risk to watercourses and potential erosion areas.

Clearing of land to accommodate the construction of the transmission lines structures will be avoided where possible to limit erosional impacts. The Project adheres to *Powerlink Functional Policy* for Substation Site Selection, with specific consideration for physical and topographical impacts including

rocky and uneven terrain. The Powerlink standard EMP (Appendix B and Appendix C) sets the requirements for erosion and sediment control and the Project will ensure the performance criteria are met.

For further information, refer to Chapter 4.0 Land.

20.2.6.4 Biosecurity

The Project will adhere to the Powerlink EMP (Appendix B and Appendix C) and Biosecurity Management Plan will be developed to support construction and operation. The biosecurity practices comply with Biosecurity Act. Regular easement inspections will be carried out to monitor and identify the introduction or spread of identified weeds or pests on easement and access tracks. If maintenance work requires access to landholders' property, Powerlink will communicate with landholders and agree upon the biosecurity management strategies, including the use of any chemicals to ensure ongoing effectiveness.

Additional controls such as vehicle wash down procedures for vehicles accessing properties and construction areas, identification of the origin of high risk construction machinery or equipment, and implementation of weed monitoring during construction and operation will be carried out to avoid new incidences of week.

For further information, refer to Chapter 12.0 Biosecurity.

20.2.6.5 Waste Management

The Project will comply with the Powerlink EMP (Appendix B and Appendix C) for Waste Management. During the construction, waste such as excess spoil, concrete, conductor drums, steel, cleared vegetation, plastic bags, food and sewage will be generated. These wastes will be recycled as much as possible. Waste materials that are known to attract vermin will be stored and handled in a hygienic manner prior to removal by a licensed waste contractor.

The Project is expected to produce relatively small quantities of hazardous (regulated) wastes such as hydrocarbons or hydrocarbon contaminated products (oily wastes and oil filters). These wastes will be disposed of by a licensed regulated waste transport contractor. Standard procedures will be developed in accordance with *AS1940:2017 Storage and Handling of Flammable and Combustible Liquids* requirements for the storage, containment, disposal and spill response for potentially hazardous waste materials.

For further information, refer to Chapter 23.0 Waste Management.

20.2.6.6 Noise and Vibration

The requirements for managing noise and vibration arising from the Project are available in the Powerlink EMP (Appendix B and Appendix C). The Project will ensure noise nuisance are reduced to so far as is reasonably practicable and noise limit will be in accordance with the EP Act.

Machinery used will be maintained, repaired or replaced when it becomes noisier. Fuel powered equipment, including those used for grass cutting, impact tool, blowers, and generators will be shut down when not in use to minimise noise nuisance to surrounding sensitive receptors.

The substation will be located to ensure sufficient setback to other land uses, specifically residential areas in accordance with the *Powerlink Functional Policy for Substation Site Selection*.

For further information, refer to Chapter 19.0 Noise and Vibration.

20.2.6.7 Particulate and Dust Control

Speed limits will be imposed for unsealed, off road access tracks. Vehicles and equipment used will be fitted with appropriate exhaust systems and will be maintained in good working condition to minimise pollutant generation.

The Powerlink EMP (Appendix B and Appendix C) for Air Quality requires that watering of work areas and access tracks to be carried out during land clearing and major construction works to ensure particulate and dust are controlled to EP Act limits.

For further information, refer to Chapter 6.0 Air Quality.

20.2.6.8 Dangerous Goods and Hazardous Substance Management

The chemicals used during the construction, operation and decommissioning phases will include fuel (predominantly diesel), lubricants, oils, minor quantities of solvents and acids, degreasers and domestic cleaning agents.

The anticipated list of chemicals used throughout the lifecycle of the Project along with their purpose and dangerous goods details are presented in Table 34. The concentration of chemicals sourced from the supplier is not likely to be changed, however some chemicals may be provided as a concentrated solution for dilution prior to use. The quantities of chemical listed are not known at this level of design, however, will be confirmed during the next phase of the design.

Table 34 Indicative List of Dangerous Goods and Hazardous Substances

Chemical Name	Design Life Cycle Stage	Purpose/ Use	DG Class	UN No.	PG
Concrete curing compound	Construction	Concreting for slab construction	N/A	N/A	N/A
Concrete retardant	Construction	Concreting for slab construction	N/A	N/A	N/A
Concrete residue	Construction	Concreting for slab construction	N/A	N/A	N/A
Kerosene	Construction	Fuel for mobile equipment	3	1223	III
Primer (solvent/glue)	Construction	Cleaning and degreaser	3	1206	II
Expanda foam (fomofill)	Construction	Sealing of joints and gaps	2.1	1950	N/A
Silicon	Construction	Sealing of joints and gaps	4.1	1346	III
Aerosols paints	Construction	Line marking	2.1	1950	N/A
Alminox	Construction	Improve joint conductivity and prevent corrosion	N/A	N/A	N/A
Electrical contact cleaner	Construction Operation	Cleaning of grease from electric components	2.1	1950	N/A
Diesel fuel	Construction Operation Decommissioning	Fuel for mobile equipment and emergency back-up diesel generator	3 (Class C1)	1202	III
Lubrication oil (including grease and transformer oil)	Construction Operation Decommissioning	Lubricate equipment and transformer insulation	Class C2	N/A	N/A
Sulphur hexafluoride (SF 6) gas	Construction Operation	High Voltage Switching Dielectric	2.2, 6	1080	N/A
Herbicides	Construction Operation Decommissioning	Weed removal	N/A	N/A	N/A

20.2.6.9 Transportation of Dangerous Goods

The transportation of dangerous goods will only be undertaken by license transporters in accordance with *Australian Code for the Transport of Dangerous Goods by Road & Rail* (ADG Code), including the requirements to display Hazchem signage, placard and carry spill containment equipment to be used by emergency services personnel in the event of an emergency.

20.2.6.10 Dangerous Goods and Hazardous Substance Storage (Permanent and Temporary)

The Powerlink EMP (Appendix B and Appendix C) provides the general requirements for hazardous materials management, and includes performance criteria such as no contamination of land or water as a result of a spill or release of hazardous material.

All chemicals will be stored, handled and used according to provisions in their Safety Data Sheet (SDS). SDS shall be made available for each chemical used and stored in an easily accessible location.

Standard procedures for the storage, containment, disposal and spill response for potentially hazardous materials will be managed in accordance with *AS 1940:2017 Storage and Handling of Flammable and Combustible Liquids* and *AS 3780:2008 Storage and Handling of Corrosive Substance*. The storage and handling, including first aid and clean up response of these chemicals will be incorporated into the Emergency Response Plan. Spill management requirements include:

- Assess spill (extent and potential to migrate offsite, fire hazard potential, type and volume).
- Isolate the spill (prevent further spillage, blocked drains and prevent access to the area).
- Notification of the spill.
- Clean up and remediation.
- Restock spill kit.

20.2.7 Health and Safety Management

20.2.7.1 High Voltage Safety

High voltage electrical work will be managed to satisfy the requirements of the Electricity Safety Act and subordinate legislation, including adherence to Powerlink's Electrical Safety Rules (ESR) and Safe Access to High Voltage Electrical Apparatus (SAHVEA).

Where landholder or community members wish to undertake work on or near a Powerlink transmission line easement, Powerlink provides guidance in their publication, *Powerlink Management of Easement Co-use Requests Guideline*, freely available on Powerlink's Website. It provides guidelines on activities which are generally permitted, require written approval or are not permitted. In addition, the easement terms and conditions also provide information on the rights and responsibilities of landholders and Powerlink on easements.

Trespassing on or vandalisms of transmission towers or the substation can result in severe or fatal injury. Substations are securely locked and monitored at all times. Powerlink is also committed to continued delivery of powerline safety messages to the community, through the 'Look up and Live' campaign, electrical safety awareness activities and community engagement activities to increase public awareness of the powerlines and substation safety.

20.2.7.2 Collision with Machinery or Equipment

Heavy machinery used during construction includes excavators, graders, rollers, cranes, generators and drill rigs. The movement of heavy equipment presents risks arising from ground instability, equipment integrity failure or human error, with the potential to cause serious injuries. As such, the operation and maintenance of machinery will be in accordance with the manufacturer's specification, machinery maintenance and testing of breaking systems. Administrative controls include risk assessments, Safe Work Method Statements / Job Safety Analysis, Take 5, training of personnel and operation of machinery by competent authorised persons. Engineering controls will also be implemented, including exclusion zones where there is the potential to encroach high voltage exclusion zones or for tasks such as working at height.

Helicopter activities may be carried out for construction and maintenance of the Project. This potentially includes heli-stringing, insulator washing work, aerial inspection and patrols. The use of helicopters during construction, for cable stringing, lifting, placement or removal of transmission line, reduces the reliance on heavy equipment and road access. Nevertheless, risks associated with low flying helicopters will be managed, including through pilot responsibilities to maintain safe distance to residential premises, livestock, and towers.

20.2.7.3 Hot Work

Activities which involve hot work have the potential to generate fires. The Project will ensure that a risk assessment process is in place in accordance with Powerlink's fire management principles to prevent outbreak of fire, including:

- Limit hot work during extreme weather conditions.
- Availability of first response fire-fighting equipment and trained personnel.
- Adopt low fire risk infrastructure design.
- Develop strategies in planning, investigation and acquisition phase.
- Timely delivery of operational and maintenance strategies including regular inspections and vegetation maintenance.

20.2.7.4 Road and Rail Safety

Vehicles used during construction and maintenance include graders, excavator and light vehicles that operate on roads and access roads around the Project corridor. Personnel operating these vehicles will be trained and authorised.

Traffic will be controlled by the provision of adequate crossing points, demarcation, signage and speed limits. Positive communication and give way in accordance with the Traffic Management Plan will be practiced to reduce risk of vehicular interactions. The Project will also apply for local authority (i.e. local Council) approval for works involving potential road closures or traffic delays to emergency services and the local community. Any temporary road closures will involve on site traffic management, so that in the event of emergency service vehicles needing to pass through the areas where stringing is occurring, passage will be provided. For further information, refer to Chapter 18.0 Transport and Traffic.

Construction or maintenance work over the Invicta Mill Cane Rail Line rail line will be coordinated by Powerlink and Invicta Mill.

20.2.7.5 Fatigue Management

Powerlink Fatigue Management Guidelines are used to ensure conditions of work of personnel align with *Work Health and Safety Act 2011*. Random breath testing and drug and alcohol testing will be carried out to identify fitness for work to reduce the likelihood of related incidents.

20.2.7.6 Underground Services

Facility records will be used, and visual inspection will be conducted to gather site information to identify any hazards, soil conditions, trenches, pits, bores, standing water and potentially dangerous obstruction which may impact on safe execution of work. The Project will lodge a *Dial Before You Dig* enquiry prior to excavation or drilling work, which provides information about underground services on the worksite. Excavation work will be carried out according to Project work plans and any excavations, including exposed underground assets, will be backfilled. Procedural control for the Project will also ensure that excavation work will comply with *Safe Work Australia Model Code of Practice*.

20.2.7.7 Electric and Magnetic Fields

EMFs are found where electricity or electrical equipment is being used. Technical assessment confirmed that co-location of the Project with the existing transmission line is below the guideline limit published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Although there is no scientifically proven causal link between EMFs from transmission lines and human health, the Project nevertheless will follow the 'prudent avoidance' approach in the design and siting of transmission lines and substation.

Powerlink has adopted the policy of prudent avoidance with regards to EMF, such as assisting the community experiencing television or radio reception problems caused by transmission line by providing advice and, if required, signal amplification equipment. Where there is a possibility that a transmission line could cause interference with the operation of an electric fence running parallel to the line, Powerlink will provide mitigation measures to assist the owner of any electric fence installation that might be adversely affected. For further information, refer to Chapter 21.0 Electric and Magnetic Fields.

20.2.8 Emergency Response Plan

20.2.8.1 Emergency Response

The Project will adhere to Powerlink's Emergency Preparedness and Response Procedure, focusing on the following:

- First aid capability.
- Fire protection capability.
- Security systems capability.
- Remote travel emergency response capability.

The testing of emergency procedures will be conducted at scheduled intervals to test the effectiveness of Powerlink's preparedness and response. Emergency procedure testing will involve desktop scenarios and procedural tests, through to complete organisation-wide drills involving emergency services, dependent on relevant emergency risk potential.

The Burdekin Shire Local Disaster Management Plans will be considered when preparing the Project specific Emergency Response Plan (ERP) in accordance with Powerlink's Emergency Management Plan. The Burdekin Shire Local Disaster Management Group will also be contacted for consultation and will be notified of the schedule and activities of the Project. Consultation will also occur with the local emergency services (State Emergency Service, Queensland Police Service, Queensland Ambulance Service and Queensland Fire and Emergency Services (QFES)) to ensure that external support will be provided by these services in an event of an emergency.

Necessary resources will be available to ensure timely provision of first aid by trained competent staff, appropriate fit-for-use first aid facilities and access to medical and allied health support as per the ERP. This is achieved by having appropriate, compliant and maintained first aid equipment, consumables, trained personnel, facilities, and medical support.

Competency of personnel for roles in emergency response will be ensured through competency training.

An appropriately trained Emergency Management Team will be available to manage threats such as large scale natural disasters such as cyclones, bushfire, or large scale flooding. Project risks involving medical emergencies, including electric shock, burn, height rescue, snake and insect bites, hazardous chemical spill and threats will be managed in accordance with the ERP.

First Aid Officers and Fire Wardens will be visibly identifiable on site to assist in the ready identification of trained personnel in the case of an emergency. Firefighting capabilities, including warning, communication and evacuation, will be addressed in the ERP.

20.2.8.2 Emergency Planning

The Project will adhere to Powerlink's ERP to manage emergencies. Where sources of emergency and disruption are foreseeable, preparedness and response will be based on the following components:

- A structured approach for incident assessment, escalation and response.
- Appropriate and timely emergency management decision making.
- The availability of trained and capable response personnel.
- The provision of necessary equipment and resources that are readily available to minimise any adverse impact on the health and safety of people or operations.

21.0 Electric and Magnetic Fields

Powerlink has not undertaken an Electric and Magnetic Field (EMF) Assessment for the Project on the basis that there are only two sensitive receptors within 2 km of the Project site, with the closest being within 2 km from the Project site. DSDILGP have confirmed that an EMF Assessment is not required on this basis and no further discussion is provided.

22.0 Bushfire Risk

22.1 Existing Environment

22.1.1 State Planning Policy - Bushfire Hazard Mapping

SPP expresses the State interests in land-use planning and development, including natural hazards, risk and resilience. The SPP includes state wide mapping for bushfire prone areas (mapped as potential fire intensity), which takes into consideration potential fuel load, maximum landscape slope and fire weather severity.

A bushfire prone area is defined by the SPP as land that is potentially affected by significant bushfires, including vegetation likely to support a significant bushfire; adjacent land they could be subject to impacts from a significant bushfire; and land that is identified by the SPP and/or a Local Planning Instrument as a bushfire prone area.

The Project site is predominately mapped within 'High, Medium and Potential Impact Buffer Potential Bushfire Intensity' Bushfire Prone Areas under the SPP mapping (DSDILGP, 2023) (Figure 14). As a result, this should pose no significant impact on the planning, design, construction or maintenance of transmission assets other than managing operational and on-site fire risks.

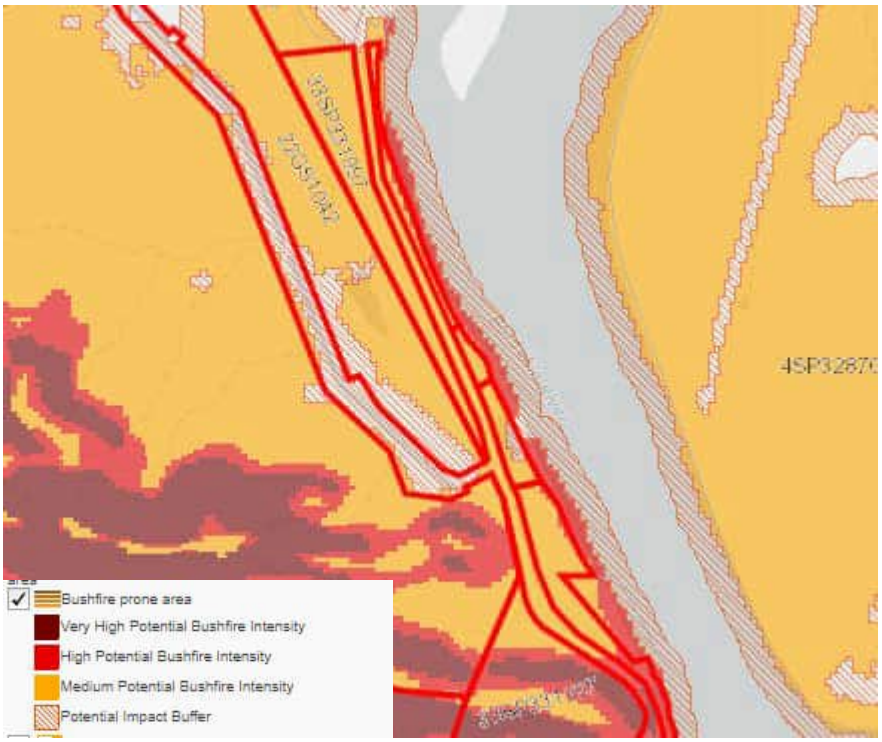

Figure 14 SPP Bushfire Prone Areas Mapped within the Project site

22.1.1.1 Local Planning Instruments

The Project site is located within the Burdekin LGA which has Local Planning Instrument being the Burdekin Shire Planning Scheme, 2022.

The Minister has identified that the natural hazards, risk and resilience State Interest has been integrated into the Burdekin Shire Planning Scheme, 2022. The Bushfire Overlay OM3 has identified that the Project site is located within the Medium Potential Bushfire Intensity and Potential Impact Buffer Areas (Figure 15).

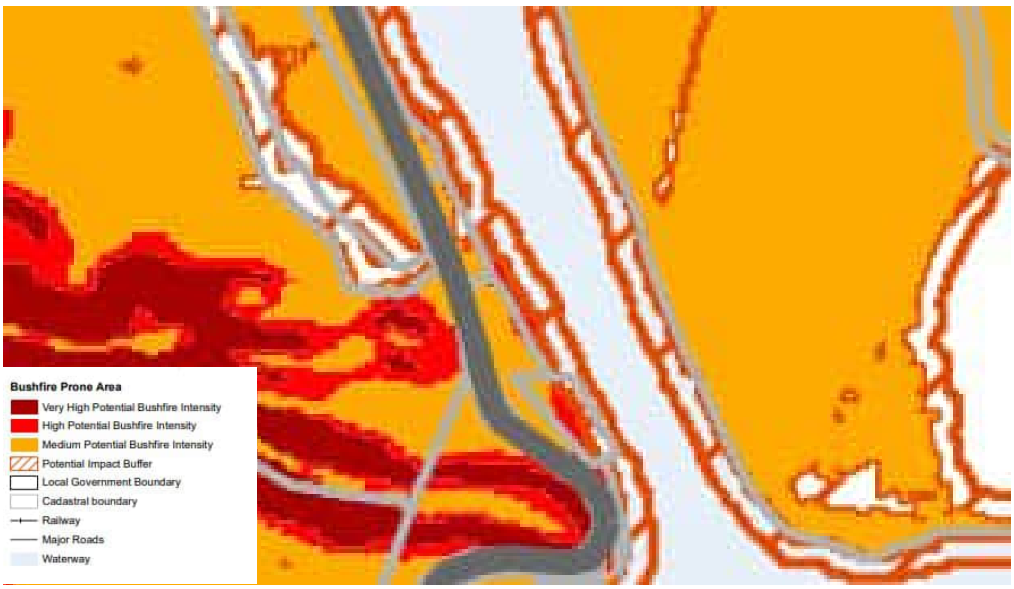

Figure 15 Burdekin Shire Planning Scheme OM3 – Bushfire Prone Areas

22.1.2 Topography and Slope

The topography of the Project site is generally flat with a slight decline in elevation from west to east towards the Burdekin River. The Project site sits at approximately 40 m AHD, with little change along the area (Queensland Government, 2023a). Topography and slope are risk factors that are considered and managed as part of land maintenance programs.

22.1.3 Vegetation

Vegetation within the Project site consists of remnant eucalypt and Corymbia species and non-remnant grassland.

Table 35 Vegetation Communities, REs and Conservation Status in the Project Site

Vegetation Community (RE Short Description[1])	RE	VM Act Class[2]	BD Status[3]	Condition	Project Site (ha)
1) *Eucalyptus platyphylla*, *Corymbia clarksoniana* woodland on alluvial plains	11.3.35	Least concern	No concern at present	Remnant	2.7

The methodology for state-wide mapping of Bushfire Prone Areas in Queensland assigns REs to 20 vegetation hazard classes, which are then grouped as either Bushfire Prone, grassfire prone or low fuel load classes (Leonard, Opie, Newnham, & Blanchi, 2013). The REs across the Project site were all identified as Bushfire Prone vegetation classes (Class 7), with the potential to support a significant bushfire or the potential to be subject to significant bushfire attack.

Clearing will be in accordance with Appendix A: Project Plans with any departures noted in EMPs for the OHTL and substation (Appendix B and Appendix C). Clearing is to consider the mature height of the vegetation, not just the height at the time of survey. The preference is to remove incompatible species with compatible vegetation retained where it does not impede the safe maintenance and operation of the high voltage network. Vegetation management programs will continue to focus on the removal of incompatible species in the maintenance phase.

22.1.4 Climate

Chapter 5.0 Climate describes the existing climatic conditions within the Project site. Climate data from two locations (Ayr DPI Research Station and Burdekin Shire Council BoM stations). The Project site typically experiences a warm tropical climate, with distinct wet (summer) and dry (winter) seasons. As of January 2024, a La Ninia year, the Project was not experiencing drought conditions.

Bushfires in North Queensland typically occur in during June and July. Bushfire risk increases during decreased rainfall paired with increasing temperatures resulting in a dry fuel load.

22.1.5 Bushfire Frequency

North Australia and Rangelands Fire Information identifies historical fire scares using aerial data (North Australia and Rangelands Fire Information, 2024). Fire scars were assessed between 2000 and 2024. Several fire scars were identified nearby the Project site (2008, 2011, 2013 and 2020), with one fire scare mapped over the Project site in 2012 which encompassed the site and its surrounds.

22.2 Potential Impacts

Bushfires are potentially harmful to people and property. Potential impacts are addressed below as either a fire hazard from the Project or fire hazard to the Project.

22.2.1 Fire Hazard from the Project

22.2.1.1 Construction

Construction equipment and vehicles have the potential to create a fire risk through the generation of sparks or heat, machinery faults which may ignite dry combustible materials. Other potential sources of ignition may arise from accidental fires from human related activities.

Construction activities will generate combustible material in the form of cardboard, and paper packing material and mulched/chipped vegetation. Potential spills of fuel, oil and flammable liquid may also increase the risk of bushfire, particularly in proximity to dry combustible materials. Procedures are adopted to manage associated fire risks.

22.2.1.2 Operation and Maintenance

Operational fire risk is generally related to external influences, such as climate, surrounding land use, and the proximity and density of surrounding vegetation. Operational faults are rare and do not necessarily result in electrical arc flashover to vegetation. During periods of reduced rainfall and increased temperatures, dry vegetation has the potential although unlikely, to come into contact with the transmission line conductor, potentially resulting in a fire event through power arcing. Due to the height of the structures these events are very rare.

Operational waste, particularly dry combustible waste, is anticipated to be limited (Chapter 23.0 Waste Management) and will be a negligible contribution to bushfire risk from the Project.

During maintenance of the infrastructure, it is anticipated that vegetation waste will be managed considering potential fire risk. Sprayed vegetation is usually left to die back and decompose naturally.

Maintenance is also likely to present similar fire risks to construction, on a smaller and more localised scale. These risks include the generation of sparks or heat, machinery faults which may ignite dry combustible materials. Other potential sources of ignition may arise from accidental fire from human related activities. Procedures are adopted to manage associated fire risks.

22.2.2 Fire Hazard to the Project

Fires burning adjacent to or under high voltage transmission lines have the potential to:

- Create electrical arcs (known as ‘flashovers’) that can endanger people, animals and objects.
- Damage or destroy the wires, insulators and supports of the transmission line.
- Interrupt electricity supply to households and industry.

Further information on safety risks associated with fires burning near transmission lines are provided on Powerlink’s website. [2]

Fire events within the vicinity of transmission lines would most likely be the result of environmental conditions, such as climatic conditions, or land use activities. Powerlink actively reduces incompatible vegetation in proximity to transmission assets during maintenance programs, with access tracks and cleared areas offering some disruption in the event that a fire occurs. OHTL access tracks may also be

[2] https://www.powerlink.com.au/sites/default/files/2020-10/Fire%20and%20transmission%20line%20safety_1.pdf

used by fire crews in the event of fire. The Project design is unlikely to impose restrictions upon existing bushfire management techniques.

OHTL are designed to be compatible with the impacts of potential natural hazards that may occur within the proposed easement and potential fire impacts to the transmission lines are limited. The substation will be surrounded by a large, cleared buffer area for protection in the event of a fire.

22.2.3 Assessment Against the SPP Benchmarks for Natural Hazards, Risk and Resilience

The overall intent of the natural hazards, risk and resilience State interest in the SPP is as follows.

> *The risks associated with natural hazards, including the projected impacts of climate change, are avoided or mitigated to protect people and property and enhance the community's resilience to natural hazards.*

The State interest includes a number of assessment benchmarks in relation to Bushfire Prone Areas, which are summarised below.

- Development avoids Bushfire Prone Areas, and where avoidance is not possible, development mitigates the risk to people and property to an acceptable or tolerable level.
- Development supports and does not hinder disaster management response or recovery capacity and capabilities.
- Development avoids increasing the severity of bushfires and the potential resulting impacts.
- Risks to public safety as a result of storage and use of hazardous materials are avoided.

Avoidance of Bushfire Prone Areas is not feasible due to the nature of the Project. Management and mitigation measures will be implemented during all stages of the Project lifecycle to minimise risks to people and property in the immediate area (refer to Section 22.3) and impacts on Powerlink's high voltage network.

The Project will involve the clearing of vegetation to facilitate construction, maintenance and operation of the transmission line which may improve access to the Project site and can be utilised by disaster management response teams if required. The cleared easement may also provide a disruption to fires, which will assist in both protecting the transmission line from nearby fire and adjoining properties in the event an outbreak occurs near the alignment.

Storage and use of hazardous materials are discussed below.

22.3 Mitigation and Management Measures

The assessment of potential impacts indicates that fire risk may potentially increase as a result the Project, particularly during the construction stage. External environmental conditions within surrounding areas, such as the proximity and density of surrounding vegetation, climatic conditions and land use activities, may also contribute to an increased fire risk. The following measures are proposed to mitigation the potential impacts of bushfire from or to the Project.

Powerlink has an 'On-Site Fire Prevention Procedure and Bushfire Mitigation Plan (ASM-PLN-A3285085). The purpose of the Bushfire Mitigation Plan is to provide a co-ordinated, integrated and transparent approach to bushfire mitigation that considers the resources and responses needed to manage risk associated with bushfires. The Bushfire Mitigation Plan is reviewed annually to ensure maintenance of and where appropriate, improvement to bushfire mitigation controls. The Bushfire Mitigation Plan has been developed based on a range of authoritative sources and references and is consistent with QFES Bushfire Risk Mitigation Plan – Template.

22.3.1 Design

- As per Powerlink's Bushfire Mitigation Procedure (ASM-PLN-A3285085) Powerlink has a specific Guideline for the Design of Transmission Lines for Bushfires which will be applied to the design of the Project.

- Queensland has adopted the Australian Standard for the Construction of Buildings in Bushfire Prone Areas - AS3959 – 2009. AS3959 sets out the requirements for the construction of buildings in bushfire prone areas in order to improve their safety when they are subjected to burning debris, radiant heat or flame contact generated from a bushfire. Project buildings constructed will be consistent with the Standard.
- Allow additional tower height clearances in areas with high fuel loads, where practicable.
- The OHTL design will include all current design principles and safeguards to avoid arcing and line breakage.
- The substation will be surrounded by a cleared buffer area for protection in the event of a fire.

22.3.2 Construction

- A Bushfire Management Plan will be developed for the Project. The Bushfire Management Plan will align with the requirements of Powerlink's Bushfire Mitigation Plan (ASM-PLN-A3285085).
- Fire hazard warnings associated with weather patterns and fire risk are issued by the BoM and the Queensland Rural Fire Service. Daily checking of fire hazard warnings will be undertaken and construction crews made aware of the fire warnings (e.g. through pre-starts).
- Project construction will be conducted in line with Powerlink's Fire Prevention Procedure (A2364455).
- Flammable and combustible liquids (i.e. fuel) will be stored within facilities designed to AS1940–2004 'The Storage and Handling of Flammable and Combustible Liquids.'
- Procedures guiding the response to emergency and fire situations, and requests from emergency management authorities, will be documented and communicated where applicable to project location.
- Firefighting equipment must be kept on site when hot works are being undertaken. Personnel must be trained in the use of the equipment.
- All machinery must have a tested and tagged fire extinguisher available.
- Burning of vegetation is prohibited, unless a permit is obtained by a local fire authority and Powerlink, prior to burning.
- Designated smoking areas are to be identified with cigarette butt bins for safe disposal.
- Where a landholder requests no smoking on their property, this must be adhered to.

22.3.3 Operation and Maintenance

- Operation and maintenance of the Project will be undertaken in line with Powerlink's Bushfire Mitigation Procedure (ASM-PLN-A3285085).
- Flammable and combustible liquids (i.e. fuel) will be stored within facilities designed to AS1940–2004 'The Storage and Handling of Flammable and Combustible Liquids'.
- Powerlink maintains its easement through routine vegetation maintenance to ensure vegetation remains outside of untrained exclusion zones and incompatible species do not interfere with the safe operation of the transmission line.
- Cleared vegetation will not be placed in a location which may increase any fire hazard and impact on the Project in the event of a fire.
- Burning of vegetation is prohibited, unless a permit is obtained by a local fire authority and Powerlink.
- Powerlink adopts an asset risk management approach that considers potential fire starts from network components (e.g. insulator and instrument failures). High consequence areas and the likelihood of failures are assessed to determine the optimal investment in the network.

23.0 Waste Management

23.1 Relevant Legislation and Policy

23.1.1 Commonwealth

23.1.1.1 National Waste Policy 2009

The National Waste Policy, agreed by all Australian environment ministers was first published in November 2009, and revised in 2018. The National Waste Policy was endorsed by the Council of Australian Governments and sets Australia's waste management and resource recovery direction to 2030 (DAWE, 2018). The policy identifies five overarching principles underpinning waste management in a circular economy. These include:

- Avoid waste.
- Improve resource recovery.
- Increase use of recycled material and build demand and markets for recycled products.
- Better manage material flows to benefit human health, the environment and the economy.
- Improve information to support innovation, guide investment and enable informed consumer decisions.

23.1.1.2 National Pollutant Inventory

The NPI tracks pollution across Australia through the reporting of emissions and transfers of 93 substances that have the potential to impact on human health and the environment. The NPI framework establishes a ‘trigger’ threshold usage for these substances and, if threshold is exceeded during a reporting year for an NPI substance, all emissions of that substance must be reported in accordance with the most current relevant Emission Estimation Technique Manuals.

The desired environmental outcomes of the NPI program are to:

- Maintain and improve air and water quality.
- Minimise environmental impacts associated with hazardous waste.
- Improve the sustainable use of resources.

23.1.2 Queensland

23.1.2.1 Waste Reduction and Recycling Act 2011

The *Waste Reduction and Recycling Act 2011* (WRR Act) contains measures to reduce waste generation and landfill disposal and encourage recycling. The legislation establishes a framework to modernise waste management and resource recovery practices in Queensland, in order to promote waste avoidance and reduction and encourage resource recovery and efficiency. The WRR Act defines the meaning of the waste and resource management hierarchy (avoid, reduce, re-use, recycle, recover, treat, dispose).

The objectives of the WRR Act are to:

- Promote waste avoidance and reduction, and resource recovery and efficiency actions.
- Reduce the consumption of natural resources and minimise disposal of waste by encouraging waste avoidance and the recovery, reuse and recycling of waste.
- Minimise overall impact of waste generation and disposal.
- Ensure a shared responsibility between government, business and industry and the community in waste management and resource recovery.
- Support and implement national frameworks, objectives and priorities for waste management and resource recovery.

The *Waste Reduction and Recycling Regulation 2011* is subordinate to the WRR Act and provides details on how the act should be applied.

23.1.2.2 Environmental Protection Act 1994

The EP Act includes provisions regarding general environmental duty, and the requirement to take all reasonable and practicable measures to prevent environmental harm. This includes requirements for waste management, such as waste prevention and minimisation.

The EP Regulation is subordinate to the EP Act and establishes requirements for the transportation of regulated waste, defines trackable waste, describes obligations for generators/transporters/waste receivers, receiving/disposing of waste at approved facilities and defines regulated waste.

23.1.2.3 Queensland Waste Strategy

Queensland's Waste Management and Resource Recovery Strategy (Queensland Government, 2021), underpinned by a waste disposal levy, provides the strategic framework for Queensland to become a zero-waste society, where waste is avoided, reused and recycled to the greatest possible extent. The strategy focuses on transitioning to the principles of a circular economy to help retain the value of material in the economy for as long as possible.

It provides the framework to help deliver coordinated, long-term and sustained growth for the recycling and resource recovery sector while reducing the amount of waste produced and ultimately disposed of, by promoting more sustainable waste management practices for business, industry and households.

23.2 Waste Management

23.2.1 General Waste Management Strategy

The principal objective of the waste management strategy for the Project is to minimise the impacts on land resources, water quality, and air quality, and to manage waste in a manner that minimises direct or indirect impacts on the environment and human health.

The main strategies that will be adopted for the Project include waste minimisation and avoidance, appropriate waste treatment including recycling and reuse where applicable, and appropriate handling, storage, collection and disposal of waste.

23.2.2 Waste Minimisation and Avoidance

The waste and resource management hierarchy is a nationally and internationally accepted guide for prioritising waste and resource management practices which is referred to in the Queensland regulatory framework (Section 23.1.2).

Waste minimisation and avoidance have been considered through the initial planning stage of the Project and will continue during construction and operation.

23.2.3 Waste Handling, Storage, Collection and Disposal

In accordance with the waste management hierarchy, waste materials will be segregated during handling and storage on-site. Materials such as metals, solvents, oils, and wood products will be segregated and where possible reused. Opportunities for recycling of other wastes will be utilised where practicable.

Storage of waste will differ according to the specific waste type and is discussed further in the following sections. Flammable and combustible liquid wastes will be stored in accordance with AS1940-2017 'The Storage and Handling of Flammable and Combustible Liquids' to prevent contamination of land, surface water and groundwater.

If waste materials cannot be reused onsite, then they will be collected by licensed contractors for offsite reuse, reprocessing, recycling or final disposal. Final disposal of wastes will be to a licensed waste facility that is suitable for the type and quantity of waste.

Local facilities which may be considered for the final disposal of wastes are discussed below. Where local facilities are unable to accept Project waste, it will be transported to larger facilities such as in Townsville.

23.2.3.1 Burdekin Shire Council

Burdekin Shire Council operates three waste transfer stations and one licenced landfill that accept commercial and domestic waste. The Kirknie Landfill is located in Home Hill, 40 km drive away.

23.2.4 Streams and Management

Anticipated waste streams were identified for the construction, operation and maintenance phases of the Project. The characteristics of individual waste streams have been determined based on similar projects. The following section details waste generating activities, wastes anticipated to be associated with Project and the proposed management method for each waste type.

23.2.5 Construction

Construction activities are expected to produce green waste, general waste, regulated waste, and wastewater. These waste streams are discussed in detail below. Construction waste management measures, including the preparation of a Waste Management Plan, are provided in Section 23.2.5.4.

23.2.5.1 General Waste

A number of different general waste streams will be generated during the construction stage of the Project, including cleared vegetation, excess spoil, waste concrete, excess fasteners, clean packing, scrap conductors and excess steel (Table 36). Table 36 provides the recycling or disposal options available for each waste stream. Quantities of waste are unavailable at this time and estimates will be generated during the detailed design phase of the Project.

In accordance with the WRR Act, single use plastic bags will not be used on the Project.

Table 36 General Waste Generation and Management During Construction

Waste type	Recycling Options	Management Method
Green waste	Vegetation stacked and left to decompose or mulched and retained on site for use in site management works (e.g. erosion control) and rehabilitation.	Felling and stacking in windrows at the edge of easement, chipping, mulching or burning. Actual disposal method on each property will be determined closer to construction in consultation with landholders.
Uncontaminated excess spoil	Reuse as fill around site or to construct ancillary infrastructure (e.g. access tracks, where material is suitable) or reinstatement of eroded areas.	Spoil may be stockpiled temporarily and mounded under transmission line structures or spread around substation site.
Minor localised spills and associated material	Nil	Contaminated soil and materials from minor spills must be transported by a company licensed to transport regulated waste and dispose of to an appropriately licensed facility.
Waste concrete	Return to concrete plant for reuse of sand and gravel.	Collected and disposed of by the Construction Contractor or concrete supplier.
Waste from clean down facility	Nil	Soil and/or geofabric material contaminated with Biosecurity Matters from cleaning vehicles, plant, equipment and machinery to be disposed at a licensed facility.
Excess nuts, bolts, etc.	Recycled via scrap metal recyclers.	Collected during and after construction.

Waste type	Recycling Options	Management Method
Timber e.g. formwork, pallets etc.	Generally not accepted back by suppliers.	Store separately and dispose at waste facility for mulching where available. Alternatively, dispose at landfill if not accepted back by suppliers.
Plastic packaging (excluding single use plastics)	Nil	Collected with co-mingled recycling at laydown yards. Dispose of at licensed recycling facility.
Cardboard packing and boxes	Collected and recycled.	Not required
Conductor drums	Returned to supplier for reuse.	Not required
Scrap conductors	Recycled via scrap metal merchants.	Not required
Excess steel	Recycled via scrap metal merchants.	Not required
Sewage	Nil	Wastes to be transported by a licensed regulated waste transport contractor and must only be disposed of at licensed disposal facilities.
Workers camp waste (mixed general waste)	Comingled recyclables arising from food packaging, paper and cardboard may be collected separately for recycling.	Recyclables can be taken to Council waste facilities providing for drop off of comingled recyclables. All other general waste should be disposed at a licensed waste facility.

23.2.5.2 Regulated Waste

Portable ablution facilities will be provided at or near each work site for use during the construction phase and controlled by the nominated Construction Contractor.

Waste produced at these ablutions facilities is considered to be a regulated waste in accordance with Schedule 7 of the EP Regulation. Therefore, these facilities will require regular servicing and all waste transport must be undertaken by a licensed regulated waste transport contractor, and waste tracking certificates must be completed. Regulated waste must only be disposed of at an appropriately licensed facility to accept the waste type (e.g. sewage treatment plant).

In the event of minor localised spills to ground e.g. hydrocarbons, including the materials associated with clean-up such as rags, gloves and soil, this waste must be transported as regulated waste by a licensed transportation company. The waste must be disposed of at a facility licensed to accept the waste type.

23.2.5.3 Wastewater

Minimal wastewater is produced during the construction phase with the self-contained ablution facilities holding the majority of water consumed (Section 23.2.5.2).

23.2.5.4 Construction Waste Management

Construction waste will be avoided, minimised and managed in accordance with Powerlink's Standard Environmental Controls (Appendix B and Appendix C). In addition to these controls, the following measures are implemented.

- Where practical, Project components should be supplied to the sites with minimal excess packaging. This practice reduces on–site waste generation.

- Uncontaminated excess spoil will be reused as fill around site or to construct ancillary infrastructure (e.g. access tracks, where material is suitable) or reinstatement of eroded areas. Excess spoil material is to be disposed of by a licensed waste contractor, if unable to be reused.
- Green waste will be managed through felling and stacking in windrows at the edge of easement, chipping, mulching or burning. Actual disposal method on each property will be determined in consultation with landholders.
- Soil and/or geofabric material contaminated with Biosecurity Matters from cleaning vehicles, plant, equipment and machinery to be disposed at a licensed facility.
- No lots within the alignment are listed on the CLR, however one lot is listed on the EMR (Chapter 4.0 Land), indicating the potential for contaminated soils to be excavated. On-site remediation of contaminated soil is considered best practice, with removal of contaminated soil for treatment or disposal off-site only to be carried out when that option is not practicable. A disposal permit is required to remove contaminated soil for treatment or disposal from land listed on EMR or CLR.
- Waste kept on-site will be stored in a manner that does not pose health and safety risks. Recycling and general waste bins will be provided at the substation site and the segregation of waste will allow for efficient reuse, recycling or disposal. Putrescibles waste will be sorted in closed waste containers to prevent the attraction and breeding of pest and disease vectors such as flies and rodents.
- Comingled recycling will be collected at laydown yards and camp locations and transported to a licensed recycling facility.
- Waste that cannot be reused onsite will be removed to an appropriate licensed facility, with preference for suitable local facilities.
- At the completion of construction the works' site will be demobilised. This includes removal of any temporary buildings and structures, with the treatment of all wastes to follow the processes outlined in Table 36.

A detailed Waste Management Plan is to be developed prior to construction, including all actions needed to effectively implement the waste management hierarchy. The requirements of the Waste Management Plan are detailed in Appendix B and Appendix C.

23.2.6 Operation and Maintenance

The types of waste generated by substation and transmission line operation and maintenance are similar to those generated as construction wastes, although in much smaller quantities (presented in Table 37).

The operating substation is to be inspected and maintained as part of a routine maintenance program. Additional inspections may be required as a result of equipment failure, modifications and upgrade or damage. The operation of the transmission lines does not generate waste, except during infrequent refurbishment programs.

The amount and types of waste likely to be generated during the maintenance of transmission lines and the easements is dictated by the surrounding land use.

Easement maintenance schedules depend on the type and growth rates of the easement vegetation, the maintenance requirements of landholders, as well as any transmission line equipment failures. Maintenance inspections are expected to occur approximately annually with vegetation regrowth being maintained less frequently, and on an as–needs basis. Extra maintenance may be required due to transmission line failure or natural disasters that may compromise the operating safety of the line or the state of the easements. Typical vegetation regrowth maintenance works include mechanical trimming or removal, hand clearing trimming and removal or selective use of herbicides, predominantly used for stump spraying.

Table 37 Waste Generation and Management During Operation and Maintenance

Waste Type	Recycling Options	Management Method
Food scraps	Quantity likely to be insufficient to warrant on-site composting.	Collected and disposed of in comingled general residual waste bin. Bin to be serviced by a licensed waste contractor. End point of disposal should be a licensed waste disposal facility.
Food packaging	Collected separately, stockpiled, and recycled when volumes are sufficient to warrant transportation.	Mixed recyclables should be rinsed and stored separately for subsequent transportation to a Council operated waste facility which accepts comingled recyclables.
Office wastes (e.g. paper, printer cartridges, computers)	Collected separately, stockpiled, and recycled when volumes are sufficient to warrant transportation.	Paper/cardboard should be stockpiled along with mixed recyclables for subsequent transportation to a Council operated waste facility which accepts comingled recyclables. Printer cartridges can be mailed to Planet Ark for subsequent recycling. Used electronic waste should be stockpiled and either returned to the supplier where such a contract agreement exists, or transported to a Council waste facility accepting e-Waste for recycling.
End of life office furniture	Offer furniture to charitable organisations where condition is suitable.	Offer to charitable organisation or dispose at a licenced waste facility.
Green waste	Sprayed vegetation is usually left to die back and decompose naturally. Suitable cleared regrowth may be mulched or chipped, with the product being sold or distributed by the Contractor.	Felling and stacking in windrows at the edge of easement, chipping, mulching or burning. Actual disposal method on each property will be determined closer to construction in consultation with landholders.
Refurbished infrastructure wastes	Manage as per construction phase for individual components.	Manage as per construction phase for individual components.
Transmission line insulators	Insulators may contain recyclable components, (e.g. fibre reinforced plastic). Options should be reviewed at the time of refurbishment.	Collected and recycled where possible, alternatively disposed at a licenced waste facility.

23.2.6.1 Regulated Waste

Easement maintenance contractors may generate herbicide containers as waste. The herbicide containers (metal and plastic) in most cases can be recycled through the herbicide manufacturers. If the containers are not accepted back by the manufacturers, they are disposed of at a landfill licensed to accept this type of waste.

The substation may include an amenities building, which will be fitted out with a kitchenette and ablution facilities. Waste produced at these ablutions facilities will be captured in a septic tank or septic system and is considered to be a regulated waste in accordance with Schedule 7 of the EP Regulation. Therefore, these facilities will require regular servicing and all waste transport must be undertaken by a licensed regulated waste transport contractor, with waste tracking certificates to be completed. Regulated wastes must only be disposed of at an appropriately licensed facility (e.g. sewage treatment plant).

23.2.6.2 Wastewater

Minimal wastewater is produced during the operation and maintenance phase with the substation ablution facilities holding the majority of water consumed (Section 23.2.6.1).

23.2.6.3 Operation and Maintenance Waste Management Plan

A detailed Waste Management Plan is to be developed prior to operation and maintenance, including all actions needed to effectively implement the waste management hierarchy and a waste monitoring program. The requirements of the Waste Management Plan are detailed in Appendix B and Appendix C.

24.0 Infrastructure

24.1 Existing Environment

24.1.1 Road Networks

The Project traverses Ayr-Dalbeg Road, being a State Controlled Road (Managed by the DTMR (Figure 16). Powerlink will seek approval under the *Electricity Act 1994* from DTMR prior to constructing the OHTL over the road.

24.1.2 Rail Networks

There are no state rail networks within the Project site, however, will go over the Invicta Mill Rail Line which is private rail line (Figure 16). Powerlink will seek approval prior to constructing the OHTL over the private rail line.

24.1.3 Airports and Air Strips

The Project site does not intersect with existing air transport infrastructure.

24.1.4 Electricity Infrastructure

Existing high voltage electricity infrastructure within the area includes 132 kV transmission line that runs from Strathmore to Clare. The Project connects almost perpendicular to this line. Spatial data also indicates there are high voltage cables that run beneath the Burdekin River, located at the Pump Station. The Project is not anticipated to impact this infrastructure.

24.1.5 Water and Sewer Infrastructure

The Project has limited access to reticulated water and sewer. The Project site is located immediately adjacent to a Sunwater intake site and agricultural channel. The Project directly traverses one registered groundwater bore (RN 186886); with two additional bores located immediately adjacent to the Project site (Figure 16).

24.1.6 Private Infrastructure

As the Project traverses through agricultural properties, there is the potential for unmapped private infrastructure to be present. Private infrastructure may include access tracks, dams, fencing and landing strips.

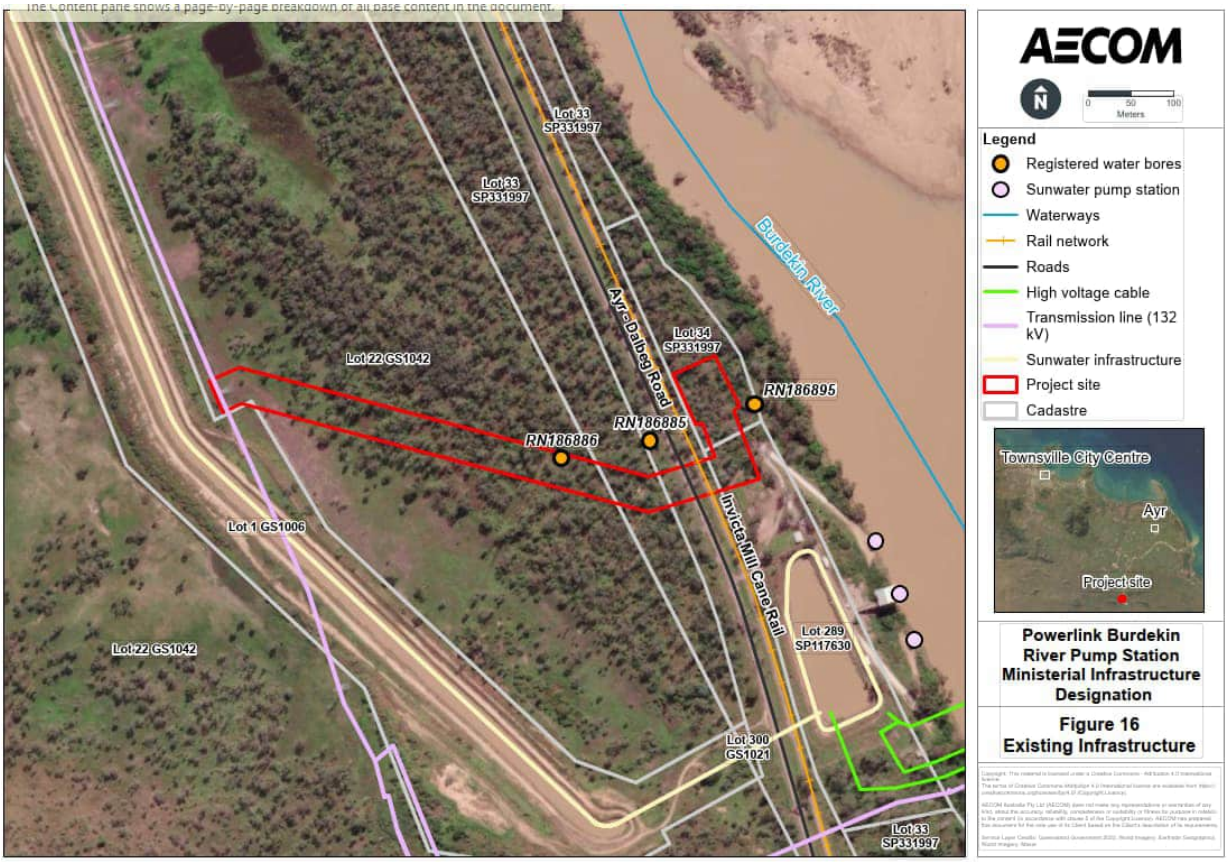

Figure 16 Infrastructure

24.2 Potential Impacts

No relocation of existing public infrastructure is required to facilitate the Project. During construction, the road network may be impacted through an increase in traffic associated with light vehicle movements, equipment haulage, and machinery movements. The Project may also require additional access points from the existing road network. Minimal access is anticipated during the operational phase and will be limited to maintenance requirements. Potential impacts associated with the road network are addressed in Chapter 18.0 Transport and Traffic.

The Project site is sufficiently removed from any aerodromes and no impacts are anticipated on this infrastructure.

24.3 Mitigation and Management Measures

Construction and operation of the Project will be managed in accordance with Powerlink's Standard Environmental Controls, provided in Appendix B and Appendix C containing Environmental Management Plan - Transmission Line, for the OHTL and substation. The following additional mitigation measures are proposed to minimise potential impacts to the limited infrastructure in close proximity to the Project.

- Access to the site during construction and operation will be undertaken in accordance with Powerlink's Land Access Protocol. This Protocol identifies Powerlink Queensland's standards and commitments when accessing and using land.
- The Project will be designed to ensure sufficient separation distance between the proposed and existing transmission / sub transmission lines.
- Powerlink will assess the potential for induced charge in proximal conductive objects, and propose mitigation measures for any objects in or near the easement that may be affected.

- The Project will be designed to consider the requirements of private infrastructure within the Project site. This may include the installation of visual marker balls on the transmission line near landing airstrips, where deemed necessary for safety.

25.0 Cumulative Impacts

25.1 Existing Environment

The Project site is located immediately adjacent to a Sunwater pump station on the banks of the Burdekin River. As enabling infrastructure, the Project will form a part of the Haughton Pipeline (Stage 2). The Project is also located nearby and within farm land and a Sunwater channel network.

Land use in the wider area generally consists of cane and agricultural farming to the western bank of the Burdekin River, with vegetated farmland used for cattle located further from the Burdekin River. There is one MID located to the north of the Project site being the Nebo to Strathmore 275 kilovolt transmission line.

25.2 Potential Impacts

25.2.1 Construction

The Project site is being developed to act as supporting infrastructure for the Haughton Pipeline (Stage 2). These projects are anticipated to occur in similar timeframes as such works are likely to be cumulative during the construction phase. Potential impacts attributed to the two projects are discussed below.

25.2.1.1 Dust

The Project's air quality assessment Chapter 6.0 Air Quality, identified two receptors within 2 km of the Project site (Figure 3, Chapter 3.0 Project Description). However, the closest receptor is located within 2 km from the Project construction footprint and is not located within 50 m of a public road. Therefore, the construction phase of the Project is classified as 'low potential impact' and no further assessment is recommended by the Good Practice Guide. As the Haughton Stage 2 pipeline infrastructure is in the immediate vicinity of the Project site, cumulative dust emissions are anticipated to have a minimal impact on local sensitive receptors.

While unlikely to impact local sensitive receptors, dust may create cause damage to the local environment. As the Project will incorporate management and mitigation measures detailed in the Projects EMP (Appendix B and Appendix C), the cumulative impacts associated with dust during construction are anticipated to be minimal.

25.2.1.2 Noise

The noise and vibration report Chapter 19.0 Noise and Vibration, concludes that all of the noise-sensitive receptors in the area are beyond the predicted operational noise setback distances from the Project and comply with the most stringent operational noise limits across the Project. Setback distances around the substation at which the noise limits can be achieved have also been calculated.

The cumulative noise impacts from the Burdekin River Pump Station and the Project have been considered, and the noise contribution of the Project to the Burdekin River Pump Station receptors are predicted to be negligible, therefore cumulative noise impacts are unlikely to be an issue.

25.2.1.3 Road Network

The Traffic Impact Assessment (Appendix E) for the Project identified a medium risk associated with the intersections on key roads that may increase traffic times and potential for collisions. However, based on the proposed mitigation measures detailed in this report the impact to traffic and roads for the Project was considered to be low.

The Project will be occurring in a similar time period to the Haughton Pipeline (Stage 2) project. During this time period there will likely be elevated levels of construction traffic moving from Townsville to the two co-located projects. While there may be an increase in traffic levels during construction, the cumulative increase from the Project is anticipated to be minimal.

25.2.1.4 Conservation Significant Species

The Project has been assessed as part of the Haughton Pipeline (Stage 2) project's EPBC Referral (2021/9133). As a result, the cumulative impacts to conservation significant species as a result of this

Project have been considered as part of this approval. The EPBC Referral identified a likely significant impact on black-throated finch (southern), koala and bare-rumped sheathtail bat habitat.

25.2.2 Operation

The operation of the Project will be limited to maintenance activities along the easement and at the substations. Therefore, any potential impacts, such as dust, noise, traffic and fauna will be minimal and short term. Therefore, cumulative impacts associated with the operational phase are not further investigated.

25.3 Mitigation and Management Measures

Given the large distance of the Project from other existing and proposed projects in the region, cumulative impacts are anticipated to be limited to the road network during construction and to conservation significant species. Nonetheless, standard environmental controls, as outlined in Appendix B: Environmental Management Plan – Substation and Appendix C: Environmental Management Plan - Transmission Line have been developed for the Project.

Potential cumulative impacts on the road network during construction will be managed through the following measures, as detailed in Chapter 18.0 Transport and Traffic.

- A detailed Traffic Impact Assessment (TIA) did not identify significant risks to traffic for the Project. However the mitigation measures proposed by this document should be followed to further reduce potential risks.
- Apply for appropriate approvals and permits under the *Transport Infrastructure Act 1994* from DTMR for any permanent or temporary access to state control roads, including associated roadworks for access, the transport of over dimensioned equipment and materials on state control roads and for ancillary works and encroachments.
- Consideration where possible during Project planning, to undertake selected construction works likely to cause significant traffic disruption and delay at times of low traffic volumes or at night to minimise localised congestion and potential safety implications.

Potential cumulative impacts of the Project will be managed under the Haughton Stage 2 pipeline EPBC Referral conditions alongside further management commitments for conservation species described in the Projects EMP and annexures (Appendix B and Appendix C).

26.0 Planning and Approval Requirements

The following section provides a description of the planning and approval context for the Project. This section includes a description of the following:

- Commonwealth approvals context and requirements.
- State, regional and local planning interests associated with the Project.

26.1 Commonwealth Legislation

26.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Commonwealth Government's central piece of environmental legislation. 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.

The Project has been referred as part of the Haughton Pipeline (Stage 2) project's EPBC Act Referral (2021/9133). The cumulative impacts to conservation significant species as a result of this Project have been considered as part of this approval.

26.1.2 Native Title Act 1993

Native title is defined under the *Native Title Act 1993* (Cth) (NT Act). Native title rights and interests are rights and interests in relation to land or waters held by Aboriginal peoples or Torres Strait Islanders under their traditional laws and customs and recognised by the common law of Australia.

Native title rights may exist regardless of whether there is a native title claim or determination in relation to the relevant land or waters and may be exclusive or non-exclusive rights. Non-exclusive rights may co-exist with the rights of others, such as a pastoral leaseholder.

Any acts or dealings in relation to land and waters that affect native title must comply with the NT Act in order to be validly done.

To the extent that Native title exists or may exist in the area of the Project site, Powerlink will comply with the requirements of the NT Act for securing an easement for the OHTL and substation. Projects and associated works undertaken by Powerlink generally fall under the provisions of Section 24KA of the NT Act, which facilitate the construction of services to the public. These provisions are also applicable in this instance, as the Project involves a transmission line easement to supply electricity to the public.

26.2 State Legislation

26.2.1 Electricity Act 1994

The *Electricity Act 1994* sets out the requirements that all electricity industry participants are required to promote a safe, efficient and reliable supply and use of electricity. The Act also requires that the supply of electricity is undertaken in an environmentally sound manner. Under Section 31(b) of the Act, a transmission entity is required to properly take into account the environmental effects of its activities under the transmission authority.

Powerlink will meet this requirement through the implementation of Project specific EMP for the OHTL and the substation (Appendix B and Appendix C). The EMPs will be implemented through the construction, operation and maintenance stages of the Project.

26.2.2 Electrical Safety Act 2002

The Electrical Safety Act seeks to prevent through regulation, the death, injury and destruction that can be caused by electricity. Accordingly, the purpose of this Electrical Safety Act is to establish a legislative framework for:

- Preventing persons from being killed or injured by electricity.
- Preventing property from being destroyed or damaged by electricity.

The Project has been designed to satisfy the requirements of the Electrical Safety Act.

26.2.3 Acquisition of Land Act 1967

The *Acquisition of Land Act 1967* governs the process for the compulsory or voluntary acquisition of land for a public purpose by a constructing authority in Queensland. Schedule 2 of the Act defines a construction authority as being the State, a local government or a person authorised by an act to take land for any purpose. In accordance with the Electricity Act, Powerlink is identified as a construction authority.

All Project site land owners have been consulted and tenure is currently being negotiated.

26.2.4 Land Act 1994

The *Land Act 1994* (Land Act) consolidates and amends the law relating to the administration and management of non-freehold land and deeds of grant in trust and the creation of freehold land, and for related purposes. The Land Act regulates a number of activities in relation to the Project, including resumptions, easements and works in local road reserves.

The Project traverses a range of tenures including Freehold, Reserve, State road reserve and private rail. Powerlink, through exemptions detailed in the Electricity Act, are able to construct, operate and maintain electricity infrastructure within road corridors by written agreement with the relevant road authority and on unallocated state land.

All Project site land owners have been consulted and tenure is currently being negotiated.

26.2.5 Transport Infrastructure Act 1994

The *Transport Infrastructure Act 1994* (TI Act) aims to provide a regime that allows for and encourages effective integrated planning and efficient management of a system of transport infrastructure. The TI Act is administered by the DTMR.

The Project crosses a State-controlled road, being Ayr-Dalbeg Road. During the construction phase the works may require temporary road closures and temporary accesses to undertake activities including line stringing and the transportation of construction material on long and/or wide haulage vehicles.

Impacts to the State-controlled road have been discussed in Chapter 18.0 Transport and Traffic (Appendix E).

26.2.6 Aboriginal Cultural Heritage Act 2003

The purpose of the *Aboriginal Cultural Heritage Act 2003* (ACH Act) is to provide effective recognition, protection and conservation of Aboriginal cultural heritage. A person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the Cultural Heritage Duty of Care). A person is taken to have complied with the Duty of Care if they are acting under a Native Title agreement or other agreement with an Aboriginal Party.

Chapter 16.0 Indigenous Cultural Heritage discusses Aboriginal Cultural Heritage related to the Project site.

26.2.7 Queensland Heritage Act 1992

The objective of the *Queensland Heritage Act 1992* (QH Act) is to provide for the conservation of Queensland's cultural heritage for the benefit of the community and future generations. The QH Act conserves and protects Queensland Heritage Places by establishing heritage registers, regulating development that may impact on registered places, and establishing a process for reporting discoveries of objects that may be of cultural heritage significance.

Chapter 16.0 Indigenous Cultural Heritage discusses Aboriginal Cultural Heritage related to the Project site.

26.2.8 Biosecurity Act 2014

The *Biosecurity Act 2014* came into effect on 1 July 2016. The Act's intent is to improve Queensland's biosecurity preparedness and response capabilities and imposes a general biosecurity obligation to all individuals and organisations whose activities pose a biosecurity risk to ensure activities do not spread a pest, disease or contaminant.

The presence of existing biosecurity matters, and potential impacts from the Project are discussed in Chapter 12.0 Biosecurity.

26.2.9 Environmental Protection Act 1994

The objective of the EP Act is:

> *"to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends".*

The EP Act is administered by DESI. Section 319 establishes the general environmental duty of care which is applicable to the Project.

Powerlink will meet the general environmental duty of care through the implementation of Project specific EMP's (Appendix B and Appendix C) for the OHTL and the substation throughout the construction and operation of the Project.

26.2.10 Nature Conservation Act 1992

The NC Act is the principal legislation for the conservation and management of Queensland's native flora and fauna, as well as important natural areas such as national parks. The Act is administered by the DESI.

In Queensland, all plants that are native to Australia are protected plants under the NC Act to prevent whole plants or protected plant parts from being illegally removed from the wild or illegally traded.

The Project site is not mapped as a 'high risk area' on the Protected Plants Flora Survey Trigger Map. No NC Act listed threated flora species were found during the field survey. A full species list is provided in Appendix G: Ecology Technical Report.

26.2.11 Fisheries Act 1994

The purpose of the *Fisheries Act 1994* is to ensure the State fisheries are economically viable, socially acceptable and ecologically sustainable.

The Project site does not intersect or interfere with any water feature mapped under the *Fisheries Act 1994*.

26.2.12 Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act) is administered by the Department of Resources (DoR) and establishes the vegetation management framework for Queensland. The VM Act regulates the clearing of native vegetation throughout Queensland with the purpose to maintain or increase biodiversity, maintain ecological processes, allow for sustainable land use and ensure clearing does cause land degradation. The Queensland Herbarium mapping identifies remnant vegetation across the State.

Chapter 9.0 Flora detailed the vegetation values within the Project site. Mapped native vegetation will be required to be cleared as a part of the Project.

The assessment of clearing native vegetation forms part of the Infrastructure Designation Process under the Planning Act. Where a designation is granted for a Project, assessable development items (such as clearing native vegetation) become accepted development under the Planning Act and therefore a Development Permit is not required.

26.2.13 Water Act 2000

The *Water Act 2000* is administered by the DRDMW and provides the legislative framework for planning, allocation and use of surface water and groundwater in Queensland.

The Project site is located immediately adjacent to the Burdekin River to the east, and an unmapped waterway to the west associated with an agricultural channel (Queensland Government, 2023). No works are proposed within the banks of the Burdekin River.

26.2.14 Planning Act 2016

The purpose of the Planning Act is to provide for an efficient, effective, transparent, integrated, coordinated and accountable system of land use planning and development assessment to facilitate the achievement of ecological sustainability. The Planning Act is primarily managed by the DHLGPPW.

The Act allows for the Minister to designate premises for the development of infrastructure prescribed within the Planning Regulation. The Planning Regulation prescribes a number of developments considered 'infrastructure', one of which is 'electricity operating works'. Infrastructure subject to the designation is detailed in Chapter 3.0 Project Description, and includes the OHTL and substation.

26.3 State Planning Instruments

State planning instruments set out the state and regional planning interests critical to responsible land-use planning and development across Queensland. The State government sets out the state and regional planning matters to be preserved and protected (the State interests). It uses two types of instruments, or tools, to do this:

- The SPP, and
- The Regional Plans.

26.3.1 State Planning Policy 2017

The SPP identifies state-wide planning matters requiring protection and enhancement. The SPP is at the top of the planning hierarchy in Queensland and prevails over 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.

The SPP outlines 17 State interests that are arranged under five broad themes. Each theme has a number of individual State interest policies within each. Individual State interests, and their relevance, are identified in Table 38 below.

Table 38 Applicability of State Interests within State Planning Policy

Theme	State Interest	Relevant	Relevant Section of MID Proposal Report
Liveable Communities and Housing	Housing Supply and Diversity	N/A	N/A
	Liveable Communities	N/A	N/A
Economic Growth	Agriculture	**Applicable**	Chapter 4.0 Land Use
	Development and Construction	N/A	N/A
	Mining and Extractive Resources	N/A	N/A
	Tourism	N/A	N/A
Environment and Heritage	Biodiversity	**Applicable**	Chapter 9.0 Flora Chapter 10.0 Fauna
	Coastal Environment	N/A	N/A
	Cultural Heritage	**Applicable**	Chapter 16.0Indigenous Cultural Heritage Chapter 17.0 Non-Indigenous Cultural Heritage
	Water Quality	**Applicable**	Chapter 7.0 Hydrology

Theme	State Interest	Relevant	Relevant Section of MID Proposal Report
Safety and Resilience to Hazards	Emissions and Hazardous Activities	**Applicable**	Chapter 20.0 Hazards, Health and Safety
	Natural Hazards, Risk and Resilience	**Applicable**	Chapter 7.0 Hydrology Chapter 22.0 Bushfire
Infrastructure	Energy and Water Supply	**Applicable**	Chapter 24.0 Infrastructure
	Infrastructure Integration	N/A	N/A
	Transport Infrastructure	**Applicable**	Chapter 18.0 Transport and Traffic
	Strategic Airport and Aviation Facilities	N/A	N/A
	Strategic Ports	N/A	N/A

26.3.2 North Queensland Regional Plan

The Project is located within the North Queensland Regional Plan (NQ Regional Plan) area (DSDILGP, 2020). Of relevance to the Project, the NQ Regional Plan covers the Townsville, Burdekin, Hinchinbrook and Charter Towers LGA.

The principal aim of the NQ Regional Plan is to determine how land use and infrastructure planning can best support economic growth and population change in the region over the next 25 years and beyond (DSDILGP, 2020).

The NQ Regional Plan contains the following vision “North Queensland thrives as a diverse, liveable and progressive region in the tropics, set around the emerging capital of northern Australia”. The vision will be realised by achieving the following four regional goals.

1. A leading economy in regional Australia
2. A rich healthy natural environment
3. Liveable, sustainable and resilient communities that promote living in the tropics
4. A safe, connected and efficient North Queensland.

Each goal has several sub items which further explain the intent of each regional goal.

The Project aligns with the intent of Goal 1 and Goal 4. The Project does not materially conflict with any of the identified regional goals or sub items.

26.4 Local Planning Instruments

26.4.1 Burdekin Shire Planning Scheme 2022

The Project is located within the Burdekin Shire Council LGA which is governed by the Burdekin Shire Planning Scheme 2022 (Planning Scheme). The Planning Scheme was adopted on the 1 March 2023. Section 1.2.1 of the Planning Scheme has stated that the Planning Minister is satisfied that the SPP is appropriately integrated into the Planning Scheme in full.

Pursuant to the Planning Scheme, the Project site is located within the Rural Zone and is subject to Acid Sulfate Soils Overlay Map, Agricultural Overlay Map Bushfire Overlay Map and Environmental Significance Overlay Map.

Pursuant to the Planning Scheme, a substation triggers Code Assessment if undertaken by a public sector entity (Powerlink).

26.4.2 Project Related Local Approvals

An approval for a Development Permit for a Material Change of Use for a Public Purpose (Pump Station) on land described as Lot 34 on SP331997, located at 4225 Ayr-Dalbeg Road, Mulgrave, was approved by the Burdekin Shire Council subject to conditions on the 24 May 2023. This approval was referred to the State Assessment Referral Agency (SARA) for Native Vegetation Clearing and State Controlled Road Matters.

Minor areas of vegetation clearing have been approved under this approval, which include those areas required to be cleared for the OHTL and the substation site. The approval includes, in its entirety, Lot 34 on SP331997 (Refer Figure 17), therefore vegetation clearing has been approved for the substation component of the Project.

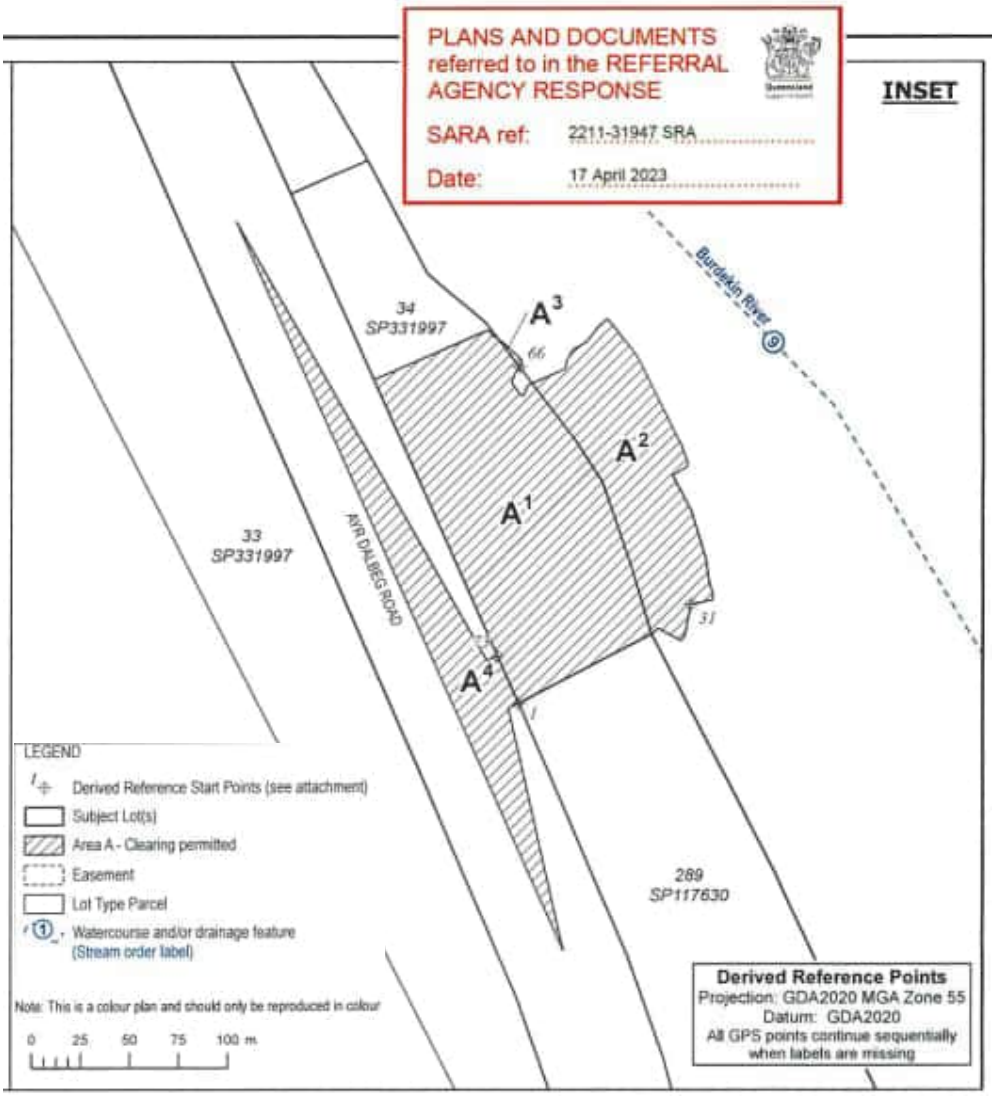

Figure 17 Section of Approved Native Vegetation Clearing Plan

26.4.3 Local Laws

There are two Local Laws applicable to the Project within the Burdekin Shire Council, being:

- Local Law No 3 – Community and Environmental Management, and
- Local Law No 4 – Local Government Controlled Areas, Facilities and Roads.

Local Law No 3 deals with declared local pests, overgrown and unsightly allotments, fires and fire hazards, community safety hazards, noise standards and building appearance. The key matters of

environmental management are discussed in the EMP's (Appendix B and Appendix C) for the OHTL and the substation.

Local Law No 4 deals with use of local government controlled areas, facilities and roads, matters affecting roads and enforcement. The key matters of the Local Law are discussed in Chapter 18.0 Transport and Traffic.

26.5 Other Related Approvals

There are two other Approvals associated with the Haughton Pipeline Stage 2 Project which have considerations for this Project. The following section discusses the Approvals in relation to the Project site only.

Development Permit for Operational Work for Native Vegetation Clearing and State Transport Corridors for an underground water supply pipeline and associated ancillary works for construction consisting of temporary access, haulage roads and stockpile areas. The Development Permit was Approved by the SARA on 14 June 2022.

Subject to the final OHTL location, minor areas of vegetation clearing may have been approved under this approval, however, no areas of the substation site have been approved as part of this Development Permit (Figure 18).

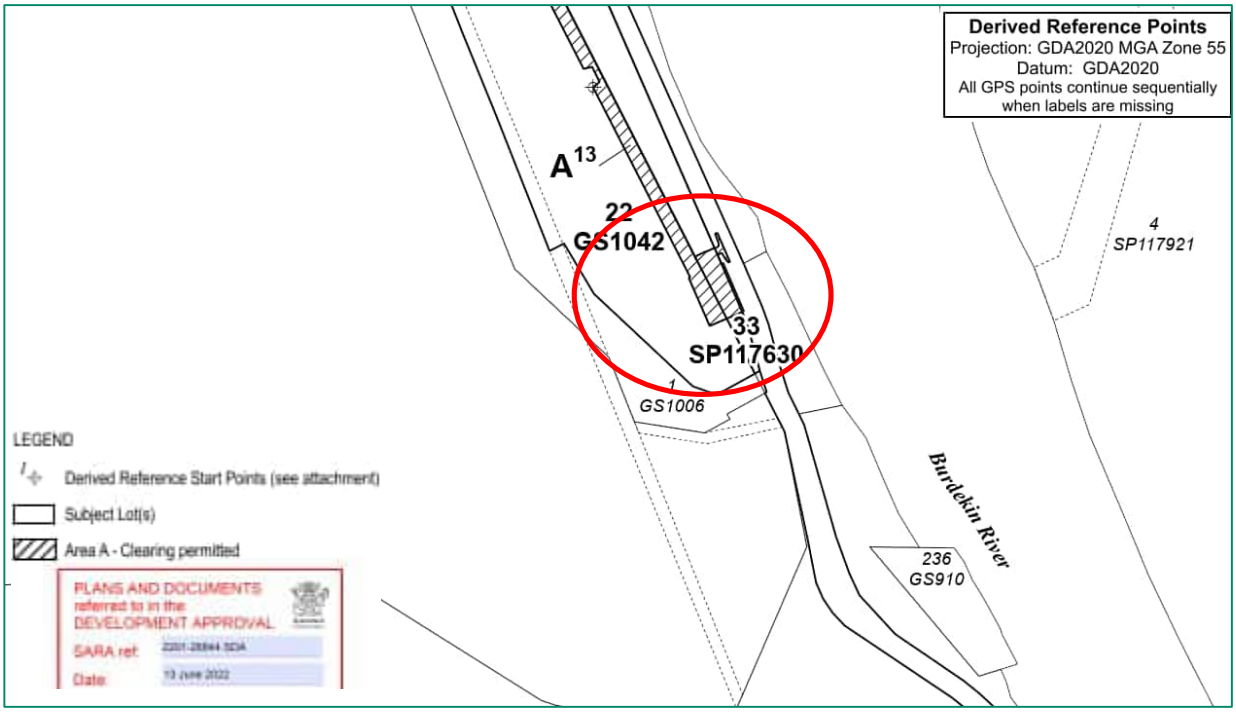

Figure 18 Section of Approved Native Vegetation Clearing Plan

Authority for Installation of Utility Assets in State Controlled Road Permit – Bulk Raw Water Pipeline (Haughton Pipeline (Stage 2)), was approved by DTMR on dated 27 September 2022.

Figure 19 demonstrates the approved Haughton Pipeline (trenchless construction) in the immediate location of the Project site.

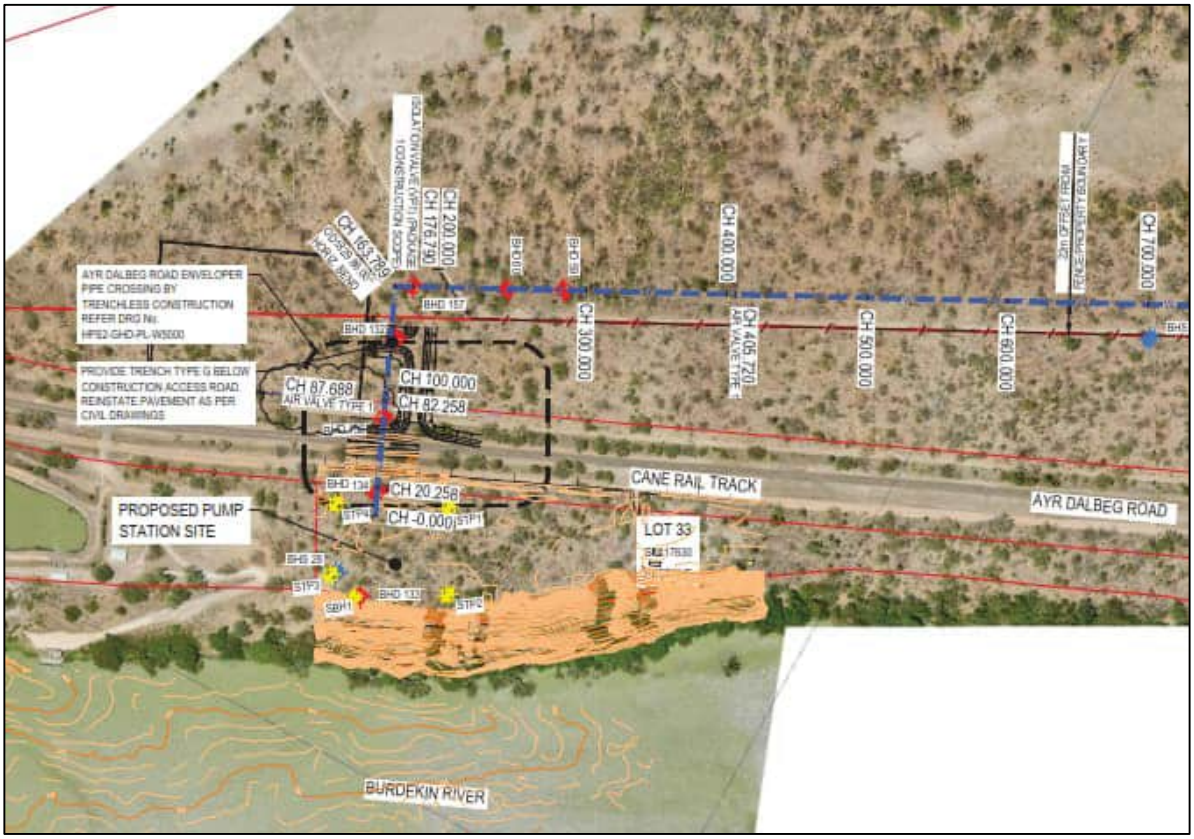

Figure 19 Approved Construction within State Controlled Road – Ayr-Dalbeg Road

26.6 Summary of Legislative Triggers

Table 39 provides a summary of the legislative triggers for the Project in addition to the Ministerial Infrastructure Designation process under the Planning Act.

Table 39 Summary of Legislative Requirements

Legislation	Authority	Activity	Approval
Commonwealth			
EPBC Act	DCCEEW	Potential Significant Impact on MNES	EPBC Act Referral (Referral number 2021/9133).
State			
TI Act	DTMR	Undertaking works within a State-controlled Road Corridor.	Section 102 of the Electricity Act
NC Act	DES	Tampering with animal breeding places	Species Management Program

27.0 Environmental Management

Powerlink is committed to the protection of the environment and management of adverse environmental impacts as a result of Powerlink activities. Every Powerlink individual is responsible and accountable for environmental management, and Powerlink leaders are active role models of this commitment.

Powerlink's Health, Safety and Environment Policy outlines the commitment to delivering environmental outcomes for everyone, everywhere and everyday by the following.

- Setting objectives and targets to monitor performance aimed at the elimination or minimisation of work-related injury, illness, and environmental harm.
- Systematically identifying, assessing, and managing as far as reasonably practicable the health and safety risks and environmental impacts which may arise from our activities.
- Ensuring health, safety and environmental responsibilities are clearly defined and individuals are accountable for performance within their scope of responsibility.
- Consulting and communicating with employees and other stakeholders on relevant health, safety and environmental matters.
- Ensuring the planning, design, construction, operation and maintenance of the network assets is safe, including electrically safe.
- Applying a continuous improvement framework to the development, implementation and review of standards, procedures and supporting documentation which complies with health, safety and environmental statutory obligations; is fit for purpose; drives improved health and safety performance, protection of the environment and prevention of pollution.
- Providing the necessary resources to meet these commitments.

27.1 Construction Environmental Management

The mitigation and management measures for this Project have been proposed in line with Powerlink's Standard Environmental Controls Specification. All construction measures proposed for the Project are documented in the EMP for the OHTL and substation (Appendix B and Appendix C) additional controls relevant to the Project are presented in the Environmental Annexures appended to the EMP. The EMP's and annexures contain:

- Roles and responsibilities.
- Performance criteria.
- Monitoring and compliance, including audits, and
- Training and competency.

The EMP is capable of being read as a stand-alone document without reference to other parts of this assessment report.

27.2 Environmental Design

Powerlink has implemented the hierarchy of management principles in the design of the Project to date. These principles and the order in which they have been applied is as follows.

- **Avoid**: locating activities to avoid direct and indirect impacts on environmental values.
- **Minimise**: minimising direct and indirect impacts where they cannot be completely avoided.
- **Mitigate**: implementing mitigation and management measures to reduce direct, indirect and cumulative impacts.

Using the principles above, Powerlink have gone through an impact minimisation process to reduce direct impacts to vegetation clearing. Key actions included reviewing the transmission line design in relation to existing vegetation on the Project site to determine how much vegetation is required to be

removed to construct, operate and maintain the transmission line. A 40 m corridor has been applied to reduce the amount of clearing required.

In addition, to reduce the extend of vegetation clearing there are a range of management and mitigation measures relevant to design and operation of the Project which have been applied or committed to. These are provided detailed in the following sections.

27.2.1 Design

Table 40 Design Environmental Management Measures

Measure	MID Proposal Chapter
Any required consents from resource interest holders will be sought once detailed design is completed and prior to construction activities commencing.	Section 26.2.3, Section 26.2.4
The location of access tracks on each property will be confirmed closer to the construction phase in consultation with each landholder. Access will be obtained from Ayr-Dalbeg Road directly to the proposed easement. No additional access points are being proposed.	Section 3.5.1
Where transmission lines cross road reserve, approval will be sought from the relevant road authority under Section 102 of the Electricity Act.	Section 3.5.9, Section 26.2.1
Where possible: • Structures will be located away from the Burdekin River as far as practicable. • Access tracks will include established and maintained erosion and control measures (culverts, whoa boys and spoon drains), minimising vegetation clearing and disturbance to soil structures.	Section 3.5.2, Section 4.3, Section 7.3.1
Geotechnical assessments will be undertaken prior to construction to determine the appropriate foundation type for each structure and the substation. The choice of foundation type is dependent on the specific nature of the soil and rock and takes into account soil/concrete friction strength, water levels, soil bearing capacity, construction constraints, rock levels, and soil properties.	Section 4.3
Prior to construction Powerlink will undertake desktop assessments to assess all parcels of land listed as containing known or suspected (likely) contamination. Testing for the presence of contamination prior to excavation or other earthworks will be undertaken based upon a risk assessment for sites listed on the EMR and where known or suspected contamination exists. Excavated soil material will be reused where possible and any contaminated material unable to be remediated must be disposed of by an appropriately licensed waste contractor to a licensed waste facility.	Section 4.3
The electricity transmission infrastructure will be designed and constructed to reasonably withstand severe weather events, including potential cyclonic conditions near the North Queensland coast.	Section 5.3
An ESCP should be developed and then implemented to ensure that potentially affected surface water from construction activities does not enter downstream surface water and ground water environments. A review of TCC Haughton Pipeline Stage 2 Project design documentation for the proposed Clare Weir pumpstation should be considered if available for this Project. The review may provide more certainty on the assumptions in this Report.	Section 7.3.3
Management measures for groundwater impacts will be required if water is sourced from bores for construction. This will be determined at the detailed design phase and will include consultation with landholders.	Section 7.3.1

Measure	MID Proposal Chapter
The volumes of water required for the Project and their locations will be determined at the detailed design phase. If water is to be sourced from a watercourse, Powerlink Queensland will extract water in accordance with the '*Exemption requirements for constructing activities for the take of water without a water entitlement (OSW/2020/5467 Version 4.01 updated 05/02/2021* or any later revision). If Powerlink Queensland cannot meet the exemption requirements of the above document, a water licence application will be required.	Section 7.3.3
• Locating the Project in close proximity to the approved substation. • Connecting the OHTL to Powerlink's easement in the most direct alignment. • Proposing the easement width to be as minimal as possible to accommodate the infrastructure. Thus, minimising environmental impacts and impacts upon existing site operations. • Designated construction access tracks are planned and located in the OHTL easement to minimise disturbance to site operations. • Property access protocols will be developed for implementation during the construction phase which will include information on access tracks, fencing, and gates that can be used as well as the need to keep gates closed for stock control.	Section 13.3
Retain existing vegetation, where possible around the corridor or associated with roads and properties near the corridor to the greatest extent compatible with safety.	Section 14.3
TCC has negotiated and executed a cultural heritage management agreement (CHMA) with the relevant Native Title party (the Bindal People) on 28 November 2020 in accordance with the *Aboriginal Cultural Heritage Act 2003*, and intends to manage any identified Aboriginal cultural heritage constraints within the Project Area in accordance with the terms set out within this agreement. The CHMA includes an agreed methodology for the identification and management of Aboriginal cultural heritage within the Project Area. A cultural heritage survey and impact assessment study over the Project Area was completed between November and December 2021 by representatives of the Bindal People and their technical advisor. This study includes detailed desktop research and cultural heritage surveys of the Project Area by the Bindal People and their technical advisor and contains their recommendations for the management of Aboriginal cultural heritage identified within the study. The results and recommendations of this study has since been submitted to TCC, and it is expected that TCC would implement these recommendations within the Project Area.	Section 16.1.1
The Project will not impact on any known registered historical cultural heritage values.	Section 17.3
To address the potential risks identified for construction traffic, the following management and mitigation measures are proposed: • As part of the Project works it is proposed that the two new site access points will be constructed generally in accordance with the rural property access arrangement for articulated vehicles (Type C) outlined in TMR Standard Drawing 1807. • Based on the current restrictions to sightlines to/from the proposed access points, it is recommended that roadside vegetation clearing be undertaken to open up/provide suitable sight distances. In addition, it is also recommended that advanced warning signage be provided on both Ayr-Dalbeg Road approaches to provide further delineation of the access points to motorists and highlight the potential for vehicle movements entering and exiting at these locations. • Provision of give way control to the new level crossing of the Invicta Mill Cane Rail Line approximately 15 m to the east of Ayr-Dalbeg Road as part of the proposed site access arrangements for the Project's substation area.	Section 18.4

Measure	MID Proposal Chapter
The design of the Project will ensure adequate emergency service access. Consideration will be given to the provision for first response firefighting, accessible and sufficient water supply for firefighting purposes and the development of safe evacuation plans.	Section 20.2.6.1
The substation will be surrounded by a cleared buffer area for protection in the event of a fire. Queensland has adopted the Australian Standard for the Construction of Buildings in Bushfire Prone Areas – AS3959-2009. AS3959 sets out the requirements for the construction of buildings in bushfire prone areas in order to improve their safety when they are subjected to burning debris, radiant heat or flame contact generated from a bushfire. Project buildings constructed will be consistent with the Standard. As per Powerlink's Bushfire Mitigation Plan (ASM-PLN-A3285085) Powerlink has a specific Guideline for the Design of Transmission Lines for Bushfires (A544415) which will be applied to the design of the Project. The transmission line design will include all current design principles and safeguards to avoid arcing and line breakage. Allow additional tower height clearances in areas with high fuel loads, where practicable.	Section 22.3.1
The Project will be designed to ensure sufficient separation distance between the proposed and existing transmission/sub transmission lines. The Project will be designed to consider the requirements of private infrastructure within the Project site. This may include the installation of visual marker balls on the transmission line near landing airstrips, where deemed necessary for safety.	Section 24.3

27.2.2 Operation and Maintenance

Table 41 Operation and Maintenance Environmental Management Measures

Measure	MID Proposal Chapter
Vegetation regrowth control within the substation compound and under the incoming power supply transmission lines will be undertaken to maintain electrical safety clearances between the conductors and vegetation.	Section 3.6
• Monitoring of erosion during routine service maintenance. • Regular routine service maintenance of vegetation for transmission line easements and substation buffer.	Section 7.3.3
Dust mitigation methods should be utilised whenever possible to minimise local impacts, especially during dry periods. To minimise potential exhaust emissions, all equipment used should be well maintained and fit for purpose.	Section 6.4
Measures to be implemented in the operational phase of the Project to protect water resources include the following. • Ongoing implementation of erosion and sediment controls for areas where required. • All vehicles and equipment is to be maintained. • Spills are to be cleaned up immediately. • Routine maintenance of vehicles is to occur in designated areas with appropriate infrastructure. Routine maintenance of vehicles, including refuelling is not to occur within 100 m of the high bank of a watercourse or drainage line. • Scour protection, beds and banks at watercourse crossings to be regularly inspected and maintained. • The hydraulic capacity of any cross-drainage infrastructure is to be regularly inspected for blockage, sediment, vegetation etc. Where flows are being inhibited by such processes, remedial actions are to occur. • Liaise with regulatory authorities where required prior to disturbing the bed and banks of any watercourse, including for remedial works.	Section 7.3.3
A Biosecurity Management Plan will be developed to support operation of the Project and to achieve Powerlink Queensland's general biosecurity obligation under the *Biosecurity Act 2014*.	Section 12.4
Monitoring of weather and identification of severe weather events in areas of operation will be carried out. Regular easement inspections will be carried out to monitor and identify the introduction or spread of identified weeds or pests on easement and access tracks. If maintenance work requires access to landholders' property, Powerlink will communicate with landholders and agree upon the biosecurity management strategies, including the use of any chemicals to ensure ongoing effectiveness.	Section 20.2.6

Measure	MID Proposal Chapter
Should radio or television interference be identified, Powerlink can assist people experiencing reception problems caused by transmission line by providing advice and, if required, signal amplification equipment. Powerlink will assess the potential for induced charge in proximal metal objects, and propose mitigation measures for any objects in or near the easement that may be affected. Where the possibility that a transmission line could cause interference with the operation of an electric fence running parallel to the line, Powerlink will provide mitigation measures to assist the owner of any electric fence installation that might be adversely affected. In the event that corona-induced interference becomes a problem, Powerlink will arrange to undertake any necessary remedial work.	Section 21
Operation and maintenance of the Project will be undertaken in line with Powerlink's Bushfire Mitigation Plan (ASM-PLN-A3285085). Powerlink adopts an asset risk management approach that considers potential fire starts from network components (e.g. insulator and instrument failures). High consequence areas and the likelihood of failures are assessed to determine the optimal investment in the network. Flammable and combustible liquids (i.e. fuel) will be stored within facilities designed to AS1940-2004 'The Storage and Handling of Flammable and Combustible Liquids'. Burning of vegetation is prohibited, unless a permit is obtained by a local fire authority and Powerlink. Powerlink maintains its easement through routine vegetation maintenance to ensure vegetation remains outside of untrained exclusion zones and incompatible species do not interfere with the safe operation of the transmission line. Cleared vegetation will not be placed in a location which may increase any fire hazard and impact on the Project in the event of a fire.	Section 22.3.3
A detailed Waste Management Plan is to be developed prior to operation and maintenance, including all actions needed to effectively implement the waste management hierarchy and a waste monitoring program. Ablution facilities will require regular servicing and all waste transport must be undertaken by a licensed regulated waste transport contractor, with waste tracking certificates to be completed. Regulated wastes must only be disposed of at an appropriately licensed facility (e.g. sewage treatment plant).	Section 23.2

27.2.3 Decommissioning

Table 42 Decommissioning Environmental Management Measures

Measure	MID Proposal Chapter
All necessary permits and / or approvals which are required to undertake decommissioning works will be sought and received prior to decommissioning works commencing. Prior to decommissioning of the transmission line, a Decommissioning Management Plan which provides detail regarding the proposed decommissioning works, environmental risks associated with decommissioning and management and mitigation measures will be prepared.	Section 3.6.2
Dust mitigation methods should be implemented during decommissioning to minimise any potential ait quality impacts.	Section 6.4.1

28.0 Community and Stakeholder Consultation

28.1 Engagement Framework

Powerlink is committed to effective and genuine engagement practices with landholders, the Traditional Owner group, the wider community and other stakeholders.

Powerlink's activities are guided by our Stakeholder Engagement Framework which is underpinned by the key principles of integrity, openness, responsiveness, accountability and inclusiveness. Our Community Engagement Strategy also underpins our engagement planning approach and commitments to ensure we remain focused on undertaking respectful and transparent engagement across all stages of our infrastructure lifecycle. These framework documents are available online.

The aim of Powerlink's engagement process for the Burdekin River Pump Station Project is to:

- Provide timely, relevant and meaningful information about the project, reflective of the scale and complexity of the project activities
- Ensure landholders, the Traditional Owner group, the wider community and other stakeholders are aware of key project activities and how they can provide genuine input within the scope of consultation processes
- Utilise a range of engagement activities to facilitate two-way information sharing with identified target stakeholder groups.

28.2 Project Stakeholders

The identified key stakeholder groups for the project are provided in Table 43. The stakeholder groups have been informed by proposed project activities, proximity to the project site, and previous engagement undertaken by TCC.

Table 43 Project Stakeholders

Stakeholder Group	Stakeholders
Elected Representatives	State Member for Burdekin, Mr Dale Last MP
	Mayor of Burdekin Shire Council, Councillor Lyn McLaughlin
Local Council	Burdekin Shire Council
Directly affected landholders	Freehold: 1 landholder
	Land Lease: Sunwater Limited
	Reserve Land: Burdekin Shire Council and 1 landholder
	Reserve: The State of Queensland (represented by the Department of Resources)
	State Controlled Road: Department of Transport and Main Roads
	Rail Line: Invicta Mill
Traditional Owner Group	Bindal People
Cane Rail Asset Owner	Wilmar Sugar
Local Environmental Groups	Lower Burdekin Landcare
	NQ Dry Tropics
Adjacent Landholders	Adjacent to project site
Wider community	Clare residents
	Residents within the Burdekin Shire

28.3 Engagement Activities to Date

28.3.1 Engagement Prior to the MID Process

TCC has managed all previous and early engagement on the project, which has included consultation with directly affected landholders and other stakeholders regarding a wide range of matters associated with the project.

28.3.2 Directly Affected Landholder Engagement

Engagement has been undertaken with the project's directly affected landholders to seek input to inform corridor investigation and selection, facilitate requirements for field assessments and confirm agreements for land access, compensation and maintenance.

28.3.3 Traditional Owner Group Engagement

TCC has engaged with the project's Traditional Owner group to develop an agreed Cultural Heritage Management Plan (CHMP). The CHMP guides the management of land use activities for the project, such as Cultural Heritage Monitors, to avoid or minimise harm to Aboriginal or Torres Strait Islander cultural heritage.

28.3.4 Engagement as Part of the MID Process

Powerlink is managing the stakeholder engagement and public consultation activities required for the MID process. Ongoing open and transparent engagement will be a key focus during the MID process and for future stages of the proposed project.

28.3.5 Preliminary Stakeholder Engagement

Preliminary stakeholder engagement commenced in December 2023 to raise awareness of the proposed project and to provide landholders, the Traditional Owner group, the wider community and other stakeholders with an opportunity to provide initial feedback prior to the MID proposal being lodged. This engagement has involved:

- Preliminary mapping to show the project's location and proposed transmission infrastructure
- A project specific webpage to host online information about the project, MID process and consultation opportunities
- Correspondence with landholders and other key stakeholders providing project information and offering an individual briefing
- Correspondence with the wider community of Clare providing project information
- Project briefings with representatives from Burdekin Shire Council (15 December 2023) and Wilmar Sugar (12 February 2024)
- No issues were raised or noted during the project briefings.
    - Burdekin Shire Council representatives requested and were provided with a copy of the presentation delivered at the briefing.
    - Wilmar Sugar representatives provided information about movements along the Invicta Mill Cane Rail Line. Representatives also requested further information about the construction phase of the proposed transmission infrastructure, when available, noting Wilmar Sugar's specifications for infrastructure over their cane rail line.

No submissions were received during the preliminary engagement phase.

28.4 Public Consultation and Further Engagement

Powerlink is continuing engagement activities with landholders, the Traditional Owner group, the wider community and other stakeholders as part of the public consultation process for this MID Proposal. These activities include:

- Advertisements in local newspapers advising of the release of the MID Proposal and how to make a submission to the Minister for the Department of Housing, Local Government, Planning and Public Works (DHLGPPW) (Figure 20)
- Providing hard copies of the MID Proposal available to view at the Burdekin Shire Council Office (Ayr) and Burdekin Shire Council Library (Home Hill Branch)
- Updates to the project specific webpage, with an electronic copy of the MID Proposal
- Project newsletter summarising the key components of the MID Proposal
- Project signage on the proposed site (Figure 21)
- Correspondence with landholders, the Traditional Owner group, the wider community and other key stakeholders advising of the release of the MID Proposal, how it can be viewed and how to make a submission to the Minister for DHLGPPW (Figure 22)
- Project stakeholder briefings, as requested
- Community information drop-in sessions in Clare with hard copies of the MID Proposal available.

Landholders, the Traditional Owner group, the wider community and other stakeholders are able to lodge formal submissions to this document via the following:

- Online at statedevelopment.qld.gov.au via the MID public register
- Email at infrastructuredesignation@dsdilgp.qld.gov.au
- Post to PO Box 15009, City East, Queensland 4002
- Call 07 3328 4811

The MID Proposal and public submissions will be assessed by the DHLGPPW. Ongoing engagement with landholders, the Traditional Owner group, the community and other stakeholders remains a key focus during all phases of Powerlink projects. This ensures Powerlink has the opportunity to strengthen and leverage relationships with key groups throughout the project lifecycle.

HAVE YOUR SAY

AYR DALBEG ROAD, QLD, 4807

PROPOSED SUBSTATION AND ELECTRICITY TRANSMISSION LINE

Powerlink Queensland is proposing to connect the Burdekin River Pump Station associated with the Haughton Pipeline Stage 2 Project into the transmission network at the above address. The proposed project includes a new:

- 132kV Substation (known as the Landers Creek Substation)
- Overhead power transmission line (OHTL) to establish a 132kV single circuit tee off into the new Substation
- 40m wide easement, 20m either side of the OHTL centreline. One partial section is 50m.

This proposal has been submitted as a request for a Ministerial Infrastructure Designation (MID) under the *Planning Act 2016*.

MID proposal can be viewed at www.statedevelopment.qld.gov.au/mid-consultations

You can make a submission, on or before <consultation end date>, to the Infrastructure Designation team via:

- online: www.statedevelopment.qld.gov.au/mid-consultations
- email: infrastructuredesignation@dsdilgp.qld.gov.au
- post: PO Box 15009, City East QLD 4002

- **Questions?** Contact the Infrastructure Designation team on 1300 967 433 or at the above email address.

The MID proposal (<MID-####-#####>) has been submitted by Powerlink Queensland to the Planning Minister under Chapter 2, Part 5 of the *Planning Act 2016*.

Figure 20 Draft Newspaper Advertisement

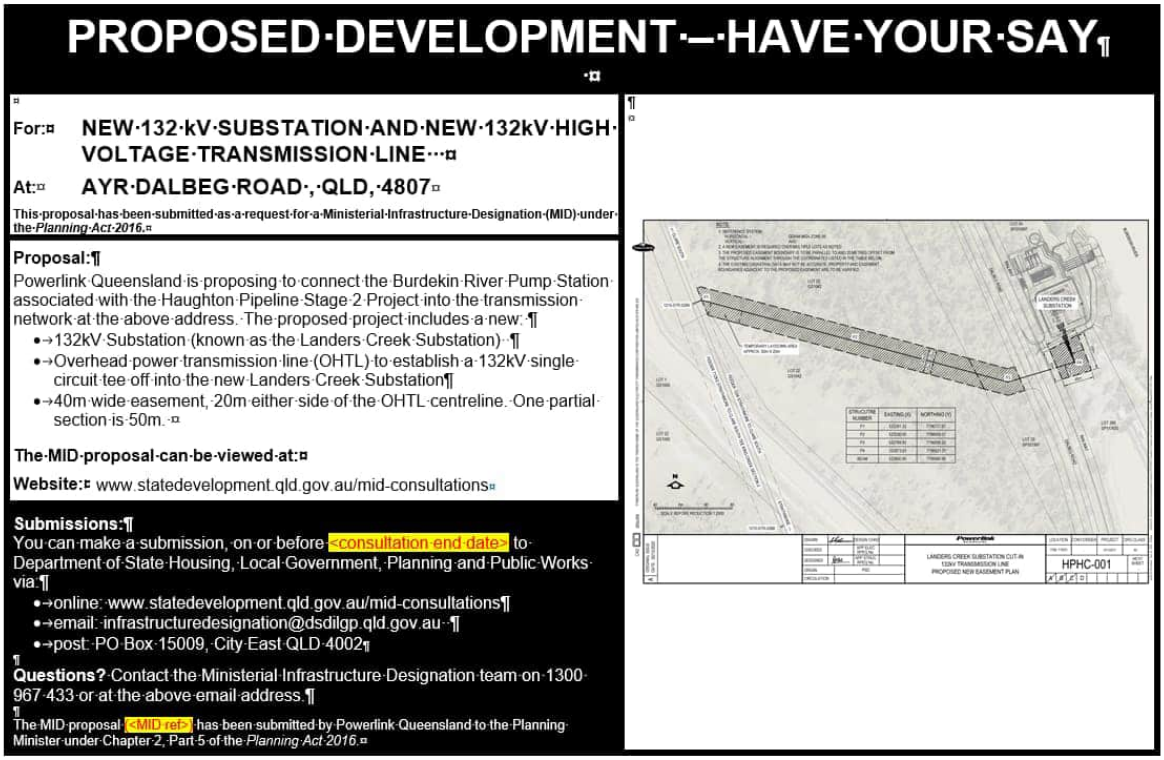

Figure 21 Draft Signage

<date>¶
<insert stakeholder>¶
<insert stakeholder mail address>¶
Email: <stakeholder email address if known>¶
Dear <stakeholder>¶
¶
RE: Proposed development – Burdekin River Pump Station Connection¶
¶
Powerlink Queensland is proposing to connect the Burdekin River Pump Station associated with the Haughton Pipeline Stage 2 Project into the transmission network at the below address.¶
¶
This proposal has been submitted as a request for a Ministerial Infrastructure Designation (MID) under the *Planning Act 2016*. It is proposed to designate the premises for infrastructure as described below:¶
¶

Real property description	Lot 34 on SP331997, Lot 289 on SP117630, Lot 33 on SP331997, Lot 22 on GS1042,
Property address	Ayr Dalbeg Road, Clare, 4807
Local government area	Burdekin Shire Council
Infrastructure type¶ (refer to Planning Regulation 2017, Schedule 5, Part 2)	Substation and electricity transmission line
Description of proposal	The project includes a new:¶ • → 132kV Substation (known as the Landers Creek Substation)¶ • → Overhead power transmission line (OHTL) to establish a single 132kV single circuit tee off into the new Landers Creek Substation¶ • → 40m wide easement, 20m either side of the OHTL centreline. One partial section is 50m.

The MID proposal has been submitted by Powerlink Queensland to the Planning Minister under Chapter 2, Part 5 of the *Planning Act 2016*.¶
¶
How to have your say¶
The MID proposal (<MID ref>) containing details of the proposal and an assessment of potential impacts is available online at:¶
• → www.statedevelopment.qld.gov.au/mid-consultations¶
You can make a submission, on or before <consultation end date>, about the MID proposal to the Ministerial Infrastructure Designation team via:¶
• → online: www.statedevelopment.qld.gov.au/mid-consultations¶
¶
• → email: infrastructuredesignation@dsdilgp.qld.gov.au¶
¶
• → post: PO Box 15009, City East, QLD, 4002.↵
¶
If you wish to further discuss the MID proposal, please contact the Ministerial Infrastructure Designations team within the Department of State Development, Infrastructure, Local Government and Planning on 1300 967 433 or at the above email address.¶
¶
Yours sincerely¶
Property Project Manager ENC <attach local context plan and site plan>¶

Figure 22 Draft Letter to Stakeholders

29.0 Glossary

Table 44 Glossary of Terms

Acronym	Definition
ABS	Australian Bureau of Statistics
AECOM	AECOM Australia Pty Ltd
AHD	Australian Height Datum
Air Quality NEPM	National Environment Protection (Ambient Air Quality) Measure (Commonwealth)
ALA	*Acquisition of Land Act 1967*
ALC	Agricultural Land Classifications
ASC	Australian Soil Classification
ASRIS	Australian Soil Resource Information System
ASS	Acid Sulphate Soils
BoM	Bureau of Meteorology
Carbon dioxide	CO_2
CASANZ	Clean Air Society of Australia and New Zealand
CHMP	Cultural Heritage Management Plan
CLR	Contaminated Land Register
CO	Carbon monoxide
CT/VT	Current Transformer/Voltage Transformer
CVT	Capacitive Voltage Transformer
DAF	Department of Agriculture and Fisheries
DES	Department of Envionment and Science
DoR	Department of Resources
DPI	Department of Primary Industries
DHLGPPW	Department of Housing, Local Government, Planning and Public Works
DSDILGP	Department of State Development, Infrastructure Local Government and Planning
DTMR	Department of Transport and Main Roads
EA	Environmental Authority
EMF	Electric and Magnetic Fields
EMP	Environmental Management Plan
EMR	Environmental Management Register
EP Act	*Environmental Protection Act 1994*
EP Regulation	*Environmental Protection Regulation 2019* (Queensland)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPP (Noise)	*Environmental Protection (Noise) Policy 2019* (Queensland)
EPP Air	*Environmental Protection (Air) Policy 2019* (Queensland)
ERA	Environmentally Relevant Activities
ERP	Emergency Response Plan

Acronym	Definition
ESR	Electrical Safety Rules
GBO	General Biosecurity Obligation
GHG	*Greenhouse Gases*
GWP	*Global Warming Potential*
IAA	Important Agricultural Areas
ICNIRP	International Commission on Non-Ionizing Radiation Protection
km	Kilometres
kV	Kilovolts
kVA	Kilovolt Amperes
LGA	Local Government Area
m	Metres
methane	CH_4
MID	Ministerial Infrastructure Designation
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
MVA	Megavolt Amperes
MW	Megawatt
NC Act	*Nature Conservation Act 1992*
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
Nitrous oxide	N_2O
NMP	Native Mounted Police
NO_2	Nitrogen dioxide
NPI	National Pollution Inventory
O_3	Ozone
OHTL	Overhead Transmission Line
PM_{10}	particles with an aerodynamic diameter less than or equal to 10 µm
$PM_{2.5}$	particles with an aerodynamic diameter less than or equal to 2.5 µm
Powerlink	Powerlink Queensland
RE	Regional ecosystem
SAHVEA	Safe Access to High Voltage Electrical Apparatus
SDS	Safety Data Sheet
SMP	Species Management Program
Specified hydrofluorocarbons	HFCs
Specified perfluorocarbons	PFCs
SPP	State Planning Policy
Sulfur dioxide	SO_2

Acronym	Definition
Sulfur hexafluoride	SF6
Sunwater	Sunwater Limited
TCC	Townsville City Council
TEC	Threatened Ecological Communities
TSP	total suspended particulates
UXO	Unexploded Ordinance
VM Act	*Vegetation Management Act 1999*
WHS Act	*Work Health and Safety Act 2011*
WHS Reg	*Work Health and Safety Regulation 2011*
WoNS	Weeds of National Significance
WWII	World War 2

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Appendix A

Project Plans

NOTE:

1. REFERENCE SYSTEM:
   HORIZONTAL :- GDA94 MGA ZONE 55
   VERTICAL:- AHD
2. A NEW EASEMENT IS REQUIRED OVER MULTIPLE LOTS AS NOTED
3. THE PROPOSED EASEMENT BOUNDARY IS TO BE PARALLEL TO AND 20 METRES OFFSET FROM THE STRUCTURE ALIGNMENT THROUGH THE COORDINATES LISTED IN THE TABLE BELOW.
4. THE EXISTING CADASTRAL DATA MAY NOT BE ACCURATE. PROPERTY AND EASEMENT BOUNDARIES ADJACENT TO THE PROPOSED EASEMENT ARE TO BE VARIFIED.

CLARE SOUTH

X: 522284.07
Y: 7796736.37

X: 522289.63
Y: 7796738.79

P1

1215-STR-0289

X: 522301.25
Y: 7796694.30

LOT 22
GS1042

PROPOSED NEW EASEMENT
APPROXIMATELY 17721m²

TEMPORARY LAYDOWN AREA
APPROX. 50m X 20m

P2

40m
20m
20m

LOT 22
GS1042

LOT 1
GS1006

FEEDER 7128/2 STRATHMORE TO CLARE SOUTH TEE KING CREEK SECTION 2

FEEDER 7208 STRATHMORE TO CLARE SOUTH

LOT 22
GS1042

N

40 0m 40 80
SCALE BEFORE REDUCTION 1:2000

1215-STR-0288

STRATHMORE →

LOT 34
SP331997

BURDEKIN RIVER

RAILWAY

DALBEG ROAD

LANDERS CREEK SUBSTATION

SUBSTATION DEVELOPMENT FOOTPRINT APPROX. 4242m²

X: 522878.70
Y: 7796663.85

50m
20m
59m

PROPOSED NEW EASEMENT APPROX. 2660m²

P4

20m
48m

X: 522900.01
Y: 7796608.34

X: 522854.27
Y: 7796594.64

X: 522780.18
Y: 7796614.20

X: 522769.50
Y: 7796611.00

(1)

X: 522834.51
Y: 7796640.54

50m

P3

(2)

X: 522770.14
Y: 7796569.44

X: 522796.11
Y: 7796577.22

PROPOSED NEW EASEMENT
APPROXIMATELY 2818m²

LOT 33
SP331997

LOT 289
SP117630

RAILWAY

DALBEG ROAD

STRUCUTRE NUMBER	EASTING (X)	NORTHING (Y)
P1	522291.22	7796717.67
P2	522530.05	7796654.07
P3	522769.82	7796590.22
P4	522873.61	7796621.31
BEAM	522850.80	7796680.96

Transmission line Easement Area
Approx. 23,199m²
Lander's Creek Substation Development
Footprint Area Approx. 4,242m²

Total Development Footprint Area Approx. 27,441m²

(1) PROPOSED TEMPORARY ACCESS FOR CONSTRUCTION AND PERMANENT ACCESS FOR MAINTENANCE.
(2) PROPOSED ACCESS TRACK (Standard Construction - in accordance with LMC-003.6 Technical specifications for access track and drainage-Specs v4.2, Prepared by Powerlink Queensland) TO BE LOCATED WITHIN THE EASEMENT BOUNDARY.

283x394

CAD

A	ORIGINAL ISSUE DATE: 20/12/2022				

DRAWN		DESIGN CHKD	
CHECKED		APP ELEC RPEQ No.	
DESIGNED		APP STRUC RPEQ No.	
ORIGIN	PSD		
CIRCULATION	-		

Powerlink QUEENSLAND

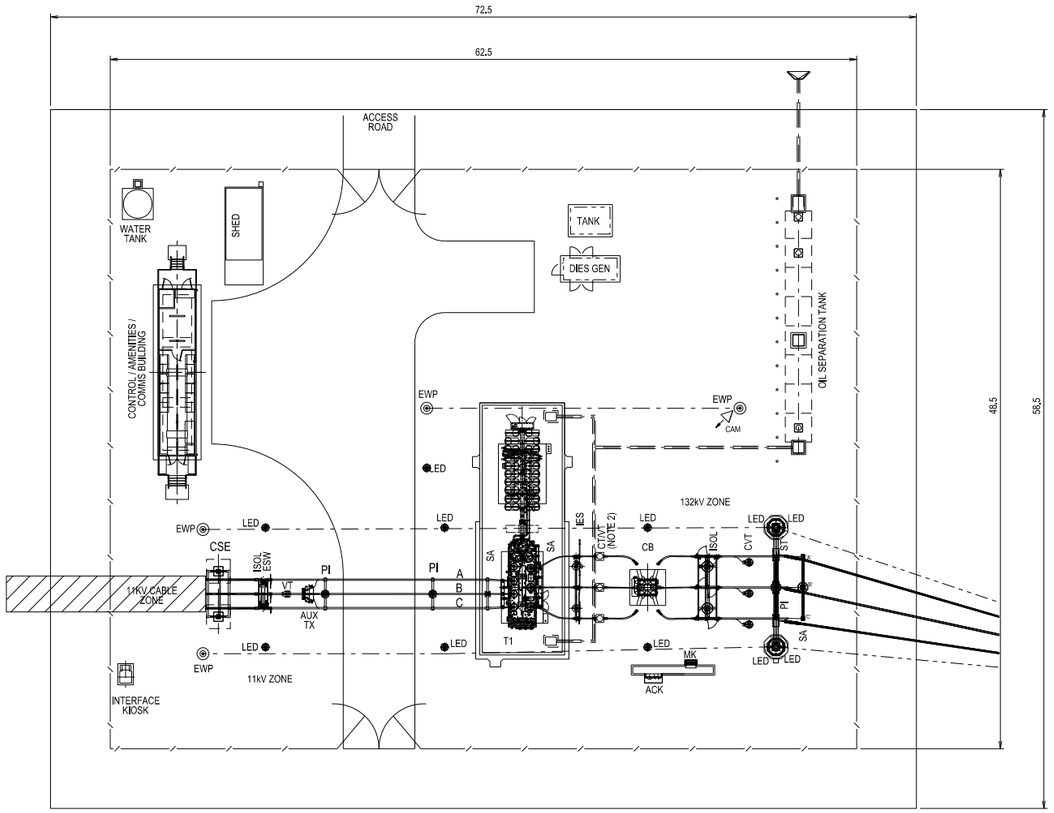
LANDERS CREEK SUBSTATION CUT-IN
132kV TRANSMISSION LINE
PROPOSED NEW EASEMENT PLAN

LOCATION	CONT/ORDER	PROJECT	DRG CLASS
7208, 7182/2	-	CP.02917	A0

HPHC-001

NEXT SHEET ---

A B C D



DRAWING REFERENCES:

LINE DIAGRAM FOR ESTIMATION PURPOSES ONLY 159477-001

PREFERRED PLANT SCHEDULE SHEET 1 OF 2 159477-003

PREFERRED PLANT SCHEDULE SHEET 2 OF 2 159477-004

NOTES:

1. ALL DIMENSIONS, POSITIONS AND EQUIPMENT SHOWN ON THIS DRAWING ARE PRELIMINARY AND INDICATIVE ONLY.
2. DEPENDING ON AVAILABILITY, CT/VT METERING UNIT MAY BE REPLACED WITH A POST CT.

0 10 20m

UNREDUCED SCALE 1:250

CAD 566x801

A ORIGINAL ISSUE DATE : 20-01-2023		CHECKED		DESIGNED	TC	Powerlink QUEENSLAND	LOCATION	CONT/ORDER	PROJECT	DRG CLASS	
		DRAWN	N.McK	DESIGN CHKD		LANDERS CREEK 132/11kV SUBSTATION HAUGHTON PUMPED HYDRO CONNECTION GENERAL ARRANGEMENT FOR ESTIMATION PURPOSES ONLY	T278		CP.02917	B6	
		ORIGIN	PSD	APPROVED	RPEQ 15377		A1-H-159477-002				NEXT SHEET 003
		CIRCULATION					A				

NOTE:
1. 33kV PLANT SHOWN UNTIL DETAILS OF 11kV PLANT RECEIVED

ITEM	DESCRIPTION	OUTLINE AGREEMENT No.	MATERIAL No. / ORDER No.	CONTRACT	ITEM	DRAWING NUMBER	QTY	ORDER DATE	DELIVERY DATE	DELIVERY LOCATION
1	132/11kV POWER TRANSFORMER, 12MVA, HV 40kA/2s, LV 25kA/2s, ONAN, Dny11 LOCATION: =T01-T1		TBC	TBC		TBC	1			LANDERS CREEK
2	145kV DEAD TANK CIRCUIT BREAKER, 3150A, 40kA, 3PAR, 5 CORE, TYPE TB1 - GE LOCATION: =D01-Q10	T0201613B1/40	39811	T0201613B1	T11	156131-005 156132-031 156133-003	1			NARANGBA
3	145kV DISCONNECTOR, 3150A, 40kA, 3 POLE, 4.7M BUS HEIGHT, MANUAL OPERATED, COMPLETE WITH SUPPORT STRUCTURE - GE LOCATION: =D01-Q12	T0201613E1/130	39858	T0201613E1	T1a	156140-007 156141-025 TO 028 156142-012	1			NARANGBA
4	145kV DEPENDENT EARTH SWITCH, 40kA, 3 POLE, 4.7M BUS HEIGHT, MANUAL OPERATED - GE LOCATION: =D01-Q16	T0201613E1/210	39866	T0201613E1	T3a	156140-007/008 156141-026 TO 028 156141-030 TO 032 156142-012	1			NARANGBA
5	145kV INDEPENDENT EARTH SWITCH, 40kA, 3 POLE, 6.5M BUS HEIGHT, MANUAL OPERATED - GE LOCATION: =D01-Q13	T0201613E1/260	39871	T0201613E1	T4b	156140-009 156141-022 156142-012	1			NARANGBA
6	145kV COMBINED CT/VT, 80A, 50kA, 50 HZ, 2 CORE, SINGLE PHASE OUTDOOR (METERING UNIT) WITH CLASS 0.2/0.5 MEASUREMENT CORES (HIGHEST RATIO 80:1) FOR TYPE 1 METERING, 132/√3 PRIMARY, 2 x 110/√3 SECONDARY - HITACHI LOCATION: =D01-T14		TBC	TBC		TBC	3			NARANGBA
7	145kV CAPACITIVE VOLTAGE TRANSFORMER, 132kV/√3 PRIMARY, 2 X 110V/√3 SECONDARY, SINGLE PHASE, POLYMER INSULATOR, OIL INSULATED, WTH HARMONIC VOLTAGE MEASUREMENT - GE LOCATION: =D01-Q1	T0201613D1/60	39839	T0201613D1	T2	156137-011 156138-041 156139-009	3			NARANGBA
8	120kV SURGE ARRESTER, 10kA, POLYMER, HEAVY POLLUTION – ABB LOCATION: =D01-F1	T0201613F3/20	41783	T0201613F3	T1	156145-002 156146-007	6			NARANGBA
9	145kV STATION POST INSULATOR, 1500MM, 8kN, 127T/127T, MEDIUM POLLUTION - GE	T0201613G1/0050	39884	T0201613G1	T1	156148-005 156149-005, 015	3			NARANGBA
10	400V DIESEL GENSET, 150kVA, 3PH, 50Hz WITH 0.8 PF LAGGING - GENELITE	T020150300/10	42081	T0201503	13	155698-025 TO 029, 031 155698-051	1			NARANGBA
11	EXTERNAL FUEL TANK FOR 150 & 250kVA GENSET - GENELITE	T020150300/50	44623	T0201503	5	155698-002	1			NARANGBA
12	11/0.415kV, 315kVA POLE MOUNT STATION SERVICES TRANSFORMER - TRYEE LOCATION: =F01-T1	PP19007400	42858 80200 80201	PP19007400	1		1			NARANGBA
13	SF6 GAS CYLINDER, 52KG		34816				2			NARANGBA
14	36kV VOLTAGE TRANSFORMER, 33kV/√3 PRIMARY, 2 X 110V/√3 SECONDARY, SINGLE PHASE, EXPOXY RESIN - ABB LOCATION: =F01-T10		40324			156163-003 156163-301	1			NARANGBA
15	36kV DISCONNECTOR, 3150A, 40KA, 3 POLE, 50HZ, GANG OPERATED, 4.2M, COMPLETE WITH SUPPORT STRUCTURE - AEM LOCATION: =F01-Q11		40621			156163-006 156163-601	1			NARANGBA

283x394

CAD

A ORIGINAL ISSUE DATE: 20/01/2023		CHECKED		DESIGNED	TC	Powerlink QUEENSLAND	LOCATION	CONTIORDER	PROJECT	DRG CLASS
		DRAWN	N. McK.	DESIGN CHKD		LANDERS CREEK 132/11kV SUBSTATION HAUGHTON PUMPED HYDRO CONNECTION PREFERRED ELECTRICAL PLANT SCHEDULE FOR ESTIMATION PURPOSE ONLY SHEET 1 OF 2	T278		CP.02917	B6
		ORIGIN	PSD	APPROVED	RPEQ 15377		A3-H-159477-003			NEXT SHEET 004
		CIRCULATION					A			

ITEM	DESCRIPTION	OUTLINE AGREEMENT No.	MATERIAL No. / ORDER No.	CONTRACT	ITEM	DRAWING NUMBER	QTY	ORDER DATE	DELIVERY DATE	DELIVERY LOCATION
16	36kV DEPENDANT EARTH SWITCH, 50Hz, MANUAL OPERATED, 4.2M - AEM LOCATION: =F01-Q14, Q15		40622			156163-006 156163-601	2			NARANGBA
17	36kV SURGE ARRESTER, 10kA, POLYMER, HEAVY POLLUTION – ABB LOCATION: =F01-F1	T0201613F3/50	39878	T0201613F3	M1	156145-005 156146-005	3			NARANGBA
18	36kV POST INSULATOR, 475mm HIGH, 8kN, C8-200, 76T/76P, MEDIUM POLLUTION - SUZHOU		36593			140383-090	9			NARANGBA
19	36kV DROP OUT FUSE HOLDER, TYPE C, PART NO. 72299/27 - NGK STANGER LOCATION: =F01-F21		31845			132944-001	3			NARANGBA
20	36kV 31A FUSE LINK, TYPE C, PART NO. ZXC705-31BK37 - NGK STANGER LOCATION: =F01-F21		31846			132944-001	3			NARANGBA
21	36kV STAND-OFF INSULATOR, 25kN - TYCO		32490			139658-001	3			NARANGBA
22	LV SWITCH FUSE HOLDER, FOR SIZE 1 & 2 FUSES, RATED TO 400A WITH BRACKET - NGK STANGER		33504			136541-001	1			NARANGBA
23	FUSE LINK, CARTIDGE 500V AC, HRC DIN TYPE 250A, FUSEMASTER NH2F-250, TYPE gG, SIZE 2		44551			156138-306	3			

NOTE:
1. 33kV PLANT SHOWN UNTIL DETAILS OF 11kV PLANT RECEIVED

CAD 283x394

ORIGINAL ISSUE DATE : 20/01/2023 A

CHECKED		DESIGNED	TC	
DRAWN	N. McK.	DESIGN CHKD		
ORIGIN	PSD	APPROVED	RPEQ 15377	
CIRCULATION				

Powerlink QUEENSLAND

LANDERS CREEK
132/11kV SUBSTATION
HAUGHTON PUMPED HYDRO CONNECTION
PREFERRED ELECTRICAL PLANT SCHEDULE
FOR ESTIMATION PURPOSE ONLY
SHEET 2 OF 2

LOCATION	CONTIORDER	PROJECT	DRG CLASS
T278		CP.02917	B6

A3-H-159477-004 NEXT SHEET --

A

Appendix B

Environmental Management Plan - Substation

Environmental Annexure

The below information identifies site-specific and/or asset related *environmental* constraints known to be potentially present at the time of writing. These constraints may require consideration when determining suitable controls or risk mitigation measures whilst undertaking activities related to the identified scope of works. *Please be aware that the information provided below is based on the best available information at the time of writing and may not be exhaustive.*

Any conditions or requirements specified in this *Environmental Annexure* are in addition to the environmental operational controls listed in either Powerlink's current environmental procedures (if work is being carried out under the Powerlink HSEMS) or the corresponding *Contractor and Supplier HSE Specification* associated with the scope of works.

Where the controls prescribed differ from the aforementioned documents, this *Environmental Annexure* takes precedence.

This form should be completed by a suitably qualified Powerlink HSE team member and saved in the corresponding Project folder on Objective.

1. Project Details

Project Number & Name	
CP.02917 Burdekin River Pump Station Project	
Powerlink Function Location/s	**Powerlink Environmental Representative**
	Dom Carrol

Scope of Works

This document provides the required standard operational controls to be implemented to meet Powerlink's environmental objectives during the construction, maintenance and operation of the Burdekin River Pump Station (the Project).

The Project comprises the following components:

- A proposed 132 kilovolt (kV) Substation to be known as Landers Creek Substation (adjoining the approved pump station).
- A proposed OHTL to establish a 132kV single circuit tee off into the new Landers Creek Substation. The OHTL will be located within a proposed new easement within Lot 289 on SP117630, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 22 on GS1042.
- The proposed new easement is 40 metres (m) wide, being 20 m either side of the OHTL centreline, with one partial section being 50 m.

This Environmental Annexure relates to works being undertaken on the proposed OHTL for the Project.

2. Document Control

Revision	Date	Summary of Changes
1.0	*25 January 2024*	First Draft

Environmental Annexure

1.1	*26 February 2024*	Final Draft
1.2	*21 March 2024*	Final Draft

3. Referenced Documents

Doc ID#	Title	Purpose
Associated Maps (e.g. EWPs / Biosecurity Zones / Approval or Permit related maps) :		
Current Permits/ Licenses/ Approvals associated with the works:		
EPBC referral 2021/9133	Haughton Pipeline Stage 2 EPBC Approval Conditions.	
Other		
	Ecology Technical Report (AECOM, 2023)	Identifies vegetation and habitat values for Commonwealth and State listed flora and fauna species.
	Weed Report (AECOM, 2023)	Identifies weeds present on site. This may be used as a pre-construction survey if works are undertaken in early 2024.

4. Environmental Considerations

Item	Site/Asset Specific Conditions or Requirements *(Refer current Permits/ Licenses/ Approvals conditions associated with the works and additional areas as suggested)*
Protected Areas & Known Sensitive Receiving Environments	- **Matters of State Environmental Significance** (MSES) and **Matters of National Environmental Significance** (MNES) have been incorporated as part of the adjacent Haughton Stage 2 Pipeline Referral. MNES and MSES **approval requirements must be revisited** following this action. - Additional MSES and MNES outside of the Haughton Stage 2 Pipeline Referral were considered by the Project's Ecology Technical Report (AECOM, 2023), with no further significant impacts or significant residual impacts identified.
Native Fauna Interactions	- Native vegetation is present within the works area. No tampering with known breeding habitat (e.g. nests, tree hollows, logs etc.) is authorised without a Low Risk or High Risk **Species Management Plan**. - **General Additional Mitigations:** o Night works within or adjacent to areas of conservation significant species' habitat will be avoided where possible. Where night works are required, lights will be directed to minimise light spill into adjacent habitats. o Covers for tower/pole excavations suitable for preventing small animals entering the excavation are to be utilized when the excavation is unattended (e.g. overnight). Covers or other

Environmental Annexure

suitable fauna barriers are to be utilized when steel reinforcement is placed within tower/pole foundation excavation and the excavation unattended (e.g. overnight).

- **Species Specific Mitigations:**
- ***Red goshawk and osprey:***
  - Retain tall trees that contain potential raptor nests (even if abandoned), especially where located along watercourses, where possible.
- ***Squatter pigeon (southern) :***
  - Speed limits will be enforced within the site to reduce risk of collision with wildlife.
  - No unauthorised off-track driving.
- ***Northern quoll:***
  - Large hollow logs that must be removed from areas of potential northern quoll habitat will be retained and relocated to adjacent or nearby areas of suitable northern quoll habitat.
  - Dewatering of trenches to be conducted to prevent breeding opportunities of cane toads. Dewatering must achieve water quality objectives outlined in Powerlink's EMP and HSE Specification.
- ***Greater glider:***
  - All hollow-bearing trees will be inspected by a fauna spotter-catcher prior to clearing to identify any denning or nesting individuals.
  - All hollow-bearing trees will be soft-felled during clearing activities.
- ***Koala:***
  - Clearing must be carried out in a way that ensures any koala present have time to move out of the clearing site without human intervention.
  - If a koala is located during pre-clearance surveys or during clearing activities:
    - The individual must not be forcibly relocated
    - Any tree which houses a koala as well as any tree with a crown that overlaps that tree will not be cleared until the koala vacates the tree on its own volition
    - Allow a clearing buffer surrounding the tree, equal to the height of the tree or deemed suitable by the fauna spotter catcher
  - Any injured koala (and fauna in general) should be transported to a vet or recognised wildlife carer.
  - Where deemed necessary by the fauna spotter-catcher, temporary exclusion fencing may be required to prevent wildlife from returning to work areas.
- ***Bare-rumped sheathtail bat:***
  - A fauna spotter-catcher must be on-site during clearing activities to identify any potential roost trees (i.e. hollow bearing trees). Any

Environmental Annexure

	bats found to be potentially affected by Project construction will be relocated to an alternative nearby empty hollow. o Any identified active roosting maternity colonies within or adjacent to the Project alignment will be considered during vegetation clearing with a sufficient buffer distance implemented to avoid potential disturbance and displacement until these roosting maternity colonies have moved on. o Clearing works should be staged to allow bats to leave roosting sites. o No vegetation clearing should occur at night (bright lights can interfere with bat behaviour). o Clearing of hollow-bearing trees will only occur where necessary and cleared logs/stags will be relocated to adjoining habitat that is to be retained. - ***Sharp-tailed sandpiper:*** o Prior to construction works commencing, the fauna spotter-catcher will confirm the presence of any migratory birds that may be disturbed by the activity. If found to be present at the time of works, appropriate mitigation measures should be developed to minimise disturbance.
Native Flora / Vegetation Management	- Native vegetation is mapped as present within the works area. No vegetation removal may occur without prior approval from the relevant authorities. - ***Black ironbox:*** o Population mapping undertaken by GHD will be reviewed, and checked during pre-clearance surveys which will include the development of any no-go areas. Confirmation of potential population avoidance will be completed during final scouting. Where possible, the siting of infrastructure will avoid areas of known occurrence as a priority. o Clearing will be restricted to the minimal amount necessary for construction and will not extend outside the Project area.
Herbicide Distribution	- The scope of works will take place within a regulated area under the *Agricultural Chemicals Distribution Control Act 1966*.
Biosecurity	- Sections of the works are located in the following **Biosecurity Zones** and may have legal movement restrictions placed on it to limit the spread of pests and diseases within the State. A number of these restrictions relate to movement of biosecurity carriers, which are things that can carry Prohibited or Restricted Biosecurity Matter (e.g. vehicles, plant and equipment/soil/mulch etc.): o *Cattle tick area (infested)* o *Sugar cane pest (zone 2)* o *Grape phylloxera risk zone.* - The following **Restricted or Prohibited Weeds** (Weeds of National Significance (WoNS) / *Biosecurity Act 2014* status) have been previously identified within the area (refer to the Weed Report (AECOM, 2023)): o Bellyache bush *(Jatropha gossypiifolia*)* (WoNS / Category 3) o Rubber vine *(Cryptostegia grandiflora*)* (- / WoNS)

Environmental Annexure

	○ Chinee apple *(Ziziphus mauritiana*)* (- / Category 3) ○ Giant rats tail grass *(Sporobolus sp.*)* (- / Category 3) ○ Yellow oleander *(Cascabela thevetia*)* (- / Category 3) ○ Elephant ear vine *(Argyreia nervosa*)* (- / Category 3). - Pre-construction and post-construction weed surveys to be undertaken within the Project area. - Development of a **Biosecurity Management Plan** for project works, - Vehicle washdowns and/or biosecurity declarations will be required upon entering, exiting the site and when leaving the project to a novel location.
Contaminated Land	- Land parcel (Lot 22 on GS1042) is listed on the State **Environmental Management Register (EMR)** for the notifiable activity of livestock dip or spray race**.** Any soil to be removed from the land parcel must be tested in line with National Environment Protection Measure (NEPM) requirements to determine whether contaminated. Contaminated soil can only be removed from land on the EMR under a **Soil Disposal Permit** that is issued by the Department of Environment and Science.
Erosion & Sediment Control/Soil Types/ Rehabilitation	- Reinstatement will be undertaken progressively during construction, where practicable, and Powerlink Queensland will ensure that all disturbed areas impacted from construction are reinstated at the end of the Project. The short-term goal of reinstatement is the stabilisation of soils to provide a suitable matrix for vegetation establishment, to aid in preventing erosion. Reinstatement also includes the replacement of topography, topsoil, and fences.
Waste	- Waste management to follow standards detailed in the Environmental Management Plan including the development of a **Waste Management Plan**. The following additional controls should be implemented as part of the **Waste Management Plan**: ○ Cleared vegetation is to mulched and reused on site. Comingled recycling will be collected at laydown yards and camp locations and transported to a licensed recycling facility. ○ Waste that cannot be reused onsite will be removed to an appropriate licensed facility, with preference for suitable local facilities. ○ Soil and/or geofabric material contaminated with Biosecurity Matters from cleaning vehicles, plant, equipment and machinery to be disposed at a licensed facility.
Amenity (Air, Visual, Noise)	- **Dust and Particulate Matter:** *The* following *measures are recommended to mitigate emissions of dust and particulate matter:* ○ watering of stockpiles (located near sensitive uses) to maintain a moisture content that minimises dust generation or alternatively temporarily cover stockpiles ○ adequately store all bulk materials, and cover vehicles transporting materials to and from site ○ limit dust-producing work on windy days when possible or water down of dusty work sites to minimise dust generation ○ watering unsealed access tracks when required for safety, or where located near sensitive uses

Environmental Annexure

	○ dependent on the machinery used, ensure chipping/mulching equipment have dust collection devices where practicable ○ disturbed areas and bare earth should be stabilised or revegetated as soon as practical to minimise wind-blown dust. - **Vehicle and Machinery Emissions Mitigation:** *The following measures are recommended to mitigate emissions from vehicle and machinery:* ○ ensure stationary plant, construction vehicles and equipment (especially those powered by diesel motors) are working correctly and maintained as per manufacturers recommendations ○ avoid or minimise queuing in roadways approaching the worksites or adjacent to other sensitive activities.
Bushfire	- Areas of the proposed substation works are classified as Medium and Potential Impact Buffer on the Bushfire Prone Area mapping on PQ Maps. - A **Bushfire Management Plan** will be developed for the Project. The Bushfire Management Plan will align with the requirements of Powerlink's ASM-PLN-A3285085 - Bushfire Mitigation Procedure .
Environmental Monitoring or Reporting	- Report to follow standards detailed in the Environmental Management Plan (*i.e. environmental events to Supervisor as soon as possible*)

5. Appendix

6. References

AECOM (2023). Ecology Technical Report, unpublished report for Powerlink. Townsville

AECOM (2023). Weed Report, unpublished report for Powerlink. Townsville

Appendix C

Environmental Management Plan - Transmission Line

Environmental Annexure

The below information identifies site-specific and/or asset related *environmental* constraints known to be potentially present at the time of writing. These constraints may require consideration when determining suitable controls or risk mitigation measures whilst undertaking activities related to the identified scope of works. *Please be aware that the information provided below is based on the best available information at the time of writing and may not be exhaustive.*

Any conditions or requirements specified in this *Environmental Annexure* are in addition to the environmental operational controls listed in either Powerlink's current environmental procedures (if work is being carried out under the Powerlink HSEMS) or the corresponding *Contractor and Supplier HSE Specification* associated with the scope of works.

Where the controls prescribed differ from the aforementioned documents, this *Environmental Annexure* takes precedence.

This form should be completed by a suitably qualified Powerlink HSE team member and saved in the corresponding Project folder on Objective.

1. Project Details

Project Number & Name	
CP.02917 Burdekin River Pump Station Project	
Powerlink Function Location/s	**Powerlink Environmental Representative**
	Dom Carrol

Scope of Works

This document provides the required standard operational controls to be implemented to meet Powerlink's environmental objectives during the construction, maintenance and operation of the Burdekin River Pump Station (the Project).

The Project comprises the following components:

- A proposed 132 kilovolt (kV) Substation to be known as Landers Creek Substation (adjoining the approved pump station).
- A proposed OHTL to establish a 132kV single circuit tee off into the new Landers Creek Substation. The OHTL will be located within a proposed new easement within Lot 289 on SP117630, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 22 on GS1042.
- The proposed new easement is 40 metres (m) wide, being 20 m either side of the OHTL centreline, with one partial section being 50 m.

This Environmental Annexure relates to works being undertaken on the proposed substation for the Project.

2. Document Control

Revision	Date	Summary of Changes
1.0	*25 January 2024*	First Draft

Environmental Annexure

1.1	*26 February 2024*	Final Draft
1.2	*21 March 2024*	Second Final Draft

3. Referenced Documents

Doc ID#	Title	Purpose
Associated Maps (e.g. EWPs / Biosecurity Zones / Approval or Permit related maps) :		
Current Permits/ Licenses/ Approvals associated with the works:		
EPBC referral 2021/9133	Haughton Pipeline Stage 2 EPBC Approval Conditions.	
Other		
	Ecology Technical Report (AECOM, 2023)	Identifies vegetation and habitat values for Commonwealth and State listed flora and fauna species.
	Weed Report (AECOM, 2023)	Identifies weeds present on site. This may be used as a pre-construction survey if works are undertaken in early 2024.

4. Environmental Considerations

Item	Site/Asset Specific Conditions or Requirements ***(Refer current Permits/ Licenses/ Approvals conditions associated with the works and additional areas as suggested)***
Protected Areas & Known Sensitive Receiving Environments	- **Matters of State Environmental Significance** (MSES) and **Matters of National Environmental Significance** (MNES) have been incorporated as part of the adjacent Haughton Stage 2 Pipeline Referral. MNES and MSES **approval requirements must be revisited** following this action. - Additional MSES and MNES outside of the Haughton Stage 2 Pipeline Referral were considered by the Project's Ecology Technical Report (AECOM, 2023), with no further significant impacts or significant residual impacts identified.
Native Fauna Interactions	- Native vegetation is present within the works area. No tampering with known breeding habitat (e.g. nests, tree hollows, logs etc.) is authorised without a Low Risk or High Risk **Species Management Plan**. - **General Additional Mitigations:** o Night works within or adjacent to areas of conservation significant species' habitat will be avoided where possible. Where night works are required, lights will be directed to minimise light spill into adjacent habitats. o Any open trenches, pits or excavations will be checked for trapped fauna in the morning and at the end of the day by a by a

Environmental Annexure

site leader. If fauna are present, a spotter catcher with relevant permits should be engaged to undertake this task.

- Trench ladders, ramps, sticks, ropes and moist hessian sacks at regular intervals (or similar) will be utilised where trenches or excavations are anticipated to remain open for extended periods. This will help trapped fauna escape and/or survive until removed by a fauna spotter-catcher.
- Covers for tower/pole excavations suitable for preventing small animals entering the excavation are to be utilized when the excavation is unattended (e.g. overnight). Covers or other suitable fauna barriers are to be utilized when steel reinforcement is placed within tower/pole foundation excavation and the excavation unattended (e.g. overnight).

- **Species Specific Mitigations:**
- ***Red goshawk and osprey:***
  - Retain tall trees that contain potential raptor nests (even if abandoned), especially where located along watercourses, where possible.
- ***Squatter pigeon (southern):***
  - Speed limits will be enforced within the site to reduce risk of collision with wildlife.
  - No unauthorised off-track driving.
- ***Northern quoll:***
  - Large hollow logs that must be removed from areas of potential northern quoll habitat will be retained and relocated to adjacent or nearby areas of suitable northern quoll habitat.
  - Dewatering of trenches to be conducted to prevent breeding opportunities of cane toads. Dewatering must achieve water quality objectives outline in Powerlink's EMP and HSE Specification.
- ***Greater glider:***
  - All hollow-bearing trees will be inspected by a fauna spotter-catcher prior to clearing to identify any denning or nesting individuals.
  - All hollow-bearing trees will be soft-felled during clearing activities.
- ***Koala:***
  - Clearing must be carried out in a way that ensures any koala present have time to move out of the clearing site without human intervention.
  - If a koala is located during pre-clearance surveys or during clearing activities:
    - The individual must not be forcibly relocated
    - Any tree which houses a koala as well as any tree with a crown that overlaps that tree will not be cleared until the koala vacates the tree on its own volition

Environmental Annexure

	▪ Allow a clearing buffer surrounding the tree, equal to the height of the tree or deemed suitable by the fauna spotter catcher o Any injured koala (and fauna in general) should be transported to a vet or recognised wildlife carer. o Where deemed necessary by the fauna spotter-catcher, temporary exclusion fencing may be required to prevent wildlife from returning to work areas. - ***Bare-rumped sheathtail bat:*** o A fauna spotter-catcher must be on-site during clearing activities to identify any potential roost trees (i.e. hollow bearing trees). Any bats found to be potentially affected by Project construction will be relocated to an alternative nearby empty hollow. o Any identified active roosting maternity colonies within or adjacent to the Project alignment will be considered during vegetation clearing with a sufficient buffer distance implemented to avoid potential disturbance and displacement until these roosting maternity colonies have moved on. o Clearing works should be staged to allow bats to leave roosting sites. o No vegetation clearing should occur at night (bright lights can interfere with bat behaviour). o Clearing of hollow-bearing trees will only occur where necessary and cleared logs/stags will be relocated to adjoining habitat that is to be retained. - ***Sharp-tailed sandpiper:*** o Prior to construction works commencing, the fauna spotter-catcher will confirm the presence of any migratory birds that may be disturbed by the activity. If found to be present at the time of works, appropriate mitigation measures should be developed to minimise disturbance.
Native Flora / Vegetation Management	- Native vegetation is mapped as present within the works area. No vegetation removal may occur without prior approval from the relevant authorities. - ***Black ironbox:*** o Population mapping undertaken by GHD will be reviewed, and checked during pre-clearance surveys which will include the development of any no-go areas. Confirmation of potential population avoidance will be completed during final scouting. Where possible, the siting of infrastructure will avoid areas of known occurrence as a priority. o Clearing will be restricted to the minimal amount necessary for construction and will not extend outside the Project area.
Herbicide Distribution	- The scope of works will take place within a regulated area under the *Agricultural Chemicals Distribution Control Act 1966*.
Biosecurity	- Sections of the works are located in the following **Biosecurity Zones** and may have legal movement restrictions placed on it to limit the spread of pests and diseases within the State. A number of these restrictions relate to movement of biosecurity carriers, which are things that can carry

Environmental Annexure

	Prohibited or Restricted Biosecurity Matter (e.g. vehicles, plant and equipment/soil/mulch etc.): o *Cattle tick area (infested)* o *Sugar cane pest (zone 2)* o *Grape phylloxera risk zone.* - The following **Restricted or Prohibited Weeds** (Weeds of National Significance (WoNS) / *Biosecurity Act 2014* status) have been previously identified within the area (refer to the Weed Report (AECOM, 2023)): o Bellyache bush *(Jatropha gossypiifolia*)* (WoNS / Category 3) o Rubber vine *(Cryptostegia grandiflora*)* (- / WoNS) o Chinee apple *(Ziziphus mauritiana*)* (- / Category 3) o Giant rats tail grass *(Sporobolus sp.*)* (- / Category 3) o Yellow oleander *(Cascabela thevetia*)* (- / Category 3) o Elephant ear vine *(Argyreia nervosa*)* (- / Category 3). - Pre-construction and post-construction weed surveys to be undertaken within the Project area. - Development of a **Biosecurity Management Plan** for project works, - Vehicle washdowns and/or biosecurity declarations will be required upon entering, exiting the site and when leaving the project to a novel location.
Contaminated Land	- Land parcel (Lot 22 on GS1042) is listed on the State **Environmental Management Register (EMR)** for the notifiable activity of livestock dip or spray race**.** Any soil to be removed from the land parcel must be tested in line with National Environment Protection Measure (NEPM) requirements to determine whether contaminated. Contaminated soil can only be removed from land on the EMR under a **Soil Disposal Permit** that is issued by the Department of Environment and Science.
Erosion & Sediment Control/Soil Types/ Rehabilitation	- Reinstatement will be undertaken progressively during construction, where practicable, and Powerlink Queensland will ensure that all disturbed areas impacted from construction are reinstated at the end of the Project. The short-term goal of reinstatement is the stabilisation of soils to provide a suitable matrix for vegetation establishment, to aid in preventing erosion. Reinstatement also includes the replacement of topography, topsoil, and fences.
Waste	- Waste management to follow standards detailed in the Environmental Management Plan including the development of a **Waste Management Plan**. The following additional controls should be implemented as part of the **Waste Management Plan**: o Cleared vegetation is to mulched and reused on site. Comingled recycling will be collected at laydown yards and camp locations and transported to a licensed recycling facility. o *Waste that cannot be reused onsite will be removed to an appropriate licensed facility, with preference for suitable local facilities*. o Soil and/or geofabric material contaminated with Biosecurity Matters from cleaning vehicles, plant, equipment and machinery to be disposed at a licensed facility.

Environmental Annexure

Amenity (Air, Visual, Noise)	- **Dust and Particulate Matter:** *The* following *measures are recommended to mitigate emissions of dust and particulate matter:* o watering of stockpiles (located near sensitive uses) to maintain a moisture content that minimises dust generation or alternatively temporarily cover stockpiles o adequately store all bulk materials, and cover vehicles transporting materials to and from site o limit dust-producing work on windy days when possible or water down of dusty work sites to minimise dust generation o watering unsealed access tracks when required for safety, or where located near sensitive uses o dependent on the machinery used, ensure chipping/mulching equipment have dust collection devices where practicable o disturbed areas and bare earth should be stabilised or revegetated as soon as practical to minimise wind-blown dust. - **Vehicle and Machinery Emissions Mitigation:** *The following measures are recommended to mitigate emissions from vehicle and machinery:* o ensure stationary plant, construction vehicles and equipment (especially those powered by diesel motors) are working correctly and maintained as per manufacturers recommendations o avoid or minimise queuing in roadways approaching the worksites or adjacent to other sensitive activities.
Bushfire	- Areas of the proposed substation works are classified as Medium and High on the Bushfire Prone Area mapping on PQ Maps. - A **Bushfire Management Plan** will be developed for the Project. The Bushfire Management Plan will align with the requirements of Powerlink's ASM-PLN-A3285085 - Bushfire Mitigation Procedure .
Environmental Monitoring or Reporting	- Report to follow standards detailed in the Environmental Management Plan (*i.e. environmental events to Supervisor as soon as possible*)

5. Appendix

6. References

AECOM (2023). Ecology Technical Report, unpublished report for Powerlink. Townsville

AECOM (2023). Weed Report, unpublished report for Powerlink. Townsville

Appendix D

Water Resource and Hydrology Technical Report

Prepared for
Powerlink Queensland
ABN: 82 078 849 233

Water Resources and Hydrology Technical Report

Natural Hazards, Risk and Resilience

26-Feb-2024
Burdekin River Pump Station Project
Doc No. 60714900

aecom.com

Delivering a better world

Water Resources and Hydrology Technical Report

Natural Hazards, Risk and Resilience

Client: Powerlink Queensland

ABN: 82 078 849 233

Prepared by

AECOM Australia Pty Ltd
Wulgurukaba of Gurambilbarra and Yunbenun, Bindal, Gugu Badhun and Nywaigi Country, Lvl 5, 7 Tomlins Street, South Townsville QLD 4810, PO Box 5423, Townsville QLD 4810, Australia
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ABN 20 093 846 925

26-Feb-2024

Job No.: 60714900

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

Quality Information

Document	Water Resources and Hydrology Technical Report
Ref	60714900
Date	26-Feb-2024
Originator	Mark de Jong
Checker/s	Ashley Astorquia
Verifier/s	Wesley Bailey

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
0	28-Nov-2023	Draft for Powerlink Review	Rouven Lau Project Manager	
A	07-Feb-2024	Final Issue	Rouven Lau Project Manager	Original previously signed
B	26-Feb-2024	Updated Final Issue	Rouven Lau Project Manager	

Table of Contents

Glossary

Acronym	Definition
ABN	Australian Business Number
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
BOM	Bureau of Metrology
DES	Department of Environment and Science
DNRME	Department of Natural Resources, Mines and Energy
EPP Water	Environmental Protection (Water) Policy 2009 (Qld)
FFA	Flood-frequency Analysis
GDE	Groundwater Dependent Ecosystems
IECA	International Erosion Control Association
m	Metres
MGA	Map Grid of Australia
MGR	Ministers Guidelines and Rules
NTU	Turbidity
OHTL	Overhead Transmission Line
Powerlink Queensland	Queensland Electricity Transmission Corporation Limited
QLD	Queensland
SPP	State Planning Policy 2017
The Project	Powerlink Burdekin River Pump Station
WQO	Water Quality Objectives
WRP	Water Resource Plans

Executive Summary

Townsville City Council (TCC) have submitted a connection application to Powerlink for the establishment of a 10-15 MW water pump load connection to the approved Burdekin River Pump Station (the Project). The Project is associated with the Haughton Pipeline Stage 2 Project. The Haughton Pipeline Stage 2 Project will connect and extend the existing Stage 1 raw water Pipeline, completed in 2020, from the Haughton River to the Burdekin River near Clare. This Project seeks to provide a power supply to the approved Burdekin River Pump Station.

The Project comprises the following components and is depicted in **Figure A**:

- A new 132kV Substation (adjoining the approved pump station).
- A new Overhead Transmission Line (OHTL) to establish a 132kV single circuit tee off into the new Landers Creek Substation. The OHTL will be located within a proposed new easement within Lot 289 on SP117630, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 22 on GS1042.
- The proposed new easement is 40 metres (m) wide, being 20 m either side of the OHTL centreline, with one partial section being 50 m.

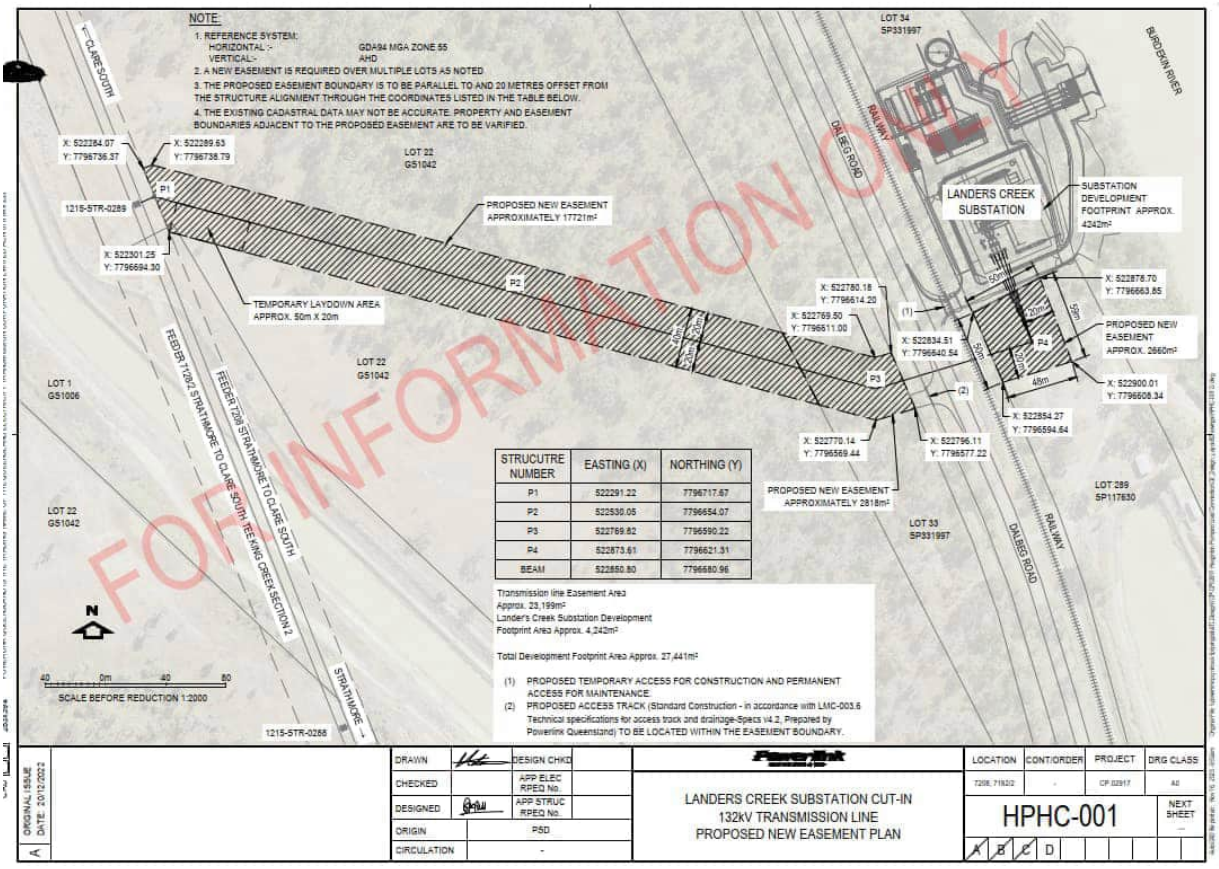

Figure A Proposed Alignment of New 132 kV Overhead Transmission Line and Substation

The role of the *Water Resources and Hydrology Technical Report* (the Report) is to inform the Ministerial Infrastructure Designation (MID) Assessment Report to support obtaining a MID for the proposed substation and OHTL under the *Planning Act 2016* (Planning Act) by:

- Describing the locations, scale and significance of hydrological features and characteristics of surface water and groundwater within the study area.
- Identifying and describing the existing physical and chemical characteristics of surface water and groundwater within the study corridor that may be affected by the Project.

- Assessing the potential impacts of the Project on the quality and quantity of surface waters, groundwater and overland flow taking into consideration the practices and procedures that would be used to avoid or minimise impacts.
- Identifying potential impacts and mitigation measures to ensure identified Environmental Values (EVs) are not adversely impacted by the Project.
- Utilising existing data wherever possible, describe the existing flood regime for the study area, including:
  - Details of historical events
  - Expected flood extents, leveraging any previous work by local or State Governments
  - Potential impacts to and from the Project and how these impacts might be mitigated/managed
  - Details of Project flood immunity and how they will be achieved.
- Utilising existing data wherever possible, describe the risk of river bank erosion to the Project.

The following conclusions have been made from this study:

- The Project works are located in both the Lower Burdekin River catchment (substation) and Barratta Creek (OHTL) catchment. The surface water EVs defined by the *Environmental Protection (Water) Policy 2009* differ between the catchments.
- There are no mapped wetlands within the Project works extents. The closest mapped wetlands are the Burdekin River channel (50 metres), the Tom Fenwick Pumpstation sediment basin (80 metres) and a small water storage (500 metres).
- There are no Groundwater Dependant Ecosystems (GDEs) or potential GDEs within a 50 km radius of the Project site.
- There are no listed water license holders that will be impacted by the Project works. Sunwater is the closest water operations licence holder. Sunwater would likely need to be consulted if surface water from the Burdekin River is used for construction activities.
- The proposed substation is located above the 1% Annual Exceedance Probability (AEP) (100 year) flood level (**Figure B**) and 0.5% AEP (200 year) flood level. As such, the substation is unlikely to cause adverse flood impacts on surrounding land uses.

The following recommendations have been noted in this study:

- An Erosion Sediment Control Plan (ESCP) should be developed and then implemented to ensure that potentially affected surface water from construction activities does not enter downstream surface water and ground water environments.
- A review of TCC Haughton Pipeline Stage 2 Project design documentation for the proposed Clare Weir pumpstation should be considered if available for this Project. The review may provide more certainty on the assumptions in this Report.

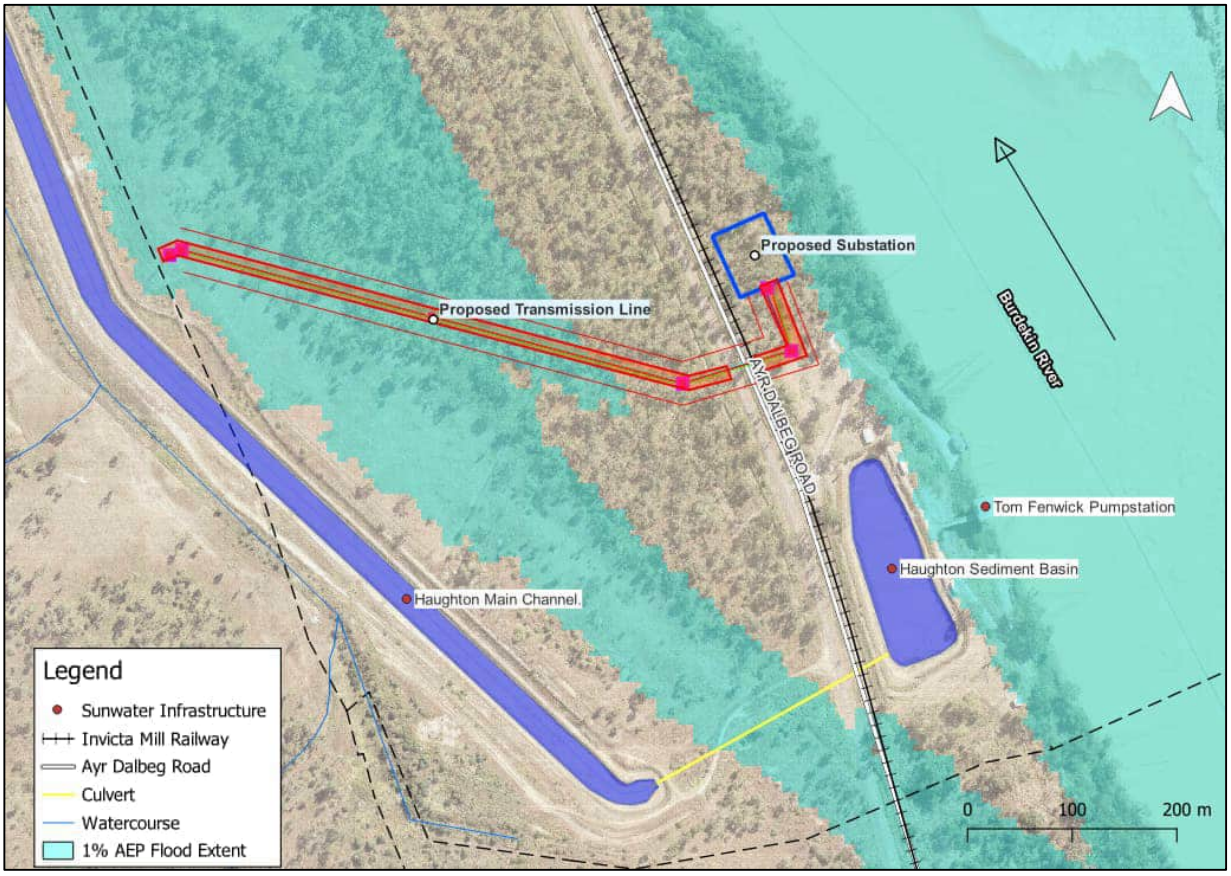

Figure B Modelled 1% AEP (100 Year) Flood Extent

1.0 Introduction

1.1 Project Overview

Townsville City Council (TCC) have submitted a connection application to Powerlink for the establishment of a 10-15 MW water pump load connection to the approved Burdekin River Pump Station (the Project). The Project is associated with the Haughton Pipeline Stage 2 Project. The Haughton Pipeline Stage 2 Project will connect and extend the existing Stage 1 raw water Pipeline, completed in 2020, from the Haughton River to the Burdekin River near Clare. This Project seeks to provide a power supply to the approved Burdekin River Pump Station.

The Project comprises the following components and is depicted in **Figure 1**:

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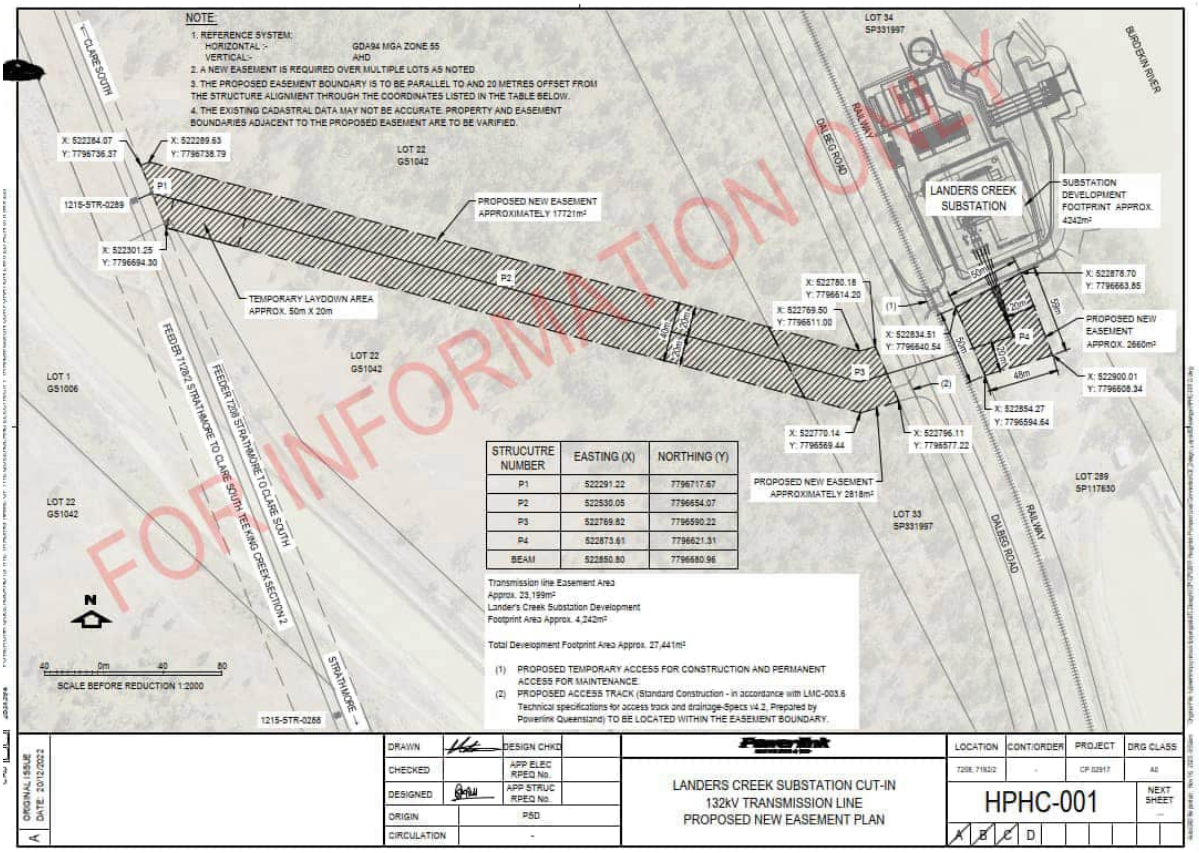


Figure 1 Proposed Alignment of New 132 kV Transmission Line and Substation

1.2 Site Description Summary

The proposed Lander's Creek substation site is located on the top bank of the Burdekin River. A review of available topographical data shows that the location is elevated above surrounding land areas. This can also be seen in **Figure 2** where the proposed substation site is located on higher ground surrounded by the 1% Annual Exceedance Probability (AEP) (1 in 100 year) flood level.

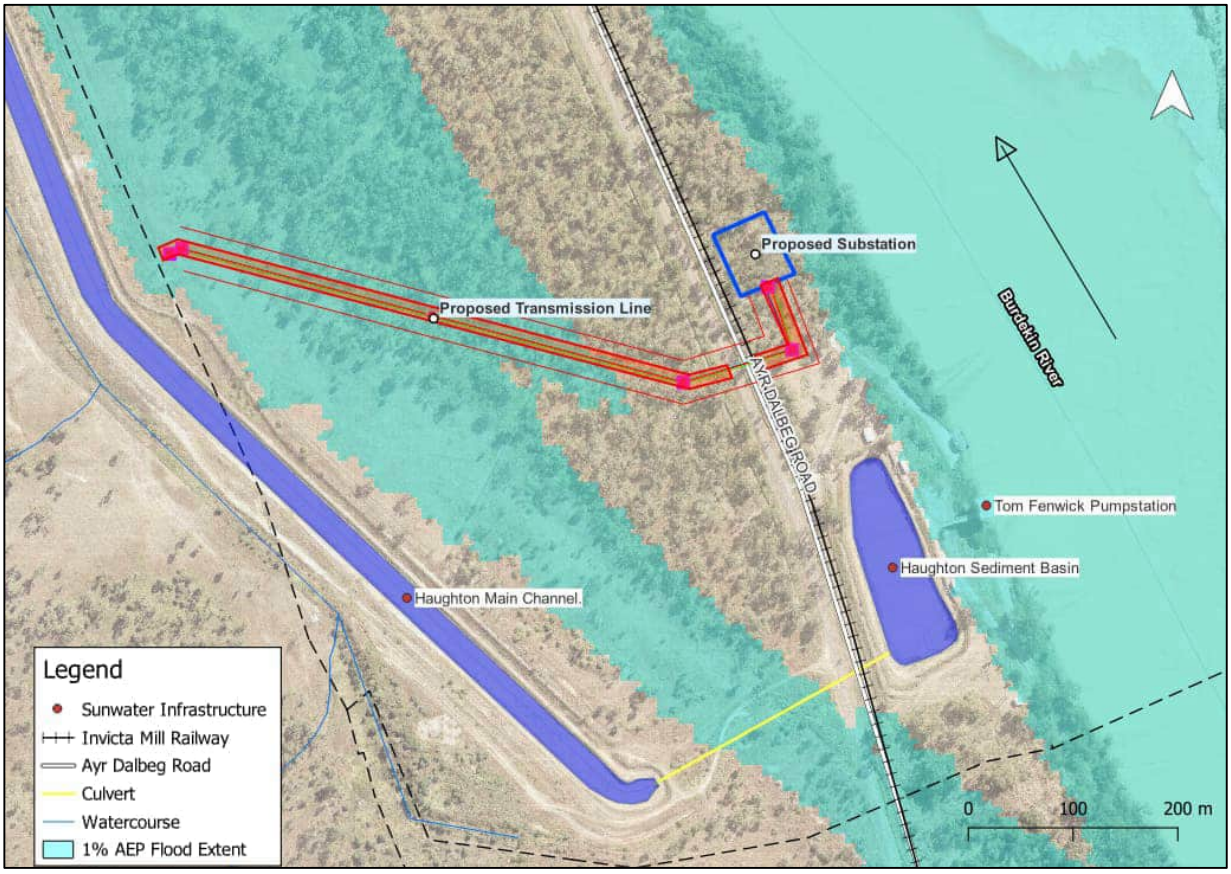


Figure 2 Project Site

1.3 Available Data

Terrain

The following Digital Elevation Model (DEM) data for the assessment was sourced from Elevation Foundation Spatial Data (ELVIS):

- Shuttle Radar Topography Mission (SRTM) ~1 second arc with a resolution of 30m.
- Light Detection and Ranging (LiDAR) Digital Elevation Model (DEM) data with a 1 metre resolution captured in 2009 for the Queensland Government *Tropical Coast 2009 Project*.

Site Details

- The project site layout by Powerlink dated 20/12/2022 was supplied for this study.
- Site level information supplied by Powerlink:
  - Existing site level: 38.5 m AHD
  - Minimum fill pad level: 38.858 m AHD.

Hydraulic and Hydrology Data

- *Ayr 2D Flood Study and Flood Risk Assessment Report* completed for the Burdekin Shire Council by Engeny in June 2012.
- *Clare Flood Hazard Mapping (Bundle 1)* completed for the Department of Natural Resources and Mines (DNRM) by DHI Water and Environment Pty Ltd (DHI) in September 2014. GIS data of the flood extent was provided along with a copy of the report, however no model files were available.

- *Dalbeg and Millaroo Flood Hazard Mapping (Bundle 1)* completed for the Department of Natural Resources and Mines (DNRM) by DHI in September 2014 (DHI 2014a). GIS data of the flood extent was provided along with a copy of the report, however no model files were available.
- *Barratta Creek Catchment Flood Study - Stage 1: Baseline Flooding Assessment* completed for the Queensland Reconstruction Authority by AECOM in June 2021.
- *Haughton Pipeline Stage 2 Project Erosion and Sediment Control Plan* completed for Townsville City Council by GHD Pty Ltd in October 2022.

Design Specifications

- *SDC-001 Substation Civil and Structural Design Specification* (ASM-SPE-A2990486) supplied by Powerlink for the Project.

2.0 Hydrology

2.1 Surface Water

The Burdekin Basin which has an approximate catchment area of 130,800 square kilometres. The Project is located in the Lower Burdekin Basin which includes the following river catchments:

- Burdekin River downstream of the Burdekin Falls Dam
- Haughton River
- Barratta Creek
- Don River.

Figure 3 shows the Project works are in both the Lower Burdekin River and the Barratta Creek catchments. The proposed substation is located Burdekin River catchment while the OHTL crosses the catchment boundary between the Burdekin River and Barratta Creek. Overflows from the Burdekin River into the Barratta Creek catchment occurs upstream of the substation site in large flood events. **Figure 3** demonstrates the following key surface water features:

- The Burdekin River is the closest mapped natural watercourse to the proposed substation site. Dry season water levels in the Burdekin River is regulated by Clare Weir located ~7.8 km downstream of the proposed substation.
- Burdekin Haughton Water Supply Scheme infrastructure including:
  - Tom Fenwick Pumpstation
  - Haughton Sediment Basin
  - Haughton Main Channel.
- The main driver of flooding at the Project site is overflows from the Burdekin River into the Barratta Creek catchment (refer **Section 3.4**).

Barratta Creek Catchment

Lower Burdekin River Catchment

Overflow

Proposed Substation

Proposed Transmission Line

AYR DALBEG ROAD

Burdekin River

Tom Fenwick Pumpstation

Haughton Sediment Basin

Haughton Main Channel.

Overflow

AECOM
www.aecom.com

N

DATUM GDA 2020, PROJECTION MGA ZONE 55

0 50 100 150 200 m

1:5,000 (when printed at A3)

Legend

- Roads
- Railways
- Existing Transmission Lines
- Culvert
- Watercourse
- Burdekin River Overflow Paths
- Proposed Transmission Line & Corridor
- Substation
- Catchment Boundary
- Sunwater Waterbody
- 1% AEP Flood Extent

HAUGHTON PUMP LOAD

Water Resources and Hydrology Review

Surface Water

PROJECT ID	60565866
CREATED BY	deJong, Mark
LAST MODIFIED	2024-02-06
VERSION	1

Figure 3

\\na.aecomnet.com\lfs\APAC\Townsville-AUTSV1\Legacy\Projects\607X\60714900_Powerlink_Haughton_Pump_Load\400_Technical\432_TechnicalArea_Water\01_Data\99_Data_Review\Surface_Water.qgz

A3 size

2.1.1 Environmental Values

Environmental values (EVs) are the qualities that make water suitable for supporting aquatic ecosystems and human uses, and require protection from the effects of habitat alteration, waste releases, contaminated runoff and changed flows to ensure healthy aquatic ecosystems and waterways that are safe for community use. The EVs of waters are protected under the *Environmental Protection (Water) Policy 2009* (hereafter referred to as EPP Water). The policy sets water quality objectives (WQOs), which are physical and chemical measures of the water (i.e. pH, nutrients, salinity etc.) to achieve the EVs set for a particular waterway or water body. EVs define the suitable uses of the water (i.e. aquatic ecosystems, human consumption, industrial use etc.). **Table 1** below lists the EVs that can be chosen for protection and provides definitions of each.

Table 1 Suite of Environmental Values that can be chosen for protection (EPP 2009)

Environmental Value	Definition
Aquatic ecosystem	A community of organisms living within or adjacent to water, including riparian or foreshore area (EPP Water, Schedule 2). The intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas, for example, biodiversity, ecological interactions, plants, animals, key species (such as turtles, platypus, seagrass and dugongs) and their habitat, food and drinking water. Waterways include perennial and intermittent surface waters, groundwaters, tidal and non-tidal waters, lakes, storages, reservoirs, dams, wetlands, swamps, marshes, lagoons, canals, natural and artificial channels and the bed and banks of waterways.
Irrigation	Suitability of water supply for irrigation, for example, irrigation of crops, pastures, parks, gardens and recreational areas.
Farm water supply	Suitability of domestic water supply, other than drinking water. For example, water used for laundry and produce preparation.
Stock watering	Suitability of water supply for production of healthy livestock.
Aquaculture	Health of aquaculture species and humans consuming aquatic foods (such as fish, molluscs and crustaceans) from commercial ventures.
Human consumption of aquatic foods	Health of humans consuming aquatic foods, such as fish, crustaceans and shellfish from natural waterways.
Primary recreation	Health of humans during recreation which involves direct contact and a high probability of water being swallowed, for example, swimming, surfing, windsurfing, diving and water-skiing. Primary recreational use, of water, means full body contact with the water, including, for example, diving, swimming, surfing, water-skiing and windsurfing. (EPP Water, s. 6).
Secondary recreation	Health of humans during recreation which involves indirect contact and a low probability of water being swallowed, for example, wading, boating, rowing and fishing. Secondary recreational use, of water, means contact other than full body contact with the water, including, for example, boating and fishing. (EPP Water, s. 6).
Visual recreation	Amenity of waterways for recreation which does not involve any contact with water - for example, walking and picnicking adjacent to a waterway. Visual recreational use, of water, means viewing the water without contact with it. (EPP Water, s. 6).

Environmental Value	Definition
Drinking water supply	Suitability of the water for supply as drinking water having regard to the level of treatment of the water
Industrial use	Suitability of water supply for industrial use, for example, food, beverage, paper, petroleum and power industries. Industries usually treat water supplies to meet their needs.
Cultural and spiritual values	Means scientific, social or other significance to the present generation or past or future generations, including Aboriginal people or Torres Strait Islanders (EPP (Water and Wetland Biodiversity)), section 6), for example: • custodial, spiritual, cultural and traditional heritage, hunting, gathering and ritual responsibilities • symbols, landmarks and icons (such as waterways, turtles and frogs) • lifestyles (such as agriculture and fishing).

The relevant surface water EVs to the Project is provided in **Table 2**. The location of the Project relative to the EV catchments is provided by **Figure WQ1206**.

Table 2 Surface Water Environmental Values

Project Element	Basin and Sub-Basin	Environmental Values											
		Aquatic Ecosystems	Irrigation	Farm Supply	Stock Watering	Aquaculture	Human Consumption	Primary Recreation	Secondary Recreation	Visual Recreation	Drinking Water	Industrial Use	Cultural
Substation	Burdekin River (Below Dam)	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔	✔
OHTL	Barratta Creek	✔	✔	✔	✔	✔	✔	✔	✔	✔			✔

WARNING This map must not be used for marine navigation. Comprehensive and updated navigation information should be obtained from published hydrographic charts.

147°E 147°30'E 20°S 20°30'S

TOWNSVILLE CITY COUNCIL
CHARTERS TOWERS REGIONAL COUNCIL
BURDEKIN SHIRE COUNCIL
WHITSUNDAY REGIONAL COUNCIL

HAUGHTON RIVER BASIN
DON RIVER BASIN
BURDEKIN RIVER BASIN

Burdekin Delta
Landers Creek
Stones Creek
Burdekin River (Below Dam)

Project Location

For coastal /marine waters, refer to plan WQ1190
For Don River Basin, refer to plan WQ1211
For Haughton River Basin, refer to plan WQ1191
For Upper Burdekin Basin, refer to plan WQ1201
For Cape Campaspe Basin, refer to plan WQ1202
For Suttor River Basin, refer to plan WQ1204
For Bowen Broken and Bogie Basin, refer to plan WQ1205

Clare Weir
Blue Valley Weir
Gorge Weir
Burdekin Falls Dam
Lake Dalrymple
Pink Lily Lagoon

Rita Island
HOME HILL
Big Patterson Island
Peters Island
Cape Upstart
Upstart Bay
R M Point
Mine Island
Nobbies Lookout

Woodstock - Giru Road
Flinders Highway
Ayr - Dalbeg Road
Home Hill - Kirknie Road
Bruce Highway
Ayr - Ravenswood Road
Burdekin Falls Dam Road
Bowen Developmental Road

PLANTATION CREEK
BURDEKIN RIVER
MAJOR CREEK
HAUGHTON RIVER
HAUGHTON MAIN CHANNEL
OAKY CREEK
REID RIVER
BARRATTA CREEK
SALTWATER CREEK
YELLOW GIN CREEK
WANGARATTA CREEK
MOLONGLE CREEK
ROCKY PONDS CREEK
PLUMTREE CREEK
KIRKNIE CREEK
SCOTT CREEK
TEATREE CREEK
DILLON CREEK
ARMSTRONG CREEK
SANDY CREEK
PANEY CREEK
SPRING CREEK
GLEN BLAZES CREEK
DINGO CREEK
JET CREEK
FISH CREEK
BORA CREEK
BRIGALOW CREEK
BOGIE RIVER
CHASEWATER CREEK
CAPSIZE CREEK
BOUNDARY CREEK
ABBOT CREEK
EMU CREEK
PADDYS CREEK
HERBERT CREEK
PULLEN PULLEN CREEK
KIRK RIVER
LANDERS CREEK
EIGHT MILE CREEK
BANANA CREEK
FENCE CREEK
SPRING CREEK
LITTLE SPRING CREEK
MILLAROO CREEK
LAGOON CREEK
BONNIE DOON CREEK
EXPEDITION PASS CREEK
BLUEWATER CREEK
CARSE CREEK
BROWN CREEK
TURKEY CREEK
DOZER CREEK
PINE CREEK
KING CREEK
OAKY CREEK
SANDY CREEK
FIVE MILE CREEK
SUHRS CREEK
HORSE CREEK
WELLINGTON SPRING CREEK
SAWPIT CREEK
FOUR MILE CREEK
ELPHINSTONE CREEK
PLUMTREE CREEK
BLACK GIN CREEK
PIG GULLY
TWO MILE CREEK
ONE MILE CREEK
SPRING CREEK
BARRABAS CREEK
CONNOLLY CREEK
TRIESTE CREEK
BURDEKIN RIVER
SIX MILE CREEK
CAMP CREEK
BRANDISON CREEK
FISH CREEK
DREGHORN CREEK
STONY CREEK
LULU CREEK
PINNACLE CREEK
ST PAULS CREEK
DEVIL CREEK
ELBOW CREEK
BURDEKIN RIVER
OAKY CREEK
FERN CREEK
CAMP CREEK
GLENROY CREEK
BOUNDARY CREEK
MOUNT GRAHAM CREEK
STONES CREEK
BULL CREEK
BURDEKIN RIVER
SANDY CREEK
BOWEN RIVER
ROCKY CREEK
CATTLE CREEK
TABLE MOUNTAIN CREEK
CRUSH CREEK
STRATHMORE CREEK
DESMOND CREEK
RED HILL CREEK
PELICAN CREEK
SANDALWOOD CREEK
GOLDBEETLE CREEK
MOONLIGHT CREEK
GLENMORE CREEK
TWO MILE CREEK
LILY CREEK
CHARLIE CREEK
GAP CREEK
GLENDON CREEK
COLLINS CREEK
BILLYCAN CREEK
OAKY CREEK
BIRRALEE CREEK
BRAWL CREEK
GLENELLA CREEK
FREDERICK CREEK
TEATREE CREEK
SMOKO CREEK
TWELVE MILE GULLY
ROSELLA CREEK
COCKATOO CREEK
PARROT CREEK
TEN MILE CREEK
MARY CREEK
FIVE MILE CREEK
ISABELLA CREEK
SELLHEW RIVER
SOMER CREEK
ANT HILL CREEK
BELL CREEK
SUTTOR RIVER
CAPE RIVER
LOW CREEK
ROLLSTON RIVER
CHINAMAN CREEK
ROCKY CREEK
SWAMP CREEK
MCDONALD CREEK
MCGREGOR CREEK
WELL CREEK
SWAMP CREEK
SPRING CREEK
BOX CAMP CREEK
YARD CREEK
CATTLE CREEK
COCKATOO CREEK
DEEP CREEK
COOPERS CREEK

Legend

- Town
- Weir
- Plume line
- Watercourse
- Road
- Local government boundary
- Environmental Value Zone
- Boundary of the waters covered by the scheduling document

Management Intent

- High Ecological Value (HEV)
- Slightly Disturbed (SD)
- Highly Disturbed (HD)
- Waters in the scheduled area that are not shown as high ecological value, slightly disturbed or highly disturbed waters have an aquatic ecosystem management intent of **moderately disturbed (MD)**

Water types

Marine / estuarine waters

- Enclosed coastal waters / Lower estuary
- Middle estuary

Fresh waters

- Burdekin Delta
- Burdekin River (below dam)
- Lakes / reservoirs
- Landers Creek
- Stones Creek
- Wetlands (palustrine)

Key to Environmental Values

Aquatic Ecosystems; Irrigation; Farm Supply; Stock Water; Aquaculture; Human Consumer; Primary Recreation; Secondary Recreation; Visual Recreation; Drinking Water; Industrial Use; Cultural & Spiritual Values

Notes:
1. The information provided on this plan is available on Queensland Globe. The GIS datasets are available for download on the Queensland Spatial Catalogue.
2. Plan refers to Queensland waters. Roads and other infrastructure are exempt.
3. Reference should be made to the Queensland Wetlands Program. The Wetland*Info* website provides a full coverage of wetlands.
4. Reference should be made to Matters of State Environmental Significance (MSES).
5. Water use restrictions apply in or near Sunwater storages (dams, weirs), as advised on the Sunwater website. Refer to council websites for facilities managed by councils.
6. Refer to North Queensland Bulk Ports for Abbot Point Port Restricted Use Area details.

Disclaimer
Whilst every care is taken to ensure the accuracy of this product, the Department of Environment and Science makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a consequence of reliance on the product, or as a result of the product being inaccurate or incomplete in any way and for any reason.

WQ1206 - Lower Burdekin

Part of basin 120

Central Queensland Map Series

This plan forms part of the Lower Burdekin and Bowen River Sub-basins Environmental Values and Water Quality Objectives scheduling document, prepared pursuant to the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*.

Queensland Government

Prepared on: 8 September 2022

N

0 2.5 5 7.5 10 12.5
Kilometres

Scale: 1:220,000 @ A1
Projection: Mercator
Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

Location Map

2.1.2 Water Quality Objectives

The relevant surface WQOs for the lower Burdekin River (below the dam) and Barratta Creek catchments from EPP 2019 is provided in **Table 3**. The high flow EPP 2019 WQOs have been listed in **Table 3** due to the elevated location of the site works on the catchment boundary between the Burdekin River and Barratta Creek catchments.

Table 3 Aquatic Ecosystem Water Quality Objectives

Project Element	Water area/type (Source: s1–s4)	Management intent /Level of protection	Water Quality Indicators											
			pH	Electrical Conductivity (µS/cm)	Turbidity (NTU)	Suspended Solids (mg/L)	Dissolved Oxygen (% sat)	Total N (mg/L)	Ammonium N (mg/L)	Oxidised N (mg/L)	Filterable Reactive P (mg/L)	Total P (mg/L)	Chlorophyll-a (µg/L)	Sulfate (mg/L)
Substation	Burdekin River (Below Dam) **HIGH FLOW ≥108.6 m^3/s at gauge 120006B – Burdekin River at Clare**	MD	6.5–8.5	110	140	70	85–110	540	10	70	20	110	1	2
OHTL	Barratta Creek **HIGH FLOW ≥3.6 m^3/s at gauge 119101A – Barratta Creek at Northcote**	MD	6.5–8.0	80	100	40	85–110	760	10	45	40	120	2	N/A

Notes:

- WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. 15). For single value WQOs, medians of test data should be less than or equal to the WQO, unless otherwise indicated (refer to section 3.1.1 for more details).
- HEV – high ecological value; SD – slightly disturbed; MD – moderately disturbed. Refer to accompanying plan for details; ID – insufficient data.
- Sources: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: QWQG guidelines and /or data; S3: ANZG (2018); S4: Other sources.

2.1.3 Water Quality

The Project is within the dry tropics of Queensland. Ephemeral flows in the watercourses and drainage lines of the dry tropics region are dominated by flows with elevated concentrations of total suspended sediments, appearing brown in colour. The majority of sediments are washed from the land surface at the onset of a major flood. Once a major flood has passed, water quality generally improves with lower suspended sediment concentrations experienced on the falling limb of the flood hydrograph.

There are two river gauges located downstream of the Project site which have available water quality information:

- DNRME Gauge 120006B – Burdekin River at Clare (7.4 km downstream of site)
- DNRME Gauge 119101A – Barratta Creek at Northcote (26.2 km downstream of site).

The above two gauges are also the streamflow reference gauges listed in **Section 2.1.2** for the WQOs. A high-level review of the available water quality sampling information from the two gauges indicated the following:

- The concentration of metals is less than the ANZECC default WQOs for the 95% species protection values.
- The concentration of the Water Quality Indicators associated with the WQOs in **Section 2.1.2** varies during the dry and wet seasons. Generally, the reviewed Water Quality Indicators from the recorded gauge data are lower than the default WQOs in **Table 3**.

The main source of sediment and nutrients affecting water quality in the lower Burdekin River and Barratta Creek catchments is from agricultural activities. The most notable agricultural activity in these catchments is sugarcane cropping.

2.1.4 Wetlands

Wetland Data (version 6.0) was acquired from the Queensland Government. Available data shows that there are no wetlands within the Project works area. The closest wetlands to the Project are outlined in **Table 4** and shown in **Figure 4**. Activities occurring as a result of construction or operation of the substation and OHTL are not expected to have any impact on these wetlands.

Table 4 Wetlands in Proximity to the Project Site

Unique ID (Habitat)	Type of Wetland	Distance to Project Site
W6_0Y2019A345745	Lacustrine (Burdekin River Channel)	60 metres east of substation site
W6_0Y2019A345721	Lacustrine (Artificial Dam)	600 metres northwest of substation site
W6_0Y2019A373746	Lacustrine (Haughton Sediment Basin)	190 metres south of substation site

Deep Creek

AYR DALBEG ROAD

Burdekin River

Proposed Substation

Proposed Transmission Line

Haughton Main Channel.

Haughton Sediment Basin

Tom Fenwick Pumpstation

AECOM
www.aecom.com

N

DATUM GDA 2020, PROJECTION MGA ZONE 55

0 50 100 150 200 m

1:5,000 (when printed at A3)

Legend

- Roads
- Railways
- Transmission Line
- Culvert
- Watercourse
- Riparian Corridor
- Proposed Transmission Line & Corridor
- Substation

Wetland Areas (Version 6)

- Modified and Artificial - Lacustrine
- Natural - Riverine

HAUGHTON PUMP LOAD

Water Resources and Hydrology Review

Wetlands

PROJECT ID	60565866
CREATED BY	deJong, Mark
LAST MODIFIED	2023-11-14
VERSION	1

Figure 4

A3 size

\\na.aecomnet.com\lfs\APAC\Townsville-AUTSV1\Legacy\Projects\607X\60714900_Powerlink_Haughton_Pump_Load\400_Technical\432_TechnicalArea_Water\01_Data\99_Data_Review\Wetland Mapping.qgz

2.1.5 Historic Flood Events

A review of historical flooding upstream of the Clare Weir at Gauge 120006B was undertaken for the *Ayr 2D Flood Study and Flood Risk Assessment (Engeny, 2012)*. The ten largest historical floods reviewed for that study is provided in **Table 5**.

The February 2019 Monsoonal Flood Event is the most recent flood with a significant discharge at Gauge 120006B. This event was not considered in the *Ayr 2D Flood Study and Flood Risk Assessment* as the study was completed in 2012. However gauge records at 120006B indicates that the February 2019 flood event would rank outside of the ten historical flood events in **Table 5**.

Table 5 Historical Flood Events (Engeny 2012)

Rank	Flow (m^3/s)	Water Year	ARI (1 in Y)	AEP (%)
1	35,305	1958	52	1.9%
2	35,249	1946	51	1.9%
3	33,864	1991	44	2.2%
4	32,154	1940	36	2.7%
5	26,736	2008	18	5.4%
6	26,330	1974	17	5.7%
7	25,899	1972	16	6.1%
8	25,734	1968	16	6.1%
9	24,912	1918	14	6.9%
10	24,701	1950	14	6.9%

The purpose of reviewing historical flood records is to highlight the major historical floods that may have potentially affected the Project site. A comparison of the base case hydraulic modelling results in **Section 3.0** to **Table 5** indicates the Project site is unlikely to have been inundated by any of the listed historical flood events.

2.2 Groundwater

2.2.1 Bores

Table 6 and **Figure 5** show that there are eight (8) registered bores within proximity of the Project site in the Queensland Registered Bore Database.

Table 6 Registered Groundwater Bores within Proximity of the Project Site

Bore ID	Date Drilled	Bore Depth Below Surface (m)	Aquifer Formation	Bore Function
186,885 (BHD156)*	10/15/2021	Unknown	No Formation Noted	Monitoring
186,886 (BHD157)*	10/25/2021	Unknown	No Formation Noted	Monitoring
186,895 (BHD133)*	11/14/2021	Unknown	No Formation Noted	Monitoring
12,000,041	5/18/1949	27	Alluvium	Decommissioned
12,000,042	5/26/1949	26	Alluvium	Decommissioned
12,000,043	9/14/1950	24	Alluvium	Decommissioned
12,000,044	6/01/1949	8	Alluvium	Decommissioned
12,000,045	6/03/1949	Unknown	No Formation noted	Decommissioned

* Townsville City Council Haughton Pipeline Stage 2 Project borehole ID

The following has been noted for the bores in **Table 6**:

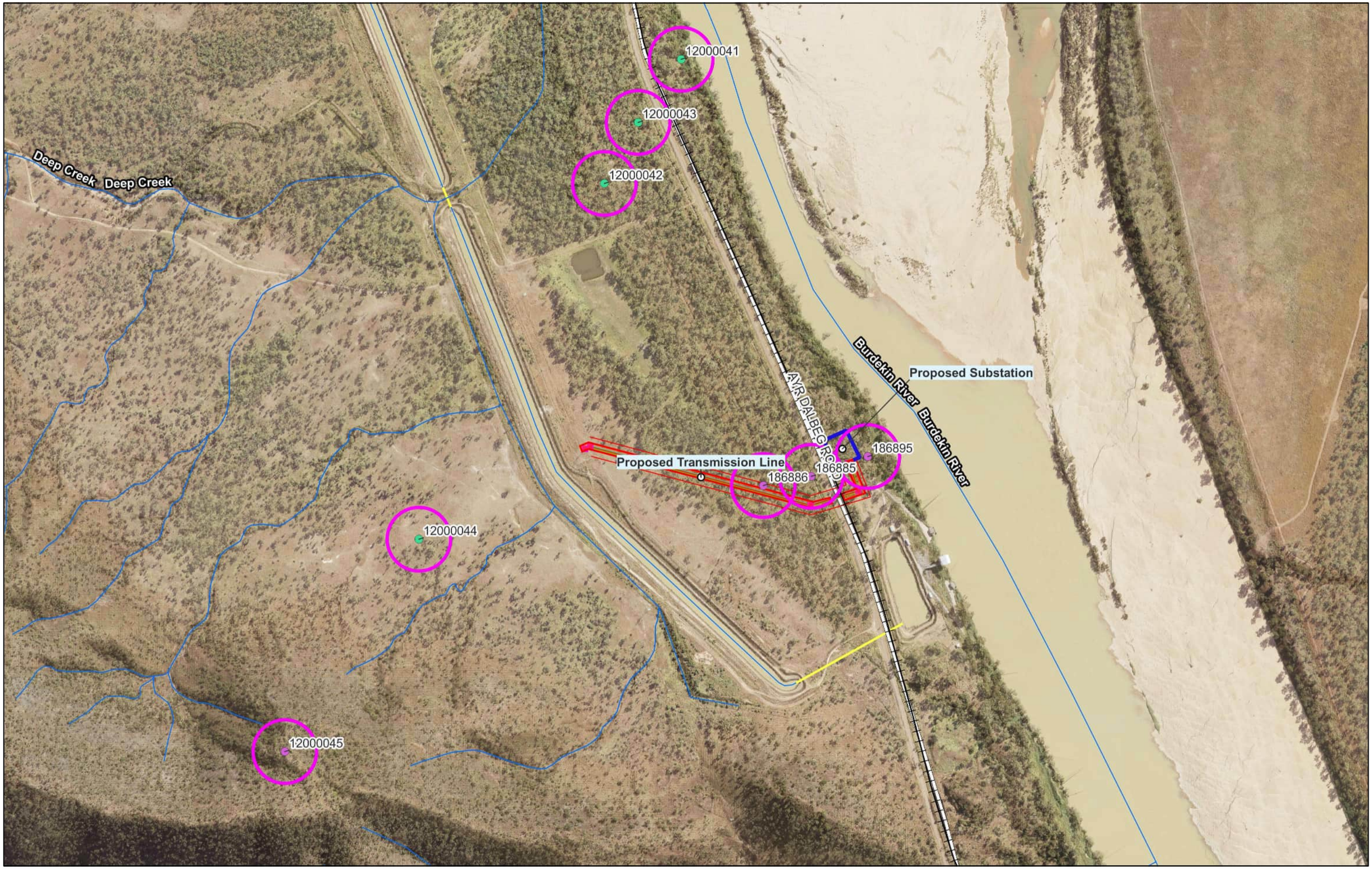
- The four (4) bores drilled before 2021 are no longer in use.
- The bores drilled in 2021 were commissioned for the Townsville City Council Haughton Pipeline Stage 2 Project (GHD, 2022). **Drawing 5** shows the location of these bores with a total of six (6) bores drilled in proximity to the Project site.
- The depth of standing water in the bores is not provided in the Queensland Registered Bore Database.
- Four (4) of the bores intercept an alluvium aquifer formation. No aquifer formation information is available for the other four (4) in the Queensland Registered Bore Database.

Further away from the Project site, the greatest density and number of bores are located north of the Project site in the sugarcane paddocks of Claire. These bores have similar characteristics to the bores located close to the Project site in that:

- most of the bores are no longer in use
- most bores were installed to a shallow depth below the surface
- most bores where information is available on the alluvium aquifer formation intercept an alluvium aquifer.

The yields and water levels of the nearby bores in the alluvium aquifers is not provided by the Queensland Registered Bore Database. However, it can be expected that the bore yields would be higher in the wet season compared to the dry season given the increase availability of water (rainfall and river flows) in the wet season.

All bores within the Burdekin Basin fall within the Burdekin Groundwater Management Area. This area is subject to the provisions in the *Burdekin Groundwater Management Area - Water sharing rules (WSS/2013/277)* as prescribed in section 27 of the Water Regulation 2016 (Water Regulation). The water sharing rules (WSS/2013/277) apply to bores which are used for purposes other than stock and domestic or prescribed activities as defined in the Water Regulation.



AECOM
www.aecom.com

N

DATUM GDA 2020, PROJECTION MGA ZONE 55

0 50 100 150 200 m

1:7,500 (when printed at A3)

Legend

- Roads
- Railways

Transmission Line

- Proposed Transmission Line & Corridor
- Substation

Registered Bores

- ALLUVIUM
- NO FORMATION PROVIDED

Aerial Photography:
The State of Queensland (Department of Natural Resources, Mines and Energy),© State of Queensland (Department of Natural Resources, Mines and Energy) 2020

HAUGHTON PUMP LOAD

Water Resources and Hydrology Review

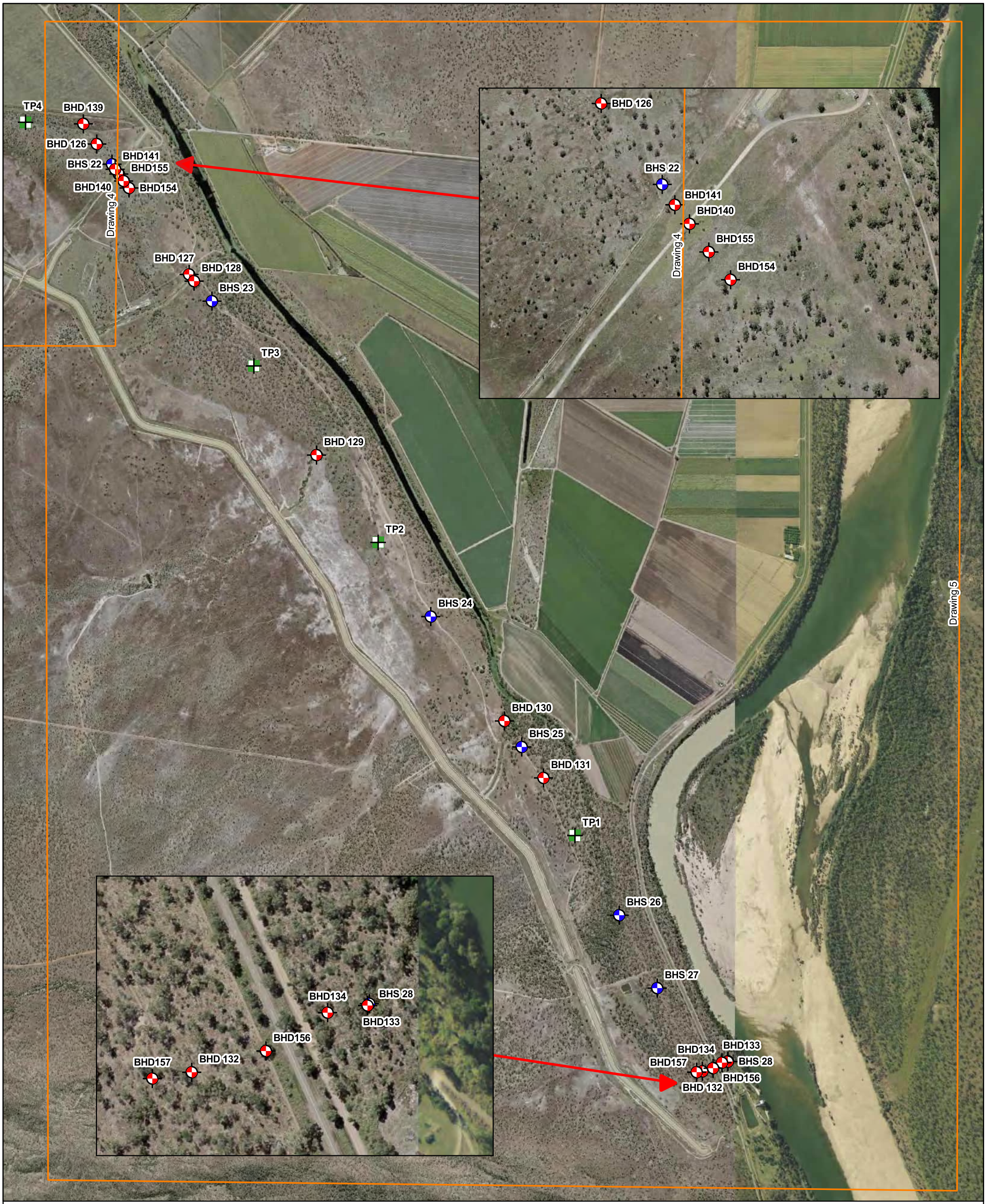
Bores

PROJECT ID	60565866
CREATED BY	deJong, Mark
LAST MODIFIED	2023-11-21
VERSION	1

Figure 5

\\na.aecomnet.com\lfs\APAC\Townsville-AUTSV1\Legacy\Projects\607X\60714900_Powerlink_Haughton_Pump_Load\400_Technical\432_TechnicalArea_Water\01_Data\99_Data_Review\Bores.qgz

A3 size



Notes:
1. Base image from Queensland Globe.
2. Test locations are approximate only and are shown with reference to existing site features.

0 0.5 1 1.5 km

Legend

- Deep borehole location and number
- Shallow borehole location and number

Douglas Partners Geotechnics · Environment · Groundwater	TITLE: Site and Test Location Plan Haughton Pipeline Duplication Project - Stage 2 Upper Haughton		N	OFFICE: Townsville
				DRAWN BY: KMF
				DATE: January 2022
CLIENT: GHD Pty Ltd	PROJECT No: 98721.00	DRAWING No: 5	REVISION: 0	SCALE: 1:20,000@ A3

2.2.2 Environmental Values

Groundwater EVs have been prepared for the Burdekin Basin and are sourced from the following document:

- *Burdekin River (lower) and Bowen River Sub-basins - Environmental Values and Water Quality Objectives 2022* by the Department of Environment and Science (DES) (**DES 2022**).

Groundwater EVs for the Burdekin Basin are provided for different aquifers which are based on lithology as outlined in the above document. The following aquifers/lithology where there are prescribed EVs apply to the Project site:

- Alluvium (Upper Barratta)
- Fractured rock (Ravenswood Granites and Volcanics)
- Cainozoic deposits (Don and Boogie Coastal Area).

The relevant groundwater EVs for the above aquifers/lithology are provided for the Project in **Table 7**. The depth of water encountered in bores and the stratigraphy of each bore will determine which of the above aquifers is applicable. However, it is likely that only the Alluvium (Upper Barratta) aquifer EVs will be applicable to the Project based on the available bore data in **Section 2.2.1**.

Table 7 Ground Water Environmental Values for the Project

Lithology and Unit	Environmental Values											
	Aquatic Ecosystems	Irrigation	Farm Supply/Use	Stock Water	Aquaculture	Human Consumption	Primary Recreation	Secondary Recreation	Visual Recreation	Drinking Water	Industrial Use	Cultural and Spiritual
Alluvium - Upper Barratta	✔	✔	✔	✔						✔	✔	✔
Fractured rock - Ravenswood Granites and Volcanics	✔	✔	✔	✔						✔	✔	✔
Cainozoic Deposits - Don and Boogie Coastal Area	✔											✔

2.2.3 Groundwater Dependent Ecosystems

A review of the Queensland Spatial data layers for Groundwater Dependent Ecosystems (GDEs) was undertaken. The dataset outlines the following GDEs:

- surface expressions of GDEs
- terrestrial GDE areas
- subterranean GDE areas.

The dataset also shows potential GDEs on the following basis:

- unconsolidated sedimentary aquifers
- consolidated sedimentary aquifers
- igneous rock aquifers
- metamorphic aquifers
- a mixture of the above.

The review determined that there are no GDEs or potential GDEs within a 50 km radius of the Project site. Furthermore, there are no GDEs or potential GDEs within the Barratta Creek catchment.

2.3 Water Resource Planning and Use

The Project is located within the Burdekin Basin Water Plan area defined by the Water Plan (Burdekin Basin) 2007. Under the *Water Act 2000* a water licence is required to take or interfere with water. Water Plans govern the allocation of water throughout each respective basin.

A search of the water entitlements database held by DNRME showed that there are no water licences assigned to allotments where the Project is sited. However, Sunwater holds a Resource Operations Licence for the Burdekin Haughton Water Supply Scheme under the *Water Act 2000*.

Given the Project will have no impact on the hydrology of natural waterways and the Burdekin Haughton Water Supply Scheme water transfer infrastructure, there will be no impact on any water licence holders.

3.0 Hydraulics Assessment

3.1 Background

Previous design phases undertaken by others assessed the flood immunity and determined site levels based on previous flood studies prepared by DHI 2014 and DHI 2014a. The DHI flood assessment indicated the site levels of 38.5 m AHD was not inundated during a 0.5% AEP flood event. As such, the minimum pad level of 38.858m was derived by the additional 300 mm as per the section 3.6.4.2 of SDC-001.

While GIS layers of flood outlines from the DHI studies were provided, no modelling or digital data of flood levels or depths were available for these studies. As part of this report, a hydraulic assessment has been undertaken to determine potential flood impacts from the Project works and identify mitigation works, if necessary. This assessment is detailed below. It should be noted that due to the absence of sufficient calibration data, the hydraulic assessment results are not intended to be used for setting the substation design surface and building floor levels.

3.2 Hydraulic Assessment Approach

Hydrologic and hydraulic modelling has been undertaken and the approaches used for the assessment are provided in **Table 8**. The modelling has utilised the available data and modelling framework from the *Queensland Reconstruction Authority (QRA) Barratta Creek Catchment Flood Study* (AECOM 2021).

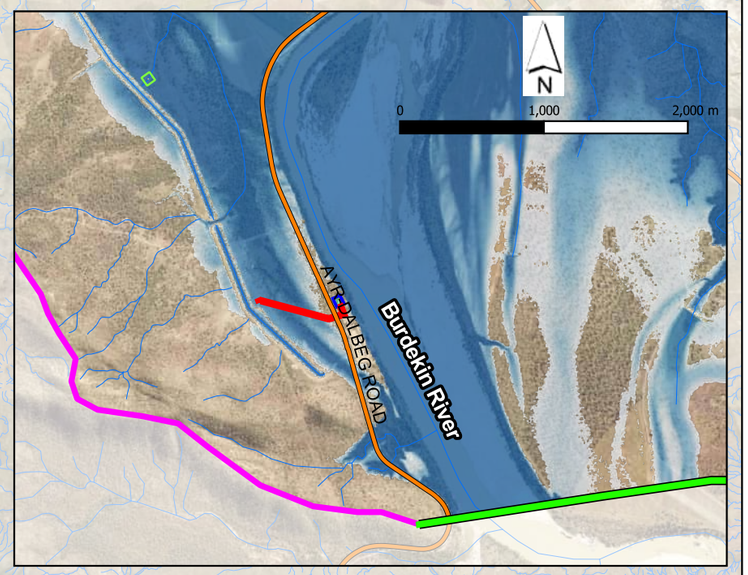
Table 8 Hydraulic Assessment Approach

Parameter	Description
Hydrologic Analysis Approach	As per the QRA Barratta Creek Catchment Flood Study: • Barratta Creek subcatchment inflows: Barratta Creek XP-RAFTS model. • Haughton River subcatchment inflows: Haughton XP-Rafts model. • Burdekin River inflow: Ayr 2D Flood Study and Flood Risk Assessment (**Engeny 2012**)
Hydraulic analysis approach	As per the QRA Barratta Creek Catchment Flood Study: • TUFLOW HPC (2020-10-AA) • Grid resolution of 10 metres • 1 metre Sub-Grid Sampling (SGS)
Terrain Models	As per the AECOM 2021 Barratta Creek Catchment Flood Study. The only high-resolution Digital Elevation Model (DEM) available for the Project site was 1-metre resolution 2009 Light Detection and Ranging (LiDAR) captured for the *Queensland LiDAR Data - Tropical Coast 2009 Project*.
Topographic Adjustments	Base Case - As per the QRA Barratta Creek Catchment Flood Study TUFLOW model.
Manning's n	As per the QRA Barratta Creek Catchment Flood Study TUFLOW model for areas outside of the Burdekin River Channel. An in-bank Manning's n of 0.025 was adopted for the Burdekin River as per the Ayr 2D Flood Study and Flood Risk Assessment (**Engeny, 2012**).
Model Extent (**Figure 6**)	The QRA Barratta Creek Catchment Flood Study TUFLOW model southern extent was extended 7.3 km southwards (upstream) along the Burdekin River to include the Project site.

Parameter	Description
Hydraulic Structures: • Pipe networks • Culverts • Pumps • Gates • Bridges	As per the QRA Barratta Creek Catchment Flood Study TUFLOW model.
Boundary Conditions	The location of the Burdekin River inflow was moved southward to match modified extent of the QRA Barratta Creek Catchment Flood Study TUFLOW model (refer above to Model Extent). It should be noted that the new position of the Burdekin River inflow boundary condition matches the regional TUFLOW model developed for the Ayr 2D Flood Study and Flood Risk Assessment (**Engeny, 2012**). All other boundary conditions are as per the QRA Barratta Creek Catchment Flood Study TUFLOW model.
Design Events	1% AEP 0.5% AEP*
Design Storm Selection	Refer to **Section 3.3**
Hydraulic Model Validation	The TUFLOW modelling results were validated to: • flood level information from the Ayr 2D Flood Study and Flood Risk Assessment (**Engeny 2012**) • flood events from the Dalbeg and Millaroo Flood Study Flood (DHI 2014). A description of the TUFLOW model validation is provided in **Section 3.4**.

* As required by the State Planning Policy (SPP) - state interest guideline: *Natural hazards, risk and resilience 2016* (DSDILGP 2016) for substations.

Giru Weir
Val Bird Weir
BRUCE HIGHWAY (AYR-TOWNSVILLE)
FLINDERS HIGHWAY (Townsville-Charters To
WOODSTOCK-GIRU ROAD
Plantation Creek
BRUCE HIGHWAY (BOWEN-AYR)
Burdekin River
HOME HILL - KIRKNIE ROAD
Reid River
AYR-DALBEG ROAD
Horse Creek
Clare Weir
AYR-RAVENSWOOD ROAD



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DATUM GDA 2020, PROJECTION MGA ZONE 55

0 3.5 7 km

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Legend

- Weirs
- Roads
- Watercourse

Hydraulic (TUFLOW) Model

- Inflow Boundary Condition
- Outflow Boundary Condition
- Source Inflow Boundary Condition
- Model Extent

1% AEP Depth Range (m)

9

0

HAUGHTON PUMP LOAD

Water Resources and Hydrology Review

TUFLOW Model

PROJECT ID	60565866
CREATED BY	deJong, Mark
LAST MODIFIED	2023-11-21
VERSION	1

Figure 6

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A3 size

3.3 Lower Burdekin River Hydrology

A review of the previous hydraulic modelling undertaken for the Barratta Creek Catchment Flood Study (**AECOM 2021**) and the Ayr 2D Flood Study and Flood Risk Assessment (**Engeny 2012**) showed that flooding at the Project site is driven by breakout flows from the Burdekin River channel. Runoff from local catchments to the Project site had marginal effect on flooding compared to the Burdekin River breakout flows.

Detailed hydrologic modelling of the entire Burdekin River catchment was beyond the scope of this study. Instead, the TUFLOW model inflows from the upper Burdekin River catchment in **Table 9** were based on the *Ayr 2D Flood Study and Flood Risk Assessment*. Except for the 0.5% AEP, the flows in **Table 9** are based on an FFA shown in **Figure 7** which was developed using the methodology outlined in the *Ayr 2D Flood Study and Flood Risk Assessment* report. The design events shown by the highlighted rows in **Table 9** were simulated for the hydraulic assessment.

Table 9 Design Peak Discharges at the Burdekin River TUFLOW Model Inflow Boundary (Engeny 2012)

AEP (%)	Average Recurrence Interval (1 in Y)	TUFLOW Model Inflow
5%	20	27,800
2%	50	35,100
1%	100	40,500
0.5%*	200	43,575
0.2%	500	52,800

* Design event flow interpolated
Simulated Design event

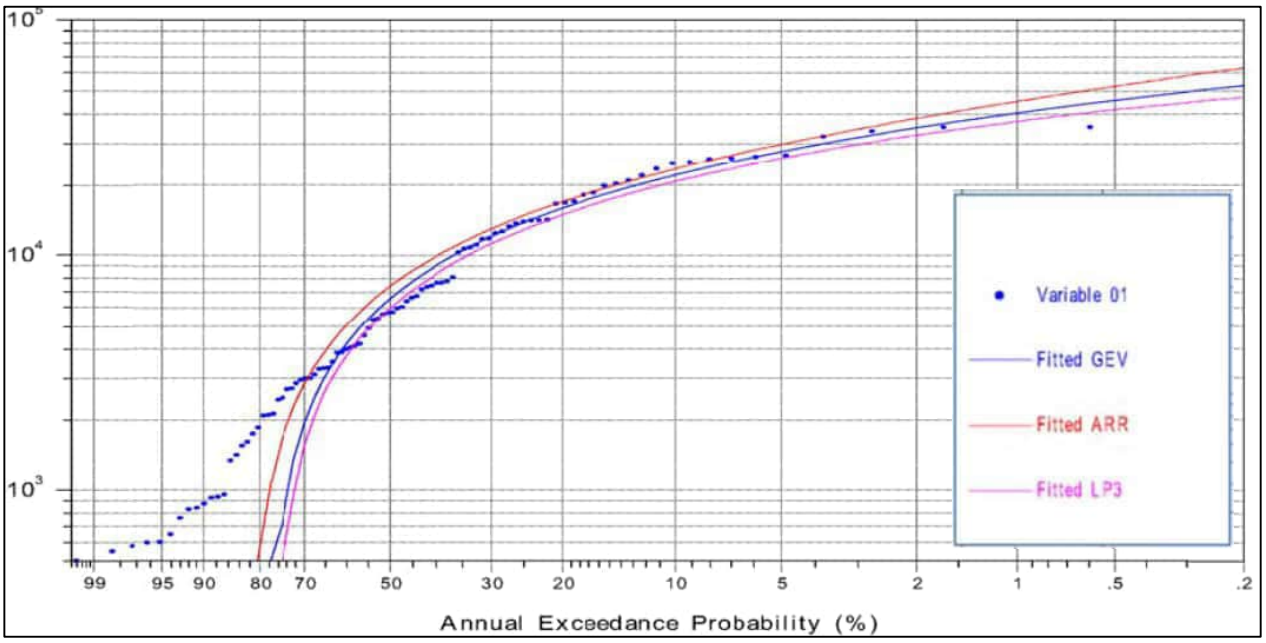


Figure 7 Flood Frequency Analysis (FFA) for the Engeny 2012 TUFLOW model Burdekin River Inflow

3.4 Hydraulic Model Validation

3.4.1 Comparison to Existing Flood Studies

The updated QRA Barratta Creek Catchment Flood Study (TUFLOW) results were validated to the following:

- Ayr 2D Flood Study and Flood Risk Assessment (**Engeny 2012**) flood level information. The TUFLOW model inflows were taken from this study (refer **Section 3.3**).
- Dalbeg and Millaroo Flood Study Flood (**DHI 2014**) flood extent information. The substation fill pad levels are based on the results from this study.

The validation provides confidence in the TUFLOW model results presented by this assessment.

The TUFLOW results at the Project site were validated to the following:

- Flood level information at gauges 120006A and 120006B (Burdekin River at Clare) from **Engeny 2012** (**Figure 8**) for the 2% AEP, 1% AEP and 0.5% AEP flood events. A comparison of the TUFLOW model flood level results to **Engeny 2012** is provided by **Table 10**.
- Flood extents from **DHI 2014** for the 2% AEP and 0.5% AEP flood events. **Figure 9** provides the comparison of the TUFLOW model flood extent results to **DHI 2014**.

Table 10 Comparison of Flood Levels From Engeny 2012 to TUFLOW

Event (% AEP)	Ayr 2D Flood Study (m AHD)		TUFLOW (m AHD)		Difference (m)	
	120006A	120006B	120006A	120006B	120006A	120006B
2% AEP	29.8	28.0	29.4	27.9	-0.4	-0.1
1% AEP	30.5	28.6	30.1	28.5	-0.4	-0.1
0.5% AEP	30.7	28.7	30.4	28.7	-0.3	0.0

Table 10 shows that the modelled TUFLOW flood levels are generally lower than the **Engeny 2012** flood levels at the downstream gauges. However, in contrast to **Table 10**, **Figure 9** shows that the TUFLOW model flood extents for both the 2% AEP and 0.5% AEP are marginally greater than **DHI 2014**.

The 0.5% AEP has the closest match between the modelled TUFLOW and **Engeny 2012** flood levels. This is noting that the 0.5% AEP is the key flood event for substation immunity (refer SDC-001).

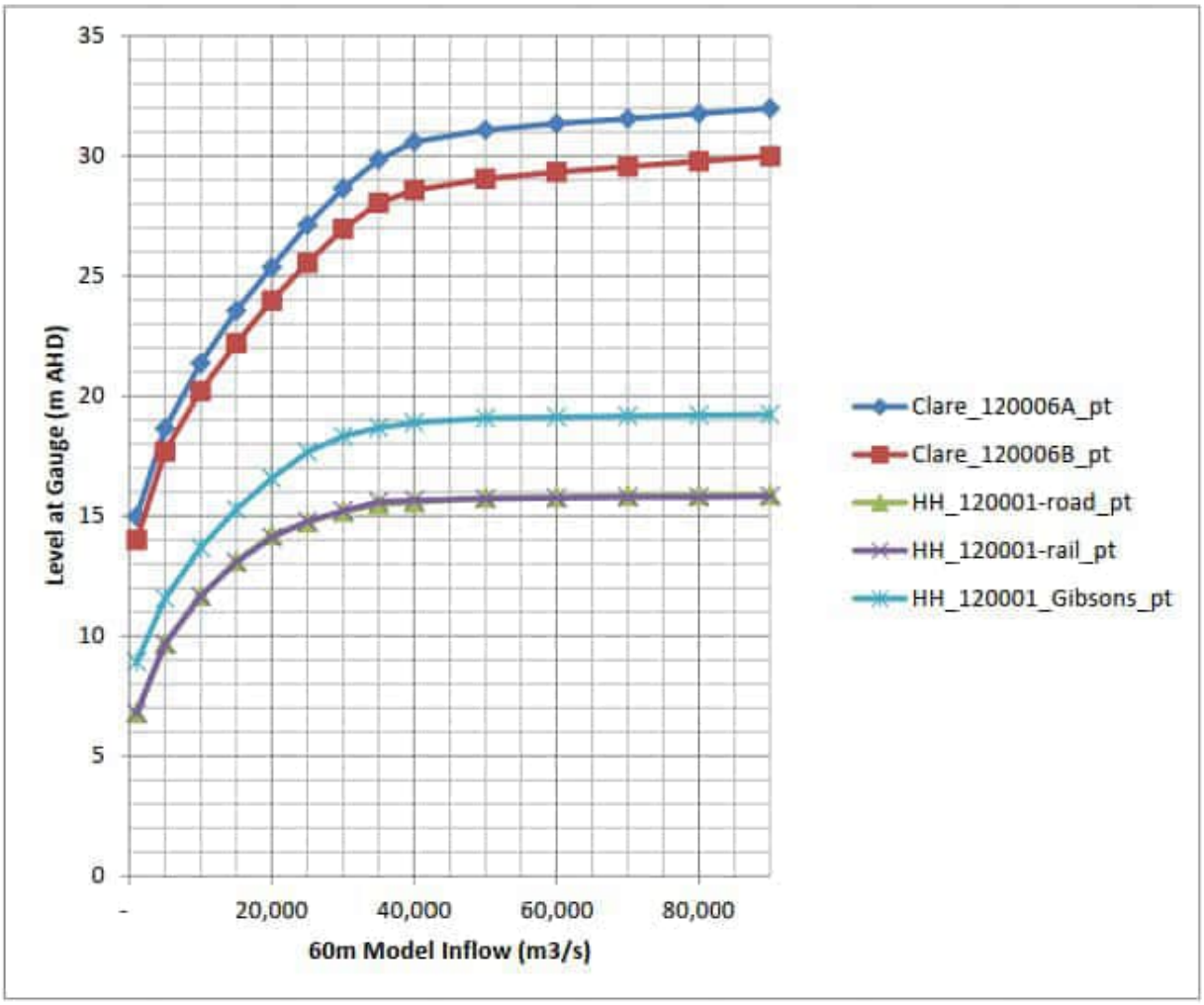
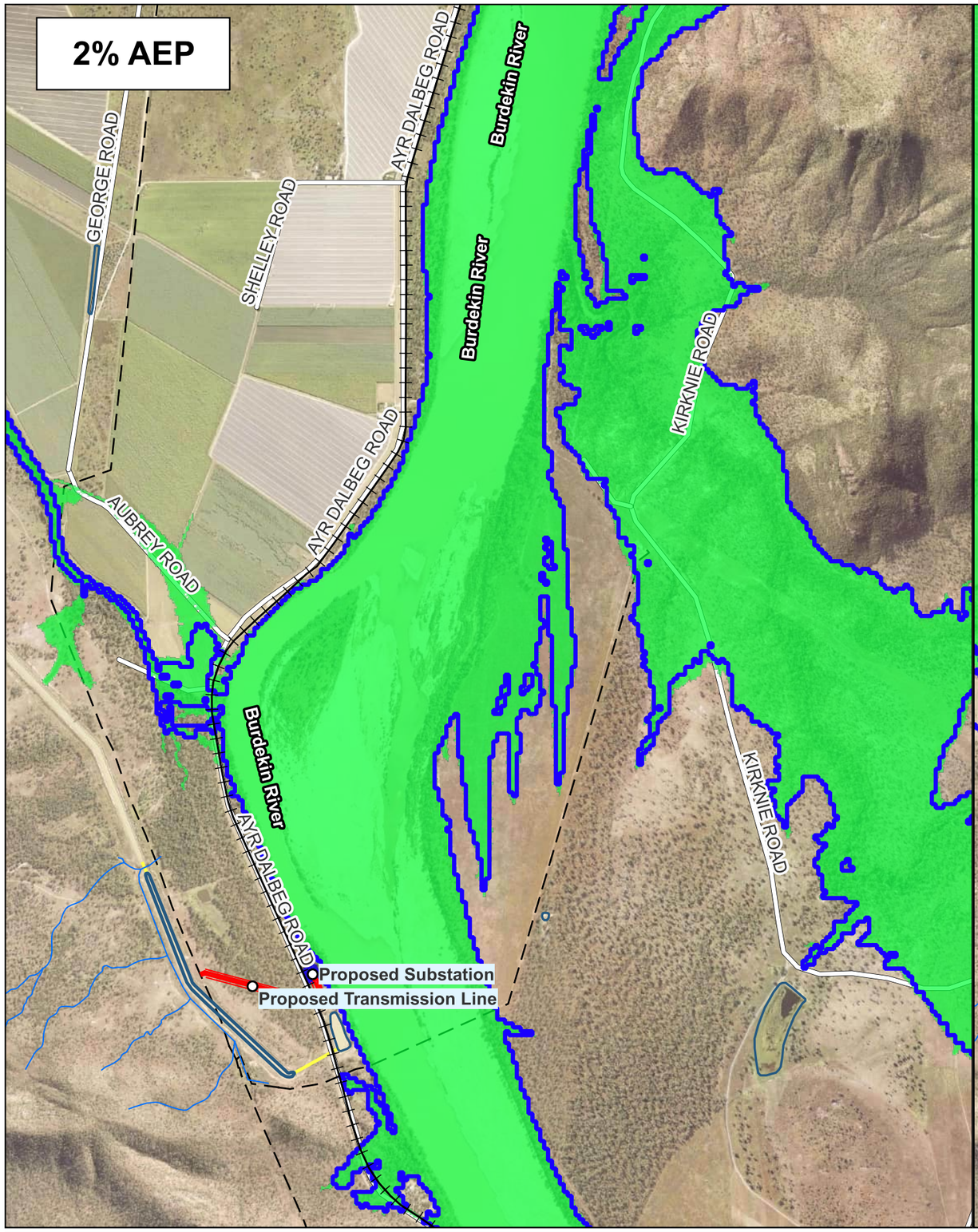
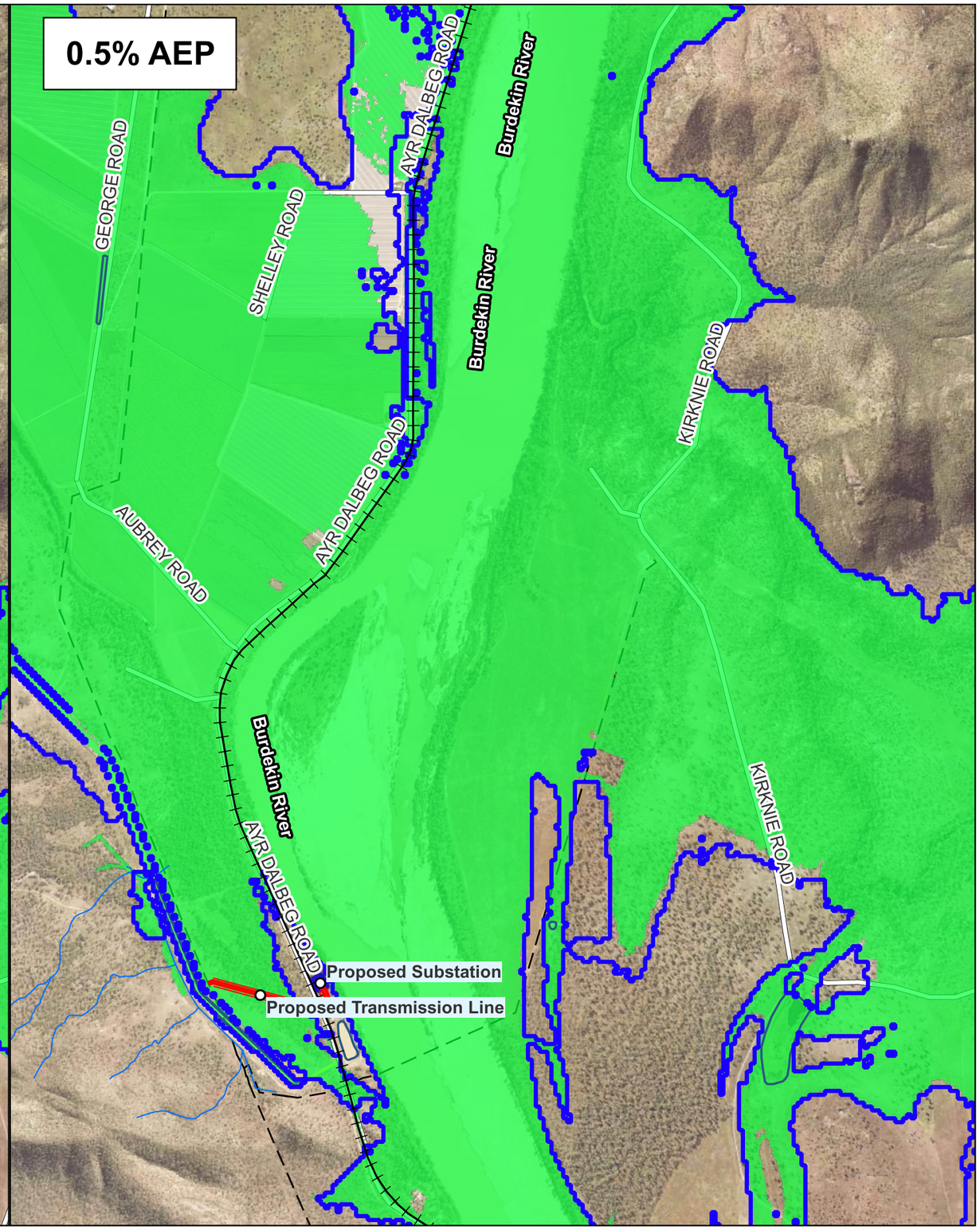


Figure 8 Gauge Station Level vs Peak Model Inflow (Engeny 2012 – Figure 4.9)





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DATUM GDA 2020, PROJECTION MGA ZONE 55

0 225 450 675 900 m

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Legend

- Roads
- Railways
- Transmission Line
- Proposed Transmission Line & Corridor
- Substation
- TUFLOW Flood Extent (This Assessment)
- Dalbeg and Millaroo Flood Study Flood Extent

HAUGHTON PUMP LOAD

Water Resources and Hydrology Review

Flood Extent Comparison

PROJECT ID	60714900
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LAST MODIFIED	2024-02-05
VERSION	1

Figure 9

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A3 size

3.4.2 Manning's Sensitivity

The base case flood assessment and previous flood studies demonstrate that that flooding at the Project site is driven by flood levels in the Burdekin River. This can be seen in **Figure 13** where the higher flood levels of the 0.5% AEP event result in an increased breakout from the Burdekin River upstream of the Project site compared to the 1% AEP event.

Flood levels along the Burdekin River are affected by the in-bank Manning's n value in the TUFLOW model. Higher Manning's n values generally result in an increase in flood levels if no other parameters in the TUFLOW model change. As such, a greater Manning's n value to what has been adopted for the Burdekin River channel from the Engeny study, (0.025) could result in the higher modelled flood levels at the substation site in the 0.5% AEP.

A Manning's n sensitivity assessment has been undertaken in the Burdekin River channel Manning's n to understand whether there is a risk of the substation site being inundated for a value greater to what has been adopted. The sensitivity assessment results are presented in **Table 11** and **Figure 10** for 2 alternate Manning's n values to the adopted Manning's n value of 0.025.

Table 11 Manning's n Sensitivity at the Burdekin River Adjacent to the Substation Site

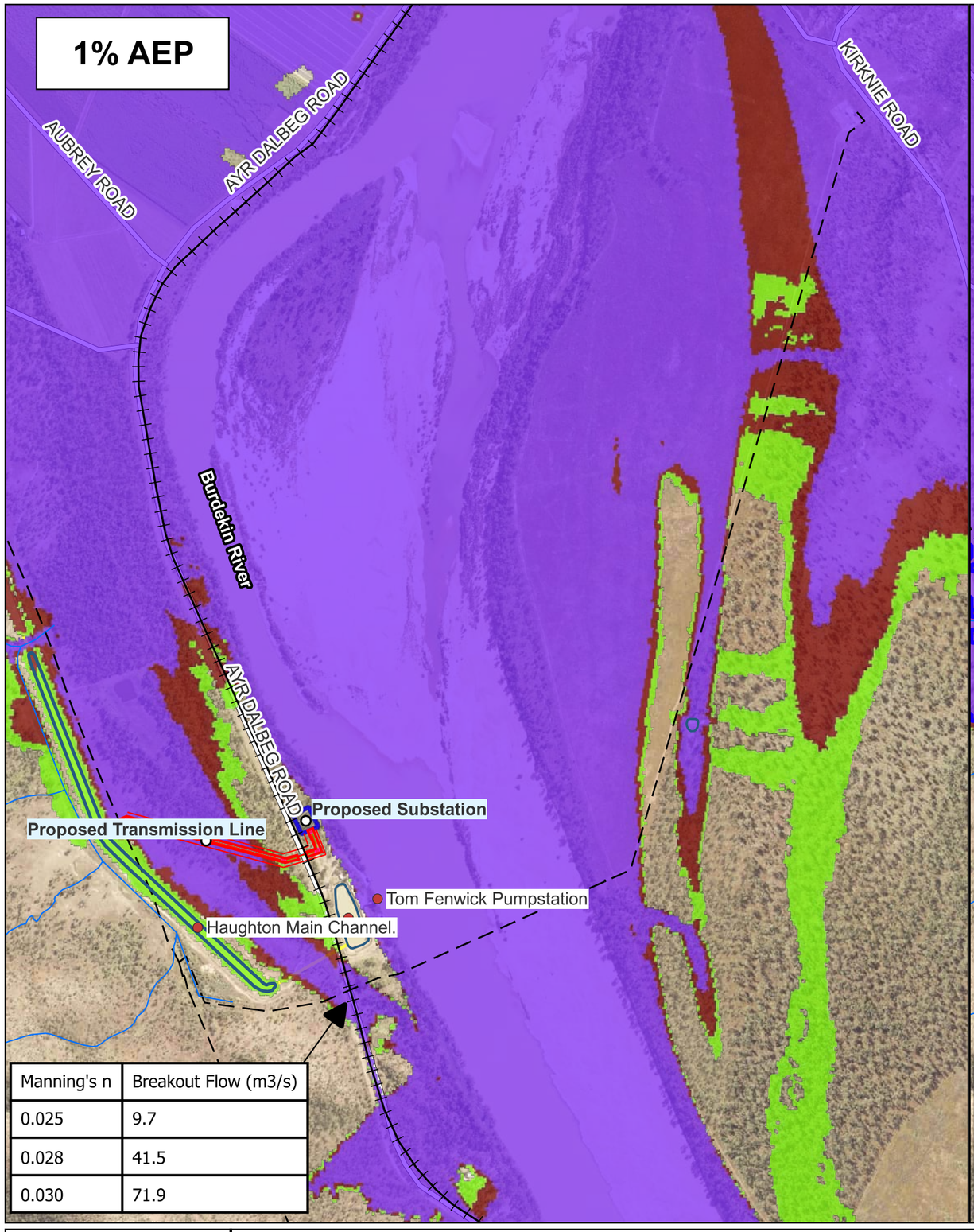
Event	Manning's n – 0.025 (Adopted)	Manning's n – 0.028		Manning's n – 0.030	
	Level (m AHD)	Level (m AHD)	Difference (m)	Level (m AHD)	Difference (m)
1% AEP	37.7	38.0	0.3	38.3	0.6
0.5% AEP	38.1	38.3	0.2	38.6	0.5

Notes:
- Existing substation ground level = 38.5 m AHD
- Proposed substation fill pad level = 38.858 m AHD

Table 11 and **Figure 10** demonstrate the following:

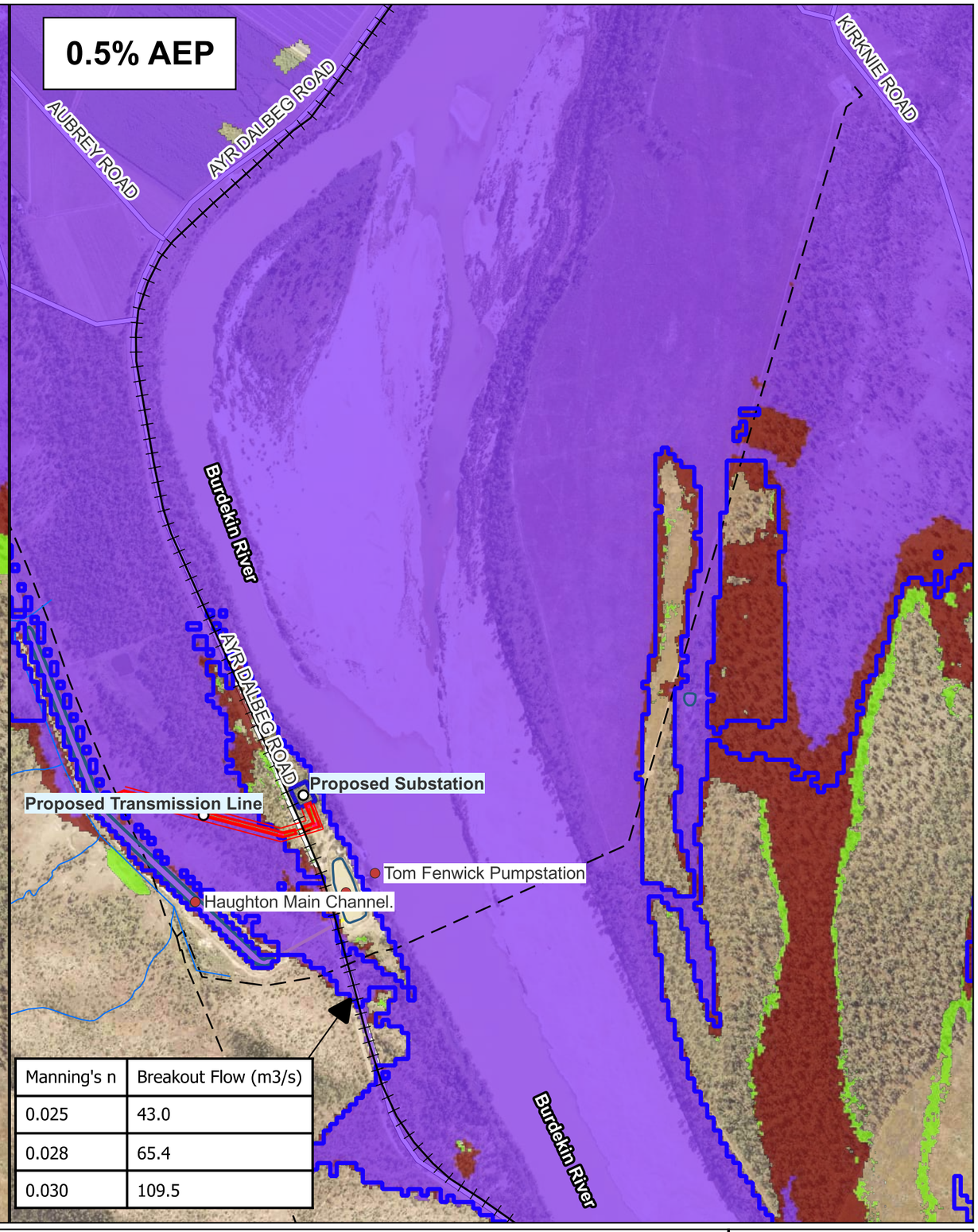
- Flood levels within the Burdekin River channel are sensitive to the adopted in-bank Manning's n value. For example, there is a 0.5 m flood level increase in the 0.5% AEP from a Manning's n of 0.025 to 0.030.
- The flow of the breakout upstream of the substation site is larger for the Manning's n scenarios compared to the 0.025 Manning's n scenario.
- There are breakouts on the eastern side of the Burdekin River in the 0.028 and 0.030 Manning's n scenarios that are not present in the adopted 0.025 Manning's n scenario. The **DHI 2014** study 0.5% AEP event flood extent does not reflect the breakout extents on the eastern side of the Burdekin River modelled in the 0.028 and 0.030 Manning's n scenarios.
- The 0.5% AEP Burdekin River channel flood level for the 0.030 Manning's n sensitivity of 38.6 m AHD is 258 mm lower than the proposed substation fill pad level of 38.858 m AHD.

1% AEP



Manning's n	Breakout Flow (m3/s)
0.025	9.7
0.028	41.5
0.030	71.9

0.5% AEP



Manning's n	Breakout Flow (m3/s)
0.025	43.0
0.028	65.4
0.030	109.5

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0 112.5 225 337.5 450 m

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Legend

- Roads
- Railways
- Transmission Line
- Proposed Transmission Line & Corridor
- Substation

Flood Extents

- Dalbeg and Millaroo Flood Study Flood Extent
- Manning's n = 0.025
- Manning's n = 0.028
- Manning's n = 0.030

HAUGHTON PUMP LOAD

Water Resources and Hydrology Review

Manning's n Sensitivity Flood Extent Comparison

PROJECT ID	60714900
CREATED BY	deJong, Mark
LAST MODIFIED	2024-02-05
VERSION	1

Figure 10

A3 size

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3.5 Base Case Flooding

3.5.1 Site Flood Immunity

The base case 1% AEP and 0.5% AEP flood depths at the Project site is demonstrated in **Figure 13**. More detailed information on characteristics of the flooding is provided by the following:

- **Figure 11** provides flood surface levels at the substation site.
- **Figure 12** provides flood surface levels at along the OHTL.
- **Table 12** provides peak flood depth, velocity and level at each proposed transmission pole and at the proposed substation.

Figure 11, **Figure 12** and **Table 12** demonstrate the following:

- The existing ground levels at the substation site are above both the 1% AEP flood level and 0.5% AEP flood level in the Burdekin River.
- The proposed OHTL easement is subject to inundation in both the 1% AEP and 0.5% AEP flood events. The flooding along the proposed OHTL easement is associated with the easement crossing an overflow channel from the Burdekin River.

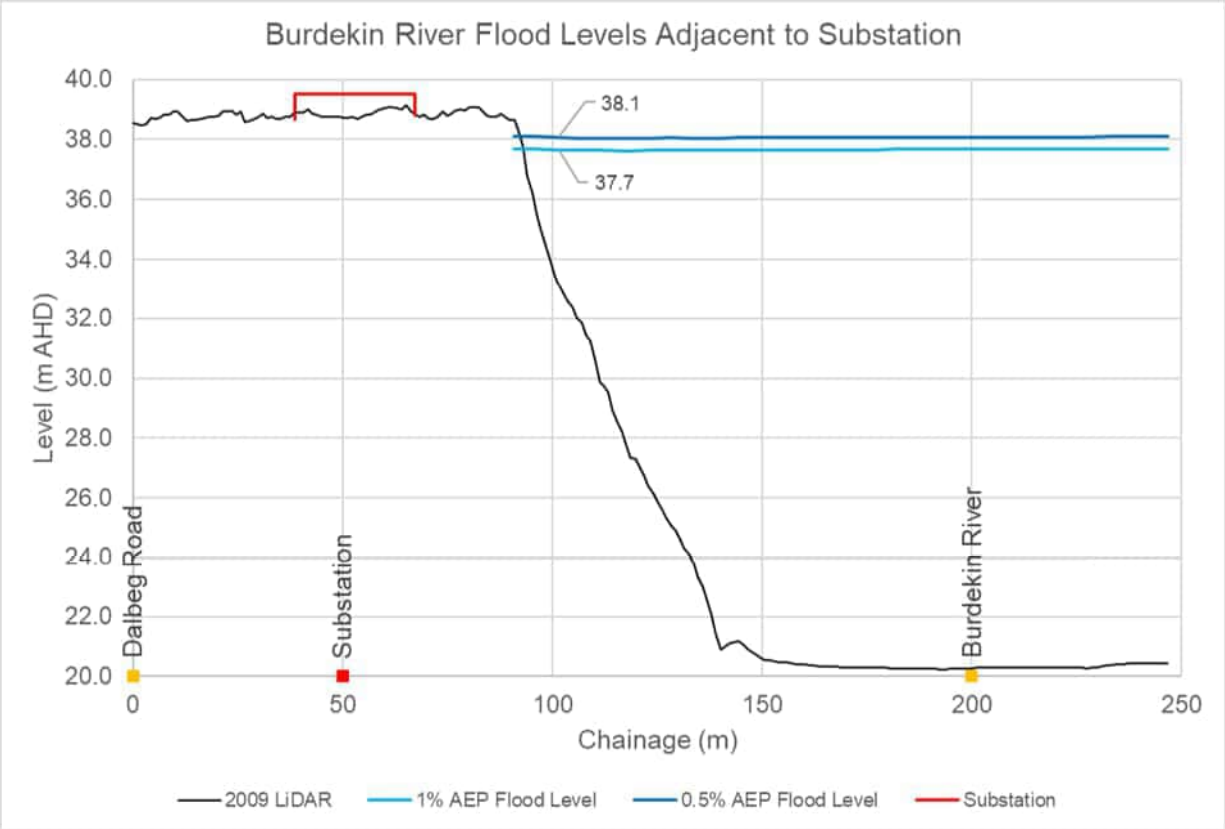

Figure 11 Base Case Burdekin River Flood Levels Adjacent to Substation

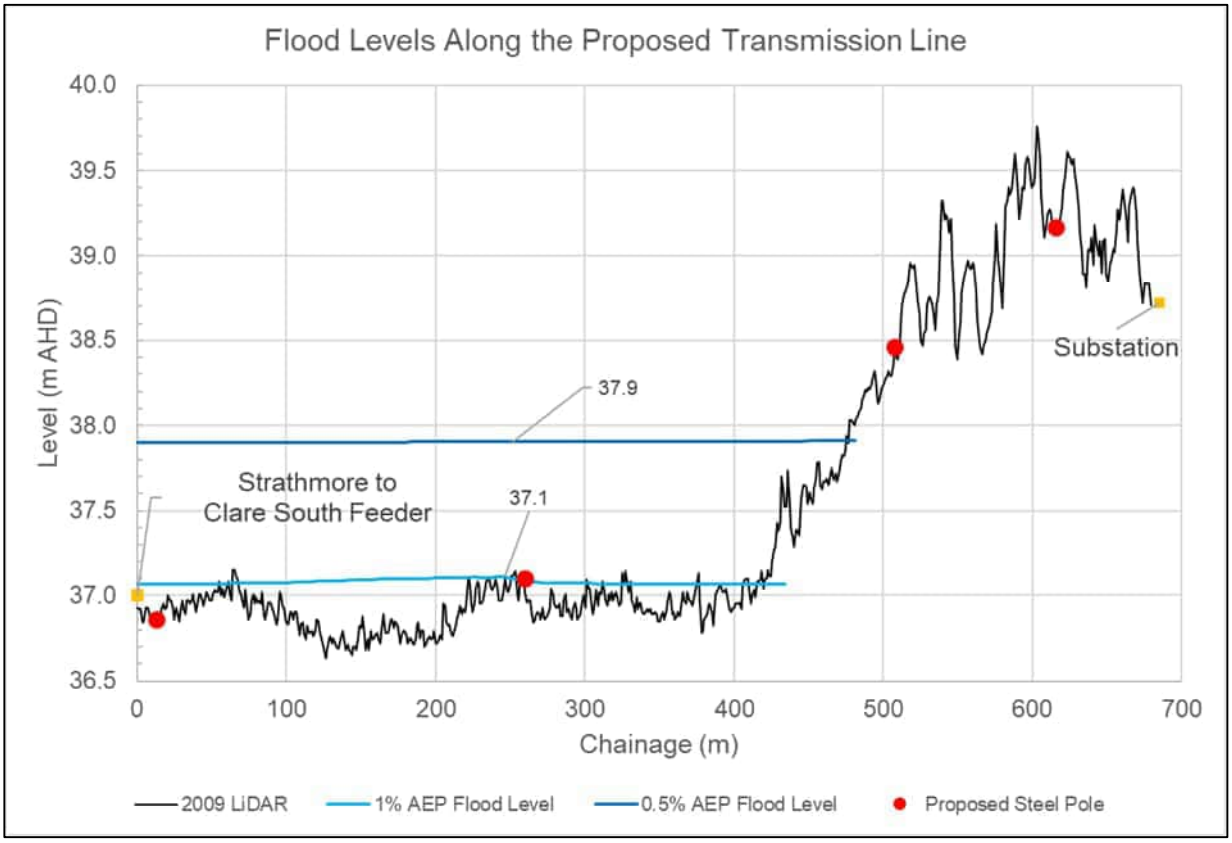

Figure 12 Base Case Flood Levels Along the Proposed Transmission Line

Table 12 Base Case Peak Depth, Velocity and Level Results

Project Element	1% AEP			0.5% AEP		
	Depth (m)	Velocity (m/s)	Level (m AHD)	Depth (m)	Velocity (m/s)	Level (m AHD)
Steel Pole 1	0.1	0.1	37.1	1.0	0.1	37.9
Steel Pole 2	0.1	0.4	37.1	1.0	0.4	37.9
Steel Pole 3	-	-	-	-	-	-
Steel Pole 4	-	-	-	-	-	-
Substation	-	-	-	-	-	-

- = Location not flooded in TUFLOW model

1% AEP

0.5% AEP

Proposed Substation
Proposed Transmission Line
Burdekin River
Haughton Main Channel.
Haughton Sediment Basin
AYR/DALBEG ROAD

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N

DATUM GDA 2020, PROJECTION MGA ZONE 55

0 45 90 135 180 m

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Legend

- Roads
- Railways
- Transmission Line
- 0.2 m Flood Level Contour (m AHD)
- Proposed Transmission Line & Corridor
- Substation

Flood Depth (m)

- 0.3
- 0.5
- 0.75
- 1
- 1.5
- 2
- 3
- >3

HAUGHTON PUMP LOAD

Water Resources and Hydrology Review

Base Case Flood Depths

PROJECT ID	60565866
CREATED BY	deJong, Mark
LAST MODIFIED	2024-02-05
VERSION	1

Figure 13

A3 size

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3.5.2 River Bank Erosion Potential

The Burdekin River channel at the Project site is incised ~19 metres below the surrounding floodplain on the west bank. The banks are steep sided, with average slopes of up to 35° and localised areas of as steep as 60° as measured from the available LiDAR data. This was previously evident in **Figure 11**.

A comparison of the 1969 historical aerial photography to more recent aerial photography in **Figure 14**. **Figure 14** shows that the top of the river bank adjacent to the site is stable and there is an increase of riparian vegetation along the river bank. The increase is in riparian vegetation is likely due to the construction of Clare Weir which provides both a more persistent water supply and higher standing water level along the river bank compared to pre-weir construction conditions.

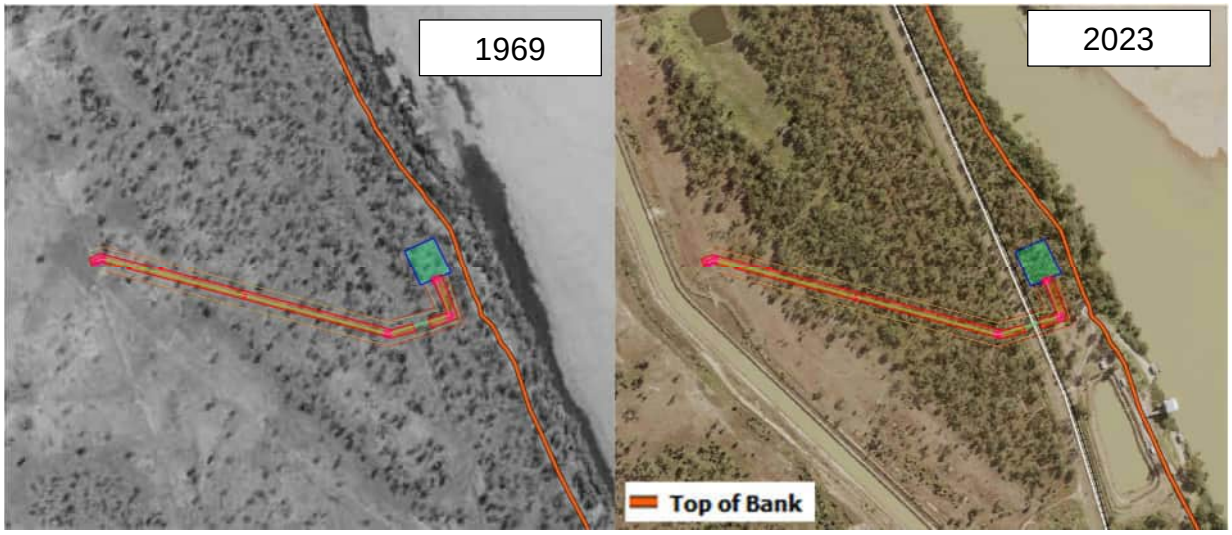


Figure 14 1969 Historical Aerial Photography

The proximity of the proposed substation next to Australia's largest river by peak flow means that it is potentially at risk of damage from river bank erosion. Historical aerial photography from 1969 (**Figure 14**) prior to the construction of Clare Weir in 1978 also shows that the Tom Fenwick Pumpstation is located in proximity to a hollow in the Burdekin River channel. The base case hydraulic modelling results have been used to understand whether there is a risk of the Burdekin River bank eroding adjacent to the proposed substation.

Bed shear stress is a parameter often used as a measure of the stream's ability to entrain bed material. It provides an indication of the potential of sediment mobilisation and transport occurring during a flood event. Critical shear stress is the shear stress when sediment starts to be mobilised in a river channel. Where bed shear stress is excessively greater than critical shear stress, channel degradation will likely result (VANR, 2004). **Table 13** provides a list of typical critical shear stress values for various river channel materials.

Table 13 Critical Shear Stress (Fischenich, 2001)

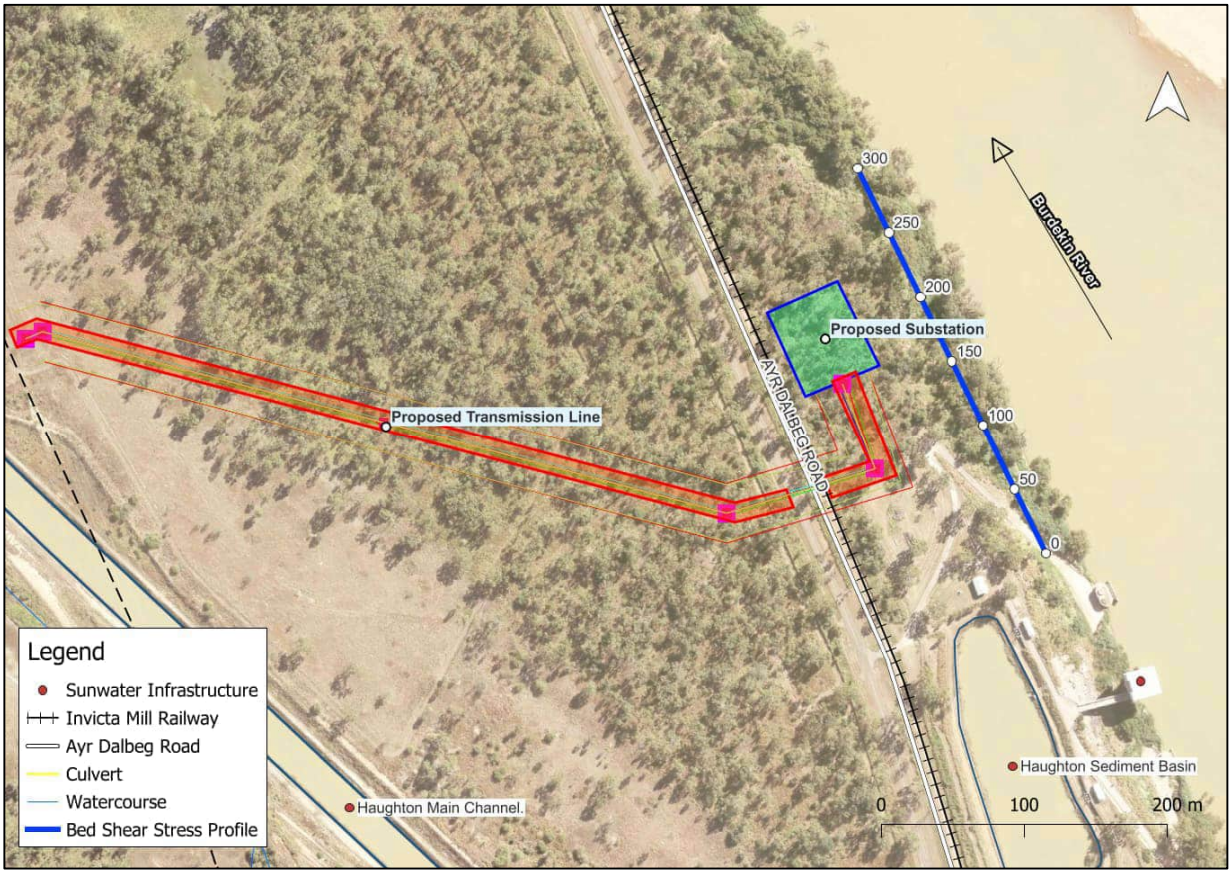
Material	Critical Bed Shear Stress (N/m^2)
Firm Loam and Sands	4
Stiff Clay, Alluvial Soils, 10mm Gravel	10
50mm Gravel	30
Short and Native Bunch Grass	40
Long Native Grass	80
150mm Cobble	100
Floodplain stripping	100
Structurally Diverse Native Vegetation	120
300mm Cobble	200

Figure 15 provides calculated bed shear stress profiles along the Burdekin River bank in proximity to the substation site from the base case hydraulic modelling. **Figure 15** shows that the river bank is subject more than 101 N/m^2 shear stress in the 1% AEP and more than 110 N/m^2 shear stress in the 0.5% AEP. Comparing the calculated shear stress values in **Figure 15** to the critical shear stress values in **Table 13**, the following is noted:

- The Burdekin riverbed material (**Table 13** - sand) will be mobilised during the 1% AEP and 0.5% AEP flood events. This mobilisation of the Burdekin riverbed is expected given its loose sandy makeup (Alexander et al, 2020).
- The Burdekin River channel bank (**Table 13** - Structurally Diverse Native Vegetation) has a low risk of scouring in both the 1% AEP and 0.5% AEP flood events.

A more detailed geomorphic study is currently outside of the scope of this Project. However, a geomorphic study should be considered during later detailed design stages to confirm whether the risk of bank erosion is to be considered for the design of the substation.

It is also noted that a geomorphic study may not be required given that the proposed adjacent TCC Clare Weir pumpstation would also have had to consider this risk of river bank scour during its design development. Therefore, a review of TCC Haughton Pipeline Stage 2 Project design documentation for the proposed Clare Weir pumpstation could be used to determine whether the risk of bank scour needs to be considered in further detail during subsequent design stages.



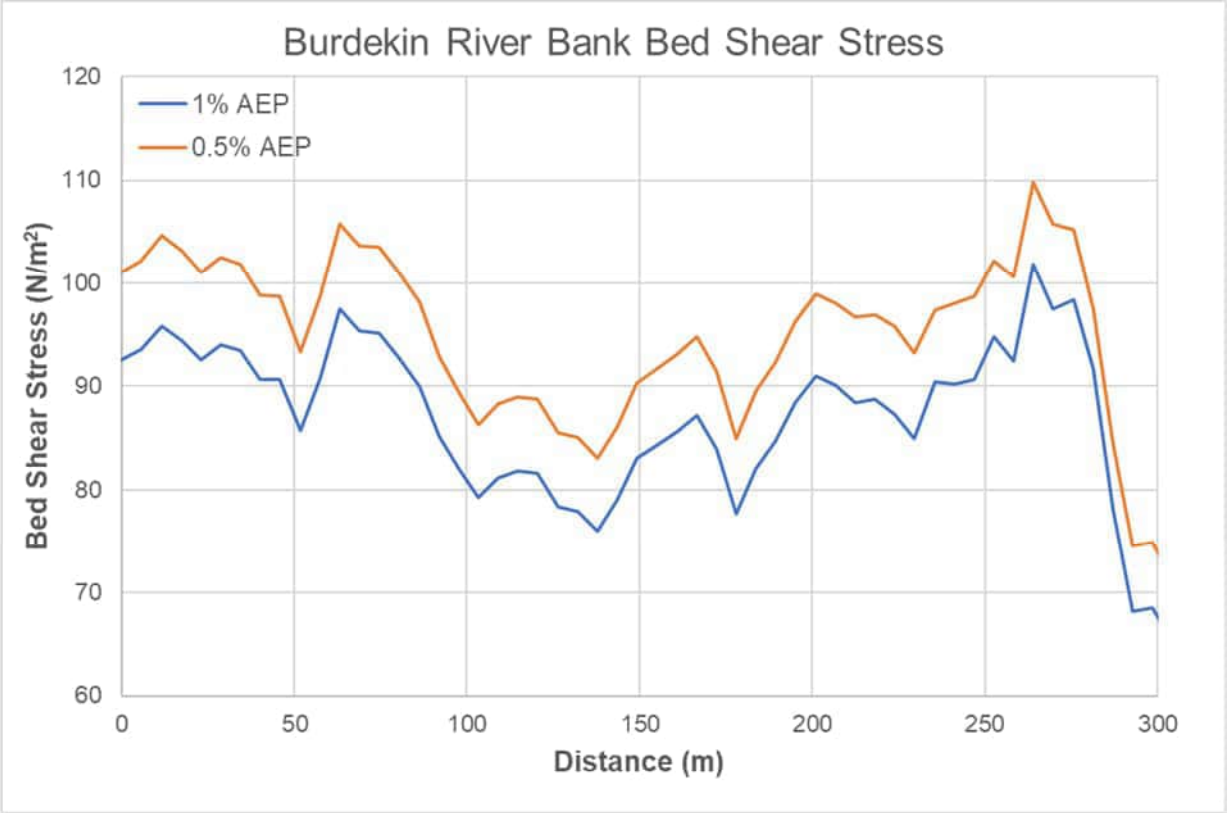


Figure 15 Bed Shear Stress along the Burdekin River Bank in Proximity to the Project Site

3.6 Flood Impacts

3.6.1 Substation

Substations are required to have at least a 0.5% AEP (1 in 200-year flood) immunity as outlined in Project design criteria – SDC001. The Specification reflects the requirements in the SPP - state interest guideline: *Natural hazards, risk and resilience 2016* (DSDILGP 2016).

The base case flood assessment in **Section 3.4** demonstrated that existing ground levels (38.5 m AHD) at the substation site is above the 0.5% AEP flood level (38.1 m AHD). The civil design includes raising the pad level by 300mm above the existing ground level to account for freeboard above the design flood level. The minimum pad level is 38.585 m AHD and as per the civil design specifications has the required flood immunity. The construction of the substation is unlikely to have an impact on existing flooding for design flood events up to an including the 0.5% AEP.

3.6.2 Transmission Line Poles

There is no flood immunity criteria presently identified for the transmission line poles. The impact of the transmission line poles on existing flooding is not within the scope of this study. However, the proposed transmission line poles are unlikely to have an impact on existing flooding conditions. This is due to their small footprint and low blockage area to relative to the floodplain flows.

4.0 Potential Impacts

4.1 Substation

4.1.1 Flooding

Existing ground levels at the proposed substation site are above the 0.5% AEP flood level required by SDC-001. As such, **Section 3.6** notes that the substation is unlikely to have an impact on existing flooding for design flood events up to an including the 0.5% AEP.

4.1.2 Surface Water Quality

Surface water quality impacts will be mostly limited to the construction phase, with minimal impacts during the operation phase. Without suitable controls or scheduled maintenance and repair of access tracks, there is the potential for additional sediment and potential pollutants associated with construction activities to be washed into drainage lines as a result of runoff.

4.1.3 Groundwater

Excavation of footings for the proposed substation poses a minor risk to ground water resources. As such, the groundwater resources are not anticipated to be impacted by the substation works.

4.1.4 Stormwater Drainage and Management

Stormwater and drainage management principles for the substation will be limited to the local catchment immediately surrounding the earth fill pads. Stormwater runoff will be generated from buildings/structures as well as hardstand areas. A stormwater drainage system will need to be incorporated into the facility. Mitigation measures used to minimise risks to the environment and safety resulting from spills are provided in **Section 5.1.2**.

4.2 Transmission Line Poles

4.2.1 Flooding

The proposed transmission line steel poles are unlikely to have an impact on existing floodplain characteristics. More details on the proposed impacts are provided in **Section 3.6.2**.

4.2.2 Surface Water

Construction activities have the potential to cause impact to riparian zones, surface water quality and flow through the clearing of access tracks, transmission line pole sites and general ground disturbance. As a result, impacts to surface water quality are primarily limited to increases in suspended sediment as a result of runoff from disturbed areas during construction.

4.2.3 Groundwater

The depth of groundwater in proximity the OHTL alignment is presently unknown using the available bore data in **Section 2.2.1**. The available bore data does indicate that the top of the aquifer in proximity of the alignment is 7-16 metres. The transmission line poles are anticipated to have a minor risk to water resources provided the excavation depth of the of footings for the OHTL poles is less than 7 meters. As such, the groundwater resources are not anticipated to be impacted by the OHTL works.

4.3 Access Tracks

An access track from Dalbeg Road will be required for the construction phase to move equipment and personnel along the proposed OHTL easement to each transmission pole construction site and to undertake vegetation clearing. During the operational phase the access tracks will be used for regular inspection and maintenance activities, including vegetation maintenance along the proposed OHTL easement. Construction of access tracks has the potential for the following impacts if unmitigated.

- Increased erosion as a result of cut and fill activities in a watercourse or drainage line.
- Increased sediment movement into downstream areas.
- Affect riparian vegetation through clearing activities.

Activities associated with access tracks are not expected to have any impacts on groundwater resources or groundwater quality.

4.4 Wetlands

There are no wetlands within the Project work extents. To ensure construction and operation activities do not impact on any wetlands in the downstream environment, erosion and sediment control measures will need to be implemented for all physical Project works.

4.5 Water Use and Sourcing

Detailed water use and souring by the Project is still currently unknown. As described in **Section 5.1.4**, it is anticipated that water would be sourced either directly from the Burdekin River channel or by agreement with Sunwater, from the nearby Burdekin Haughton Water Supply Scheme infrastructure. It is expected that the water usage requirements for the Project would be small given the scale of the proposed works.

5.0 Mitigation and Management Measures

5.1 Detailed Design

The detailed design of the Project has not yet been finalised. A number of key items should be considered during subsequent design phases. The Project should incorporate the following elements during the detailed design and pre-construction phase.

- Minimise runoff and stormwater concentration.
- Utilise existing access tracks wherever possible.
- Minimise soil disturbance when clearing vegetation along the OHTL easement.
- Implement clean water diversions around local stockpiles and exposed areas.
- Spill kits are to be kept at each work area. Ensure that all personnel are trained in the location and use of spill kits.

Further details regarding specific aspects of the Project that need to be considered during the detailed design phase are provided below.

5.1.1 Substation

The substation is required to be installed above the 0.5% AEP water level in accordance with SDC-0016. The base case flood hydraulic modelling in **Section 3.4** indicated that existing ground levels at the site have a 0.5% AEP flood immunity.

5.1.2 Stormwater Drainage and Management

A stormwater drainage system is provided in all Powerlink Queensland substations in order to capture and manage stormwater runoff. Fixed plant that contain large volumes of hydrocarbons are typically bunded. Bund design criteria should generally be in accordance with AS1940:2004 (The Storage and Handling of Flammable and Combustible Liquids) and consist of the following:

- Sized to contain at least 110% of the oil volume from the items enclosed.
- 1 m separation to be maintained with the bund and all oil containing parts.
- Floor and walls of the bund are to be impermeable to oil and water.
- Oil and water leaks are to be prevented by appropriately sealing cable and pipe entries to the bunded area.

5.1.3 Groundwater

Management measures for groundwater impacts will only be required if water is sourced from bores for construction. This will be determined during subsequent design phases and should include consultation with landholders if necessary.

5.1.4 Water Use and Sourcing

Detailed water use and souring by the Project is still currently unknown. The volumes of water required for the Project will be determined at the detailed design phase. As part of detailed design, consultation with landholders on land access should also include discussions with Burdekin Shire Council for access to water if required. It is likely that water would be either directly sourced from the Burdekin River channel or a water storage associated with the Burdekin Haughton Water Supply Scheme.

If water is to be sourced directly from a watercourse, Powerlink Queensland will extract water in accordance with the '*Exemption requirements for constructing activities for the take of water without a water entitlement* (OSW/2020/5467 Version 4.01, updated on 5 May 2021)' or any later revision. If Powerlink Queensland cannot meet the exemption requirements of the above document, a water licence application will be submitted with DNRME.

5.2 Construction Activities

5.2.1 Erosion and Sediment Control

All construction activities have the potential to cause erosion and sedimentation through clearing and disturbance of soil. Powerlink Queensland's standard environmental controls relating to soil erosion and sediment control will minimise impacts on the receiving environment. These Standard Controls should be implemented throughout the entire Project. In summary the controls include the following.

- Identify environmental values and water quality objectives of the receiving waters. Utilise regional water quality objectives where available (refer to **Section 2.1**).
- Manage disturbance in accordance with the IECA Best Practice Guidelines by developing and then implementing an ESCP for the substation and transmission line pole sites, prior to ground disturbance.
- Minimise ground disturbance and retain ground cover to reduce the surface area potentially subject to erosion.
- Undertake progressive rehabilitation of disturbed areas as soon as practicable to establish ground cover.
- Employing measures from Powerlink Queensland's "Transmission Line Access Tracks Guideline" (ASM–GDL–A576805).
- Undertake visual assessments for the effectiveness of erosion and sediment control structure. This should be 24 hours proceeding of expected significant rainfall events and weekly inspections when no significant rainfall is expected. Records of this monitoring are to be kept, maintained and made available for inspection.

The above controls should be applied to all site disturbances during the construction and operation phases.

5.2.2 Surface Water Quality

Construction works have the highest probability of having an impact to surface water quality through the mobilisation of additional sediment as a result of ground disturbance activities. Principles of runoff management will include the following.

- Manage ground disturbance in accordance with the IECA Best Practice Guidelines (refer Section **5.2.1**).
- All hazardous and flammable materials are to be stored in accordance with AS1940:2004.

5.3 Operational Phase

Risks to water resources will decrease during the operational phase of the Project. This phase requires less ground disturbance and areas that have been disturbed during the construction phase have been rehabilitated. Measures to be implemented in the operational phase of the Project to protect water resources include the following.

- Ongoing implementation of erosion and sediment controls for areas where required.
- Spills are to be cleaned up immediately.

6.0 Conclusions and Recommendations

AECOM was engaged by Powerlink to undertake a desktop assessment of water resources (groundwater and surface water) MID that could be impacted by the proposed substation and OHTL. The assessment focused on identify the potential risks to existing water resources and provide mitigation measures and associated legislative requirements for managing the identified risks.

The following conclusions were reached in the Report:

- Groundwater is unlikely to be impacted by the proposed substation and OHTL during construction and operation.
- Surface water is unlikely to be impacted by the proposed substation and OHTL during construction and operation as
    - There are no natural wetlands within and immediately downstream of the Project site.
    - The proposed substation is located above the current 1% AEP (100 Year) and 0.5% AEP (200 Year) flood levels required by SDC-001.
    - The Burdekin Haughton Water Supply Scheme infrastructure owned by Sunwater will not be impacted by the project works.
    - There are no listed active water license holders (granted under the *Water Act 2000*) on the properties where the Project site is located on that will be impacted.
    - The Projects works will include measures to manage potentially contaminated stormwater from the site which will prevent damage to downstream EVs.

The following conclusions have been noted in this Report:

- An ESCP should be developed and then implemented to ensure that potentially affected surface water from construction activities does not enter downstream surface water and ground water environments.
- A review of TCC Haughton Pipeline Stage 2 Project detailed design documentation for the proposed Clare Weir pumpstation should be considered if available for this Project. The review may provide more certainty on the assumptions in this Report.

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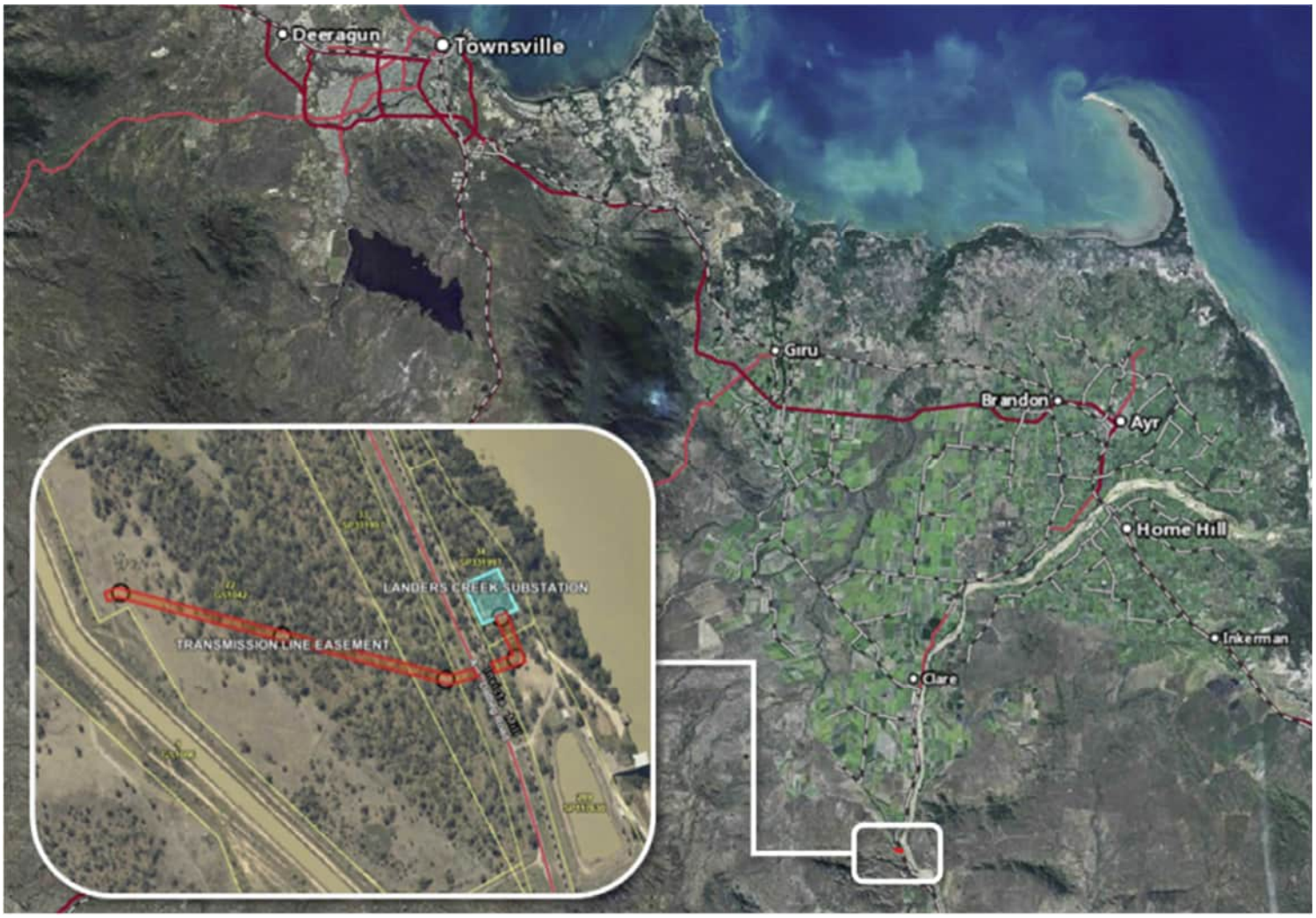
Appendix E

Traffic Impact Assessment

ACCESS TRAFFIC
CONSULTING



Landers Creek Substation & Overhead Transmission Line

Traffic Impact Assessment

February 2024

Prepared for AECOM Pty Ltd

Quality Information

Document	Traffic Impact Assessment
Client	AECOM Pty Ltd
Reference	AEC0123-002
Date	22 February 2024
Prepared By	Andrew Barrie

Revision History

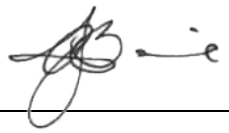
Rev	Revision Date	Details	Authorised	
			Name / Position	Signature
0	30/01/2024	Draft for Client Comment	Andrew Barrie Principal Traffic Engineer	Original Signed
A	22/02/2024	Final	Andrew Barrie Principal Traffic Engineer RPEQ 12801	

Table of Contents

1.0 Introduction and Summary

1.1 Project Overview

Townsville City Council (TCC) have submitted a connection application to Powerlink for the establishment of a 10-15 MW water pump load connection to the approved Burdekin River Pump Station (BRPS), which is associated with the Haughton Pipeline Stage 2 Project. The Haughton Pipeline Stage 2 Project will connect and extend the existing Stage 1 raw water pipeline (completed in 2020), from the Haughton River to the Burdekin River near Clare.

This Project (Landers Creek Substation) seeks to provide the required power supply to service the approved Burdekin River Pump Station, with the proposed works comprising the following components:

- A new 132kV Substation (adjoining the approved BRPS).
- A new Overhead Transmission Line (OHTL) to establish a 132kV single circuit tee off existing overhead infrastructure to the new Landers Creek Substation. The OHTL will be located within a proposed new easement within Lot 289 on SP117630, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 22 on GS1042.

1.2 Project Context

Access Traffic Consulting (ATC) was therefore commissioned by AECOM Pty Ltd on behalf of Powerlink to undertake a Traffic Impact Assessment (TIA) for the construction and operations phases of the proposed Landers Creek Substation and associated overhead transmission line (the Project).

The Project site is located within the Burdekin Shire Council local government area, approximately 85km to the south-east of the regional centre of Townsville and 44km to the south-west of the township of Ayr. Vehicular access to the subject site is proposed to be gained via access points from the adjacent state-controlled link of Ayr-Dalbeg Road.

In addition, Project traffic is also expected to other elements of the state-controlled road network as part of the expected transport routes for the works, including Townsville Port Road, sections of the Bruce Highway and the key intersection of the Bruce Highway / Ayr-Dalbeg Road.

The Traffic Impact Assessment (TIA) was carried out to determine the level of potential impacts of both the construction and operations phases of the Project on the operation of the surrounding local government and state-controlled road networks. As such the proposal has been assessed considering the relevant State government guidelines and Council controls, including the Department of Transport and Main Roads' Guide to Traffic Impact Assessment (GTIA – 2018) and the Burdekin Shire Planning Scheme (2022), with the outcomes of the TIA to be provided in support of the subsequent development application.

The assessment methodology adopted for this TIA is summarised in the key tasks listed below.

- Broadly identify the existing transport infrastructure which is of relevance to the Project.
- Estimate traffic generation associated with the construction and operations phases of the Project and the distribution of this Project traffic on the identified road network, including the movement of materials, plant and equipment in addition to the construction and operational phase workforces.
- Assess the potential impact of the estimated Project traffic on the operation of the surrounding transport network during both the construction and operational phases of the Project.
- Establish potential mitigation and management strategies to be implemented during the construction and operational phases of the Project to offset any identified impacts (if required).

As outlined above, the adopted methodology centres on establishing a background or "pre development" traffic scenario for the identified transport routes and comparing this with a scenario including the Project-generated traffic, i.e. the "with development" scenario.

This process allows for the assessment of the traffic impacts of the Project in terms of road safety, access requirements, intersection operations, road link capacity, pavement and other transport infrastructure. Following this, if required, potential mitigation and/or management measures would be formulated to address the potential traffic impacts caused by the proposed Project.

1.2.1 Scope and Study Area and Scope

As noted above, is located within the Burdekin Shire Council local government area, approximately 85km to the south-east of the regional centre of Townsville and 44km to the south-west of the township of Ayr.. This assessment relates to the construction and operation of both the substation area and overhead transmission line elements of the proposed Project, located on the eastern and western sides of the state-controlled Ayr-Dalbeg Road respectively, as shown in **Figure 1**.

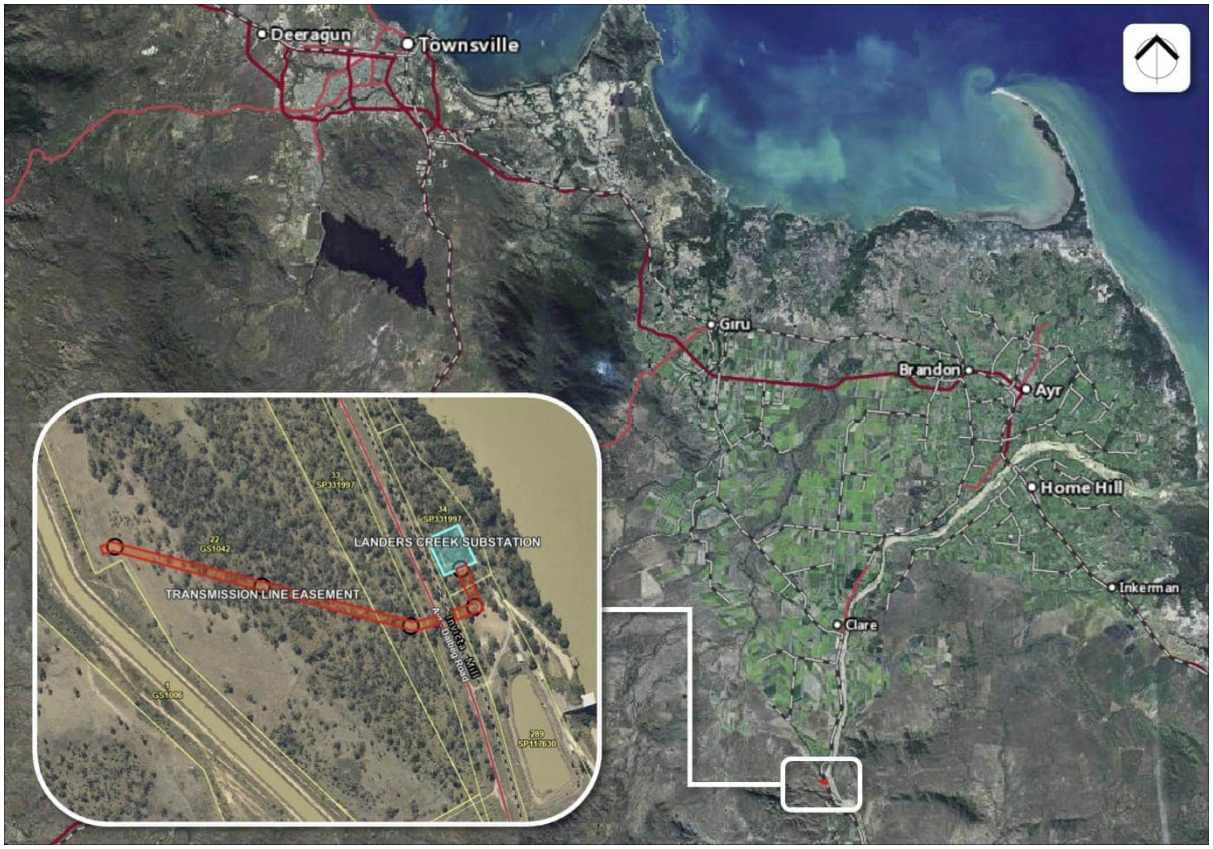


Figure 1 Study Area – Landers Creek Substation & OHTL **[Source: Qld Globe]**

2.0 Existing Conditions

2.1 Land Use and Zoning

The subject site of the proposed Landers Creek Substation and Overhead Transmission Line project is currently zoned as "Rural" land under the Burdekin Shire Planning Scheme, as shown in **Figure 2.**

Figure 2 Land Use Zoning **[Source: BSC Planning Scheme]**

2.2 Adjacent Land Use / Approvals

As shown in **Figure 2** above, the surrounding land to the subject site is also currently zoned "Rural" under the Burdekin Shire Planning Scheme.

Further to this, information was also provided regarding the expected timeframes and traffic volumes on the surrounding road network associated with the main construction works for Stage 2 of the Haughton Pipeline Project as outline in the Traffic Impact Assessment for these works prepared by GHD (are expected to be completed prior to the construction phase of this Project.

Based on this information it was identified that the works for the Stage 2 Haughton Pipeline Project and those for the proposed Project would not occur concurrently, with the pipeline works anticipated to be completed prior to the commencement of construction for the Landers Creek Substation and Overhead Transmission Line Project.

2.3 Surrounding Road Network Details

2.3.1 Project Transport Routes

This section describes the road transport network expected to be utilised by the Project, which were established from the following information regarding the expected construction and operations activities associated with the Project provided by Powerlink.

- Gravel and pavement materials will be imported to site from local quarries, in particular the BQC Quarry on Ayr-Dalbeg Road to the north-east of the Project site and transported to the site via Truck & 3 Axle Dog configurations (assumed) via Ayr-Dalbeg Road.
- General construction materials, equipment, componentry, and plant for the proposed facility will be delivered to site via road transport from either Townsville or Ayr, utilising sections of Townsville Port Road and the Bruce Highway.

- Electrical infrastructure and components for the substation are proposed to be delivered to Project site via the Port of Townsville, noting that the larger site transformer and switchroom elements are anticipated to be delivered under permit.
- Construction staff for the Project are expected to commute daily between Townsville and the site, using a combination of private vehicles and work trucks.
- Similarly, staff for the periodic (3 monthly) routine service maintenance completed as part of the operations phase of the Project are also expected to also travel between Townsville and the subject site, again utilising a combination of private vehicles and work trucks.
- Finally, the heavy vehicle movements during the Project's operations phase are expected to be limited to material and/or component deliveries associated with the periodic routine service maintenance activities, which are all expected to travel between Townsville and the Project site.

Based on this information, the Project is anticipated to utilise the following transport routes, as shown diagrammatically in **Figure 3**:

State (TMR) Controlled Roads

- Townsville Port Road (841) - Ch. 0.000 km to Ch. 7.811 km.
- Bruce Highway (10M Townsville – Ingham) - Ch. 0.000 km to Ch. 8.635 km.
- Bruce Highway (10L Ayr – Townsville) - Ch. 0.000 km to Ch. 77.913 km.
- Bruce Highway (10K Bowen – Ayr) - Ch. 105.415 to Ch. 112.120 km.
- Ayr-Dalbeg Road (545) - Ch. 0.000 km to Ch. 42.285 km.

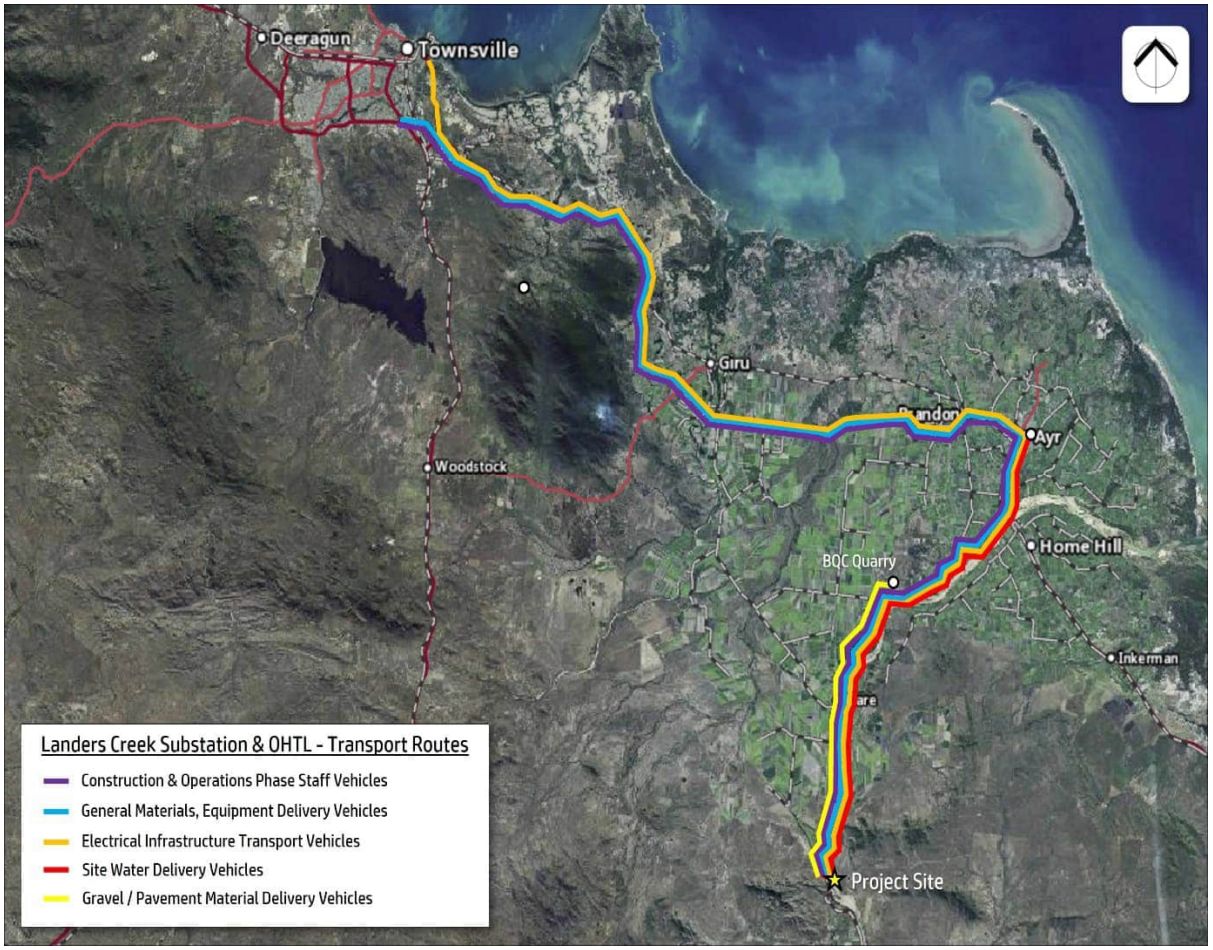


Figure 3 Project Transport Routes **[Source: QLD Globe]**

2.3.2 Road Links

Reference has been made to the existing road hierarchy identified in Council's Planning Scheme, with all relevant sections of the external road network expected to be utilised by Project traffic classified as state-controlled roads, as shown in **Figure 4** below, with further details of the relevant road links provided in the following sections.

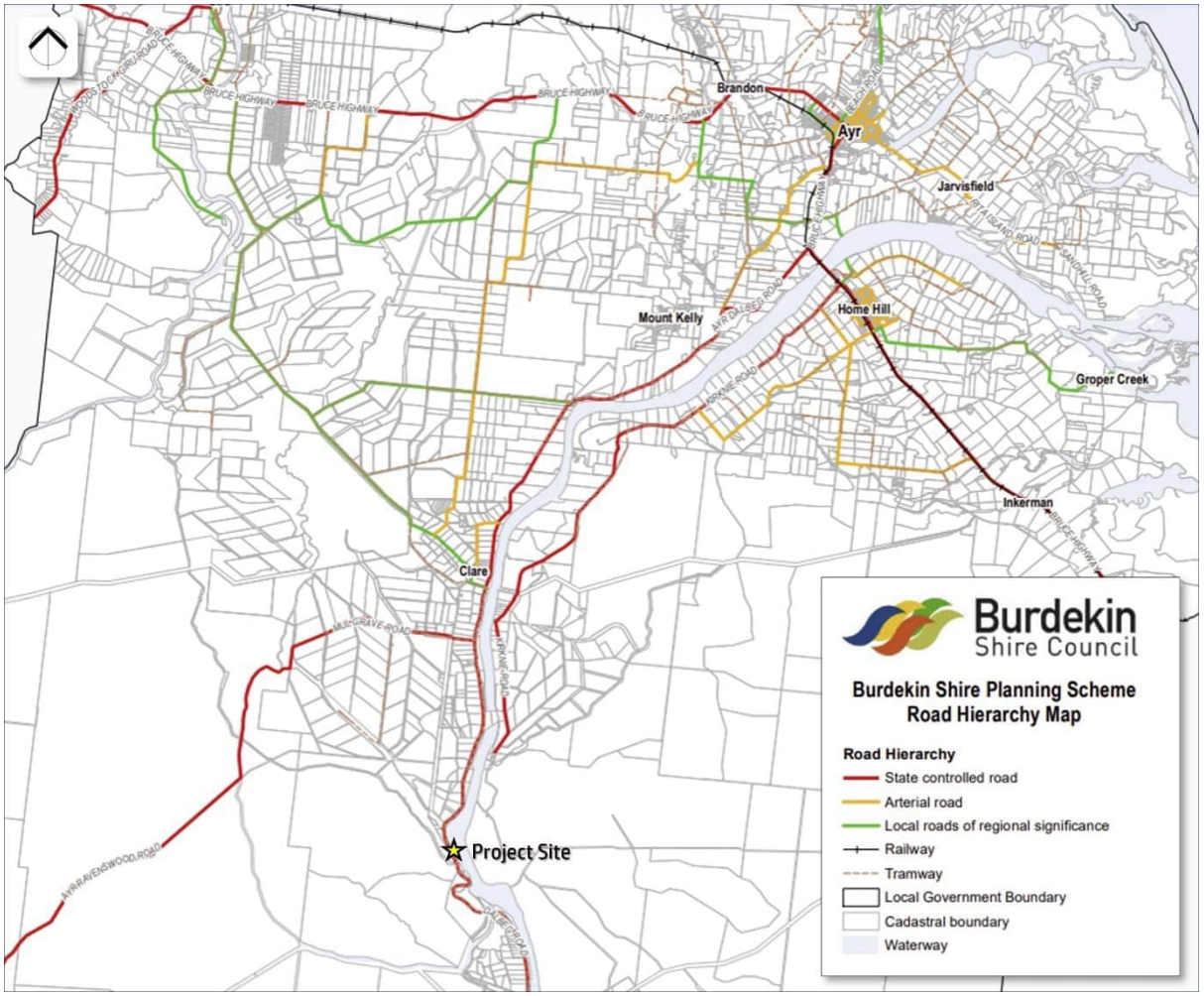


Figure 4 BSC Road Hierarchy Mapping **[Source: BSC Planning Scheme]**

2.3.2.1 Bruce Highway

The section of the Bruce Highway anticipated to be relevant to the Project is the length between the intersection with Douglas-Garbett Road (840 University Road / Nathan Street – approx. TMR chainage 10M 8.635km) in Townsville to the intersection with Ayr-Dalbeg Road to the south of Ayr (TMR chainage 10K 105.415km). This section of the highway is proposed to be utilised by both construction and operations staff travelling between the site and Townsville, as well as by general material, equipment and component delivery vehicles from Townsville.

The full length of the identified section of the Bruce Highway is noted to be an approved B-Double route, with the link providing a variety of urban and rural road cross sections. As such the posted speed limits on the link range from 60km/h in urban areas (Ayr etc) to a higher speed limit (100 km/h) on the rural highway sections between centres.

2.3.2.2 Townsville Port Road

The full 7.811km length of the Townsville Port Road between the port facilities and the Bruce Highway is considered relevant to the Project, with this link proposed to be utilised as part of the transport route for the larger electrical components (transformer / swithchroom etc), which are assumed to originate from the Port of Townsville.

Townsville Port Road is an approved B-Double route, with temporal access (8pm to 5am) also available to Type 1 Road Trains. Typically the link is configured as a two-way, two-lane, undivided carriageway (refer Figure 5) with a varying posted speed limit between 60km/h (northern section) to 100 km/h (southern section.

Figure 5 Townsville Port Road

2.3.2.3 Ayr-Dalbeg Road

As shown in **Figure 4**, Ayr-Dalbeg Road is a state-controlled road that as its name reflects provides a north-south connection between the Bruce Highway south of Ayr to the locality of Dalbeg in the south. The section of this link expected to be relevant to the Project is the 42.285km length between the Bruce Highway (south of Ayr) and the proposed Project site access points, with this length of road to be utilised by all traffic associated with both the construction and operations phase of the Project.

Currently the link operates as a sealed two-way, two-lane rural road with an undivided cross-section (refer **Figure 6** and **Figure 7**), with a posted speed limit of 100km/hr.

Figure 6 Ayr-Dalbeg Road (Looking North)

Figure 7 Ayr-Dalbeg Road (Looking South)

2.3.3 Intersections

In addition to the road links discussed above, the state controlled intersection of the Bruce Highway / Ayr-Dalbeg Road, located to the north-east of the Project site has been identified as relevant to the assessment as it will act as the main access point for Project traffic from Townsville and Ayr via the Bruce Highway to the Project site via Ayr-Dalbeg Road. Further details of this intersection are provided below.

2.3.3.1 Bruce Highway / Ayr-Dalbeg Road

The Bruce Highway/Ayr Dalbeg Rd intersection is currently a lit, unsignalised three-way "T" intersection with the state controlled Bruce Highway functioning as the major road and the wester Ayr-Dalbeg Road leg forming the minor side road approach.

The intersection is located within an 80 km/h posted speed zone and generally provides one through lane in each direction on all approaches. There is also an auxiliary left turn lane (AUL) and a channelised right turn lane (CHR) provided on the northbound and southbound Bruce Highway approaches respectively.

The right and left turn vehicle movements out of Ayr-Dalbeg Rd are give-way controlled, with a channelised left turn slip lane provided for vehicles exiting to the north, noting that this lane exits into the start of the northbound overtaking lane on the Bruce Highway. The current configuration of the intersection is shown further in **Figure 8** below.

Figure 8 Bruce Highway / Ayr-Dalbeg Road Intersection – Existing Configuration [Source: Qld Globe]

2.4 Existing Traffic Volumes

2.4.1 Road Link Volumes

The background traffic volumes for the relevant sections of the surrounding road network for the Project were established using the available 2022 AADT segment traffic count data from TMR via the Queensland Open Data Portal.

Using the available traffic volumes (2022) and identified 10-year growth rates (average growth rate, compounding annually) for the relevant road sections forecasts of the current (2020) traffic volumes on the road network were established. It is noted that for any segments where a historical 10-year growth rate was negative, a conservative growth rate of 1.0% was applied to enable estimates of the future traffic volumes to be made.

Based on the above, the forecast background traffic volumes for each of the relevant road segments for the current (2024) road conditions were established, with a summary provided in **Table 1**.

Table 1 Existing (2024) AADT Traffic Volumes

Site ID	Road Segment		Base Data Year	Base Year AADT				10 Yr. GR %	Background AADT (2020)			
	Start (km)	End (km)		Gaz	% HV	A-Gaz	% HV		Gaz		A-Gaz	
									Total	HV	Total	HV
Townsville Port Road (841)												
92206	0.000	7.336	2022	1,408	29.17%	1,278	30.83%	*1.00%*	1,436	419	1,304	402
92236	7.336	7.811	2022	2,007	22.36%	1,812	28.92%	*1.00%*	2,047	458	1,848	535
Bruce Highway (10M Townsville – Ingham)												
92177	0.000	2.544	2022	6,807	17.37%	6,771	9.12%	1.12%	6,960	1,209	6,924	631
92204	2.544	3.853	2022	6,877	15.94%	7,147	20.48%	*1.00%*	7,015	1,118	7,291	1,493
92178	3.853	8.635	2022	17,280	2.93%	18,584	16.79%	3.17%	18,393	539	19,781	3,321
Bruce Highway (10L Ayr - Townsville)												
91398	0.000	2.150	2022	2,448	14.44%	2,720	13.09%	*1.00%*	2,497	361	2,775	363
91399	2.150	6.439	2022	3,442	13.35%	3,400	27.87%	*1.00%*	3,511	469	3,468	967
91699	6.439	64.166	2022	2,928	19.93%	2,813	19.01%	1.37%	3,009	600	2,891	550
92216	64.166	66.821	2022	4,163	23.05%	4,057	22.12%	1.86%	4,319	996	4,209	931
92201	66.821	77.913	2022	7,502	14.93%	7,588	13.73%	3.68%	8,064	1,204	8,157	1,120
Bruce Highway (10K Bowen - Ayr)												
90004	**105.415**	108.960	2022	4,447	13.47%	4,482	12.69%	*1.00%*	4,536	611	4,572	580
91443	108.960	110.550	2022	5,230	19.33%	5,198	11.46%	*1.00%*	5,335	1,031	5,302	608
91396	110.550	112.120	2022	3,020	7.06%	2,482	3.10%	*1.00%*	3,081	217	2,532	78
Ayr-Dalbeg Road (545)												
91502	0.000	**14.620**	2022	442	18.20%	438	33.60%	*1.00%*	451	82	447	150
90018	**14.620**	36.452	2022	218	19.24%	218	23.99%	*1.00%*	222	43	222	53
91478	36.452	**42.235**	2022	74	5.90%	76	12.78%	*1.00%*	75	4	78	10
	42.235	**42.285**	2022	74	5.90%	76	12.78%	*1.00%*	75	4	78	10

TMR Chainage 105.415km 10K – Intersection Bruce Highway / Ayr-Dalbeg Road | TMR Chainage 14.620km 454 – Ayr-Dalbeg Road / BQC Quarry Access | TMR Chainage 42.235km 454 – Ayr-Dalbeg Road / Project Access 1 (Landers Creek Substation) | TMR Chainage 42.285km 454 – Ayr-Dalbeg Road / Project Access 2 (OHTL Easement)

2.4.2 Intersection Volumes

Peak period traffic counts were undertaken at the Bruce Highway / Ayr-Dalbeg Road intersection by Matrix Traffic and Transport Data on Wednesday 2 June 2021 as part of the previous TIA for the Haughton Pipeline Stage 2 project. A copy of the raw data for this count is provided for reference in **Appendix A**, with the recorded data indicating that the traffic peak hours at the intersection occurred from 8am – 8am and between 3pm – 4pm.

The relevant growth rates for each approach to the intersection (as identified in **Table 1**) were then applied to the recorded 2021 volumes to establish forecast AM and PM peak hour volumes for current 2024 traffic conditions, with further details of these calculations and the resultant volumes included for reference in **Appendix B.**

2.5 Site Access

There are currently no existing access points into the proposed Project site area from Ayr-Dalbeg Road.

2.6 Intersection and Network Performance

2.6.1 Road Links

Based on the forecast daily traffic volumes for current (2024) traffic conditions detailed in **Table 1** above, it can be seen that all sections of the road links identified as relevant for the Project can be seen to be currently operating satisfactorily and well within capacity. This is shown by all bi-directional daily volumes within the corresponding capacity range for either a 4-lane urban arterial road (approx. 60,000vpd – Bruce Highway 10L/10M), rural arterial road / highway (approx. 15,000 vpd – Bruce Highway 10L/10K & Townsville Port Road), urban arterial roads (approx. 20,000 vpd – Bruce Highway 10L) and rural local collector road (3,000 vpd – Ayr-Dalbeg Road) respectively.

2.6.2 Intersections

The forecast (2024) traffic volumes at the Bruce Highway / Ayr-Dalbeg Road intersection identified in **Appendix B** were utilised to undertake preliminary intersection analysis (using SIDRA software) to establish the operational performance of the intersection under current traffic conditions. A summary of the results of this analysis is provided in **Table 2**, with further detailed SIDRA results included for reference in **Appendix C**

Table 2 2024 (Existing) SIDRA Results – Bruce Highway / Ayr-Dalbeg Road intersection (Existing Configuration)

Analysis Scenario	Intersection Degree of Saturation	Intersection Level of Service**	Intersection Average Delay (sec)	Maximum 95% Back of Queue Length (m)
Bruce Highway / Ayr-Dalbeg Road				
2024 AM Peak	0.387	LOS C	3.0	12.0
2024 PM Peak	0.285	LOS B	2.5	8.3

** Intersection LOS not available for priority-controlled intersections, as such value of LOS provided is for critical movement at intersection

The results above indicate that the existing configuration of the Bruce Highway / Ayr-Dalbeg Road intersection operates adequately under the forecast 2024 traffic conditions, with all values for DOS, average delay and vehicle queueing being within acceptable limits of operation for a priority-controlled intersection.

2.7 Road Safety

2.7.1 Road Crash History Review

A review of the road crash history on the relevant sections of the Bruce Highway (500m either side of the Ayr-Dalbeg Road intersection) and Ayr-Dalbeg Road was undertaken using the road crash data available from the Queensland Globe database (2001-2020), noting that only the latest 5 years of data (2016-2020) has been assessed.

The results of this assessment identified 1 recorded crash within thus period at the key Bruce Highway / Ayr-Dalbeg Road intersection and a further 2 crashes on the relevant section of Ayr-Dalbeg Road between the Bruce Highway and the Project site. A summary of the details of the recorded crash data is provided for reference in **Table 3**.

Table 3 Summary of Road Crash History (2016-2020)

Crash Reference Number	Crash Year	Crash Severity	Crash Type	DCA Code	Crash Description
Bruce Highway (500m in either direction of Ayr-Dalbeg Road intersection)					
269959	2016	Hospitalisation	Multi-Vehicle	104	Vehicles Adjacent Approach: Thru-Right
Ayr-Dalbeg Road					
349879	2020	Hospitalisation	Single Vehicle	804	Off Path on Curve: Off Carriageway LT Bend Hit Object
328880	2018	Fatal	Single Vehicle	704	Off Path Straight: Right Off Carriageway Hit Object

The data above identifies that there has only been a limited number of crashes recorded on the relevant section of the network over the last 5 years of data. The detailed information also highlights that the crashes recorded on the Ayr-Dalbeg Road are single vehicle crashes typical on higher speed rural links. Based on the low number of crashes recorded it can be concluded that there is not any specific, existing road feature or design deficiency that is likely to be contributing to crashes along the Project route that requires mitigation works prior to the expected increase in traffic as a result of the proposed Project.

2.8 Pavement Loadings

Estimates were generated for the forecast background or pre-development pavement loadings on each of the identified road segments over the proposed construction period, which has been identified as the period of peak traffic loading for the Project.

Traffic loads on the pavement are defined in terms of Equivalent Standard Axle (ESA) for granular pavements and Standard Axle Repetitions (SAR) for other pavement types. The ESA for the background traffic heavy vehicle component on the network was calculated based on the identified heavy vehicle percentages for the relevant road sections, with the following assumptions applied to this calculation.

- The existing percentage of heavy vehicles will be maintained for future years.
- The impact of light vehicles can be ignored as the contribution to pavement loading (ESAs) is negligible in comparison to heavy vehicles.
- Equivalent Standard Axles per Heavy Vehicle (ESAs/HV) were adopted as follows (based on advice previously received from TMR for similar pavement impact assessments):
  - 2.9 ESAs/HV for the Bruce Highway.
  - 3.2 ESAs/HV for all other state-controlled roads (including Townsville Port Road and Ayr-Dalbeg Road).
- The background period of the assessment is the proposed duration of construction i.e. 9 months which equates to approximately 274 days.

A summary of the forecast background ESAs for each of the relevant road segments for the proposed construction phase for the Project (October 2024 to June 2025) is provided in **Table 3**.

2.9 Transport Infrastructure

2.9.1 Rail Level Crossings

Project traffic is also anticipated to utilise four existing level rail crossings on the critical Ayr-Dalbeg Road section of the external road network, including:

- Crossing of the North Coast Rail Line across Ayr-Dalbeg Road located approximately 200m to the west of the Bruce Highway / Ayr-Dalbeg Road intersection.

- 2 crossings of Pioneer Mill Cane Rail Line across Ayr-Dalbeg Road located approximately 6.07km and 13.66km to the south-west of the Bruce Highway.
- Crossing of Invicta Mill Cane Rail Line across Ayr-Dalbeg Road located approximately 26.79km to the south-west of the Bruce Highway.

Good sightlines are generally available to the crossings from both directions on the Ayr-Dalbeg Road approaches, with the crossing of the North Coast Line including vehicle controls of approach signage, flashing/warning signals and boom gates on both approaches (see **Figure 9**), with the lower volume (both road and rail movements) cane rail crossings utilising signage and flashing light control measures (see **Figure 10** and **Figure 11**).

Figure 9 North Coast Line Rail Crossing of Ayr-Dalbeg Road [Source: Google Street View]

Figure 10 Pioneer Mill Line Cane Rail Crossing of Ayr-Dalbeg Road – Ch. 6.07km [Source: Google Street View]

Figure 11 Pioneer Mill Line Cane Rail Crossing of Ayr-Dalbeg Road – Ch. 13.66km [Source: Google Street View]

Table 3 Forecast Future Background ESAs – Project Construction Phase

Segment ID	AADT Segment		Base Data Year	Base Year HV %		Base Year HV Volume		10 Yr. GR %	2025 HV Volumes		ESAs / HV	No. Days	Background ESAs	
	Start (km)	End (km)		Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz			Gaz	A-Gaz
Townsville Port Road (841)														
92206	0.000	7.336	2022	29.17%	30.83%	411	394	*1.00%*	423	406	3.2	274	371,025	355,934
92236	7.336	7.811	2022	22.36%	28.92%	449	524	*1.00%*	462	540	3.2	274	405,400	473,392
Bruce Highway (10M Townsville – Ingham)														
92177	0.000	2.544	2022	17.37%	9.12%	1,182	618	1.12%	1,223	638	2.9	274	971,439	507,350
92204	2.544	3.853	2022	15.94%	20.48%	1,096	1,464	*1.00%*	1,129	1,508	2.9	274	897,429	1,198,302
92178	3.853	8.635	2022	2.93%	16.79%	506	3,120	3.17%	556	3,426	2.9	274	441,794	2,722,693
Bruce Highway (10L Ayr – Townsville)														
91398	0.000	2.150	2022	14.44%	13.09%	353	356	*1.00%*	364	367	2.9	274	289,395	291,488
91399	2.150	6.439	2022	13.35%	27.87%	460	948	*1.00%*	473	976	2.9	274	376,188	775,762
91699	6.439	64.166	2022	19.93%	19.01%	584	535	1.37%	608	557	2.9	274	483,009	442,618
92216	64.166	66.821	2022	23.05%	22.12%	960	897	1.86%	1,014	948	2.9	274	805,818	753,615
92201	66.821	77.913	2022	14.93%	13.73%	1,120	1,042	3.68%	1,248	1,161	2.9	274	991,906	922,638
Bruce Highway (10K Bowen – Ayr)														
90004	**105.415**	108.960	2022	13.47%	12.69%	599	569	*1.00%*	617	586	2.9	274	490,397	465,636
91443	108.960	110.550	2022	19.33%	11.46%	1,011	596	*1.00%*	1,042	614	2.9	274	827,649	487,678
91396	110.550	112.120	2022	7.06%	3.10%	213	77	*1.00%*	220	79	2.9	274	174,552	62,991
Ayr-Dalbeg Road (545)														
91502	0.000	**14.620**	2022	18.20%	33.60%	80	147	*1.00%*	83	152	3.2	274	72,671	132,947
90018	**14.620**	36.452	2022	19.24%	23.99%	42	52	*1.00%*	43	54	3.2	274	37,890	47,245
91478	36.452	**42.235**	2022	5.90%	12.78%	4	10	*1.00%*	4	10	3.2	274	3,944	8,774
	42.235	**42.285**	2022	5.90%	12.78%	4	10	*1.00%*	4	10	3.2	274	3,944	8,774

TMR Chainage 105.415km 10K – Intersection Bruce Highway / Ayr-Dalbeg Road | TMR Chainage 14.620km 454 – Ayr-Dalbeg Road / BQC Quarry Access | TMR Chainage 42.235km 454 – Ayr-Dalbeg Road / Project Access 1 (Landers Creek Substation) | TMR Chainage 42.285km 454 – Ayr-Dalbeg Road / Project Access 2 (OHTL Easement)

3.0 Proposed Development Details

3.1 Development Site Plan

The proposed layout of the Landers Creek Substation and Overhead Transmission Line is shown in Drawing HPHC-001 Rev D included for reference in **Appendix D**. This plan as shown in **Figure 12** below outlines the proposed location of both the substation and transmission line alignment and the associated access points from Ayr-Dalbeg Road, while **Figure 13** provides further details of the internal substation layout including the proposed access configuration, internal access roads and vehicle circulation arrangements.

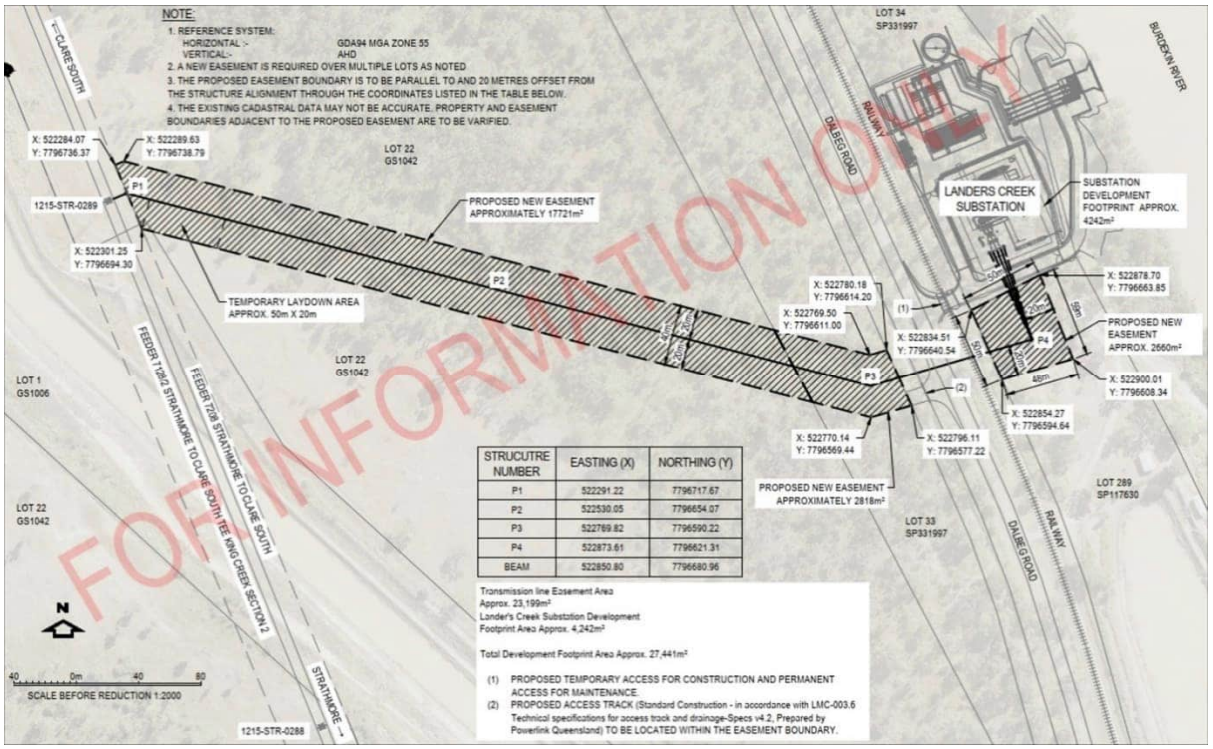


Figure 12 Site Location, Layout and Access Arrangements – Landers Creek Substation & OHTL **[Source: Powerlink]**

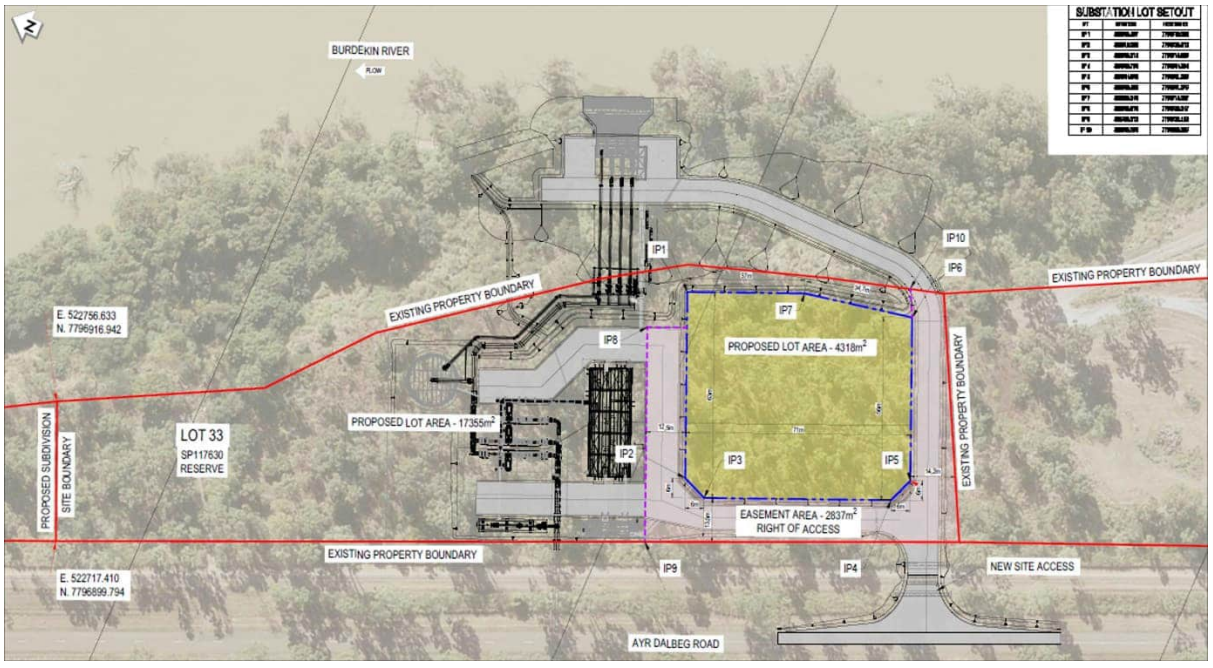


Figure 13 Substation Layout – Landers Creek Substation & OHTL **[Source: Powerlink]**

3.2 Construction Phase Details

Based on information provided by Powerlink it is understood that the construction of the proposed Landers Creek Substation and associated overhead transmission line is anticipated to commence in October 2024 (pending approvals) and be completed in June 2025, with an expected construction timeframe of 8 months. Further to this, it is understood that the proposed construction works will generally be undertaken approximately 12 hours per day (6:30am to 6:30pm), 6 day per week (Monday to Saturday), noting that contractors may adopt working rosters to manage efficiency and fatigue.

The proposed construction works are anticipated to include periods for site mobilisation, civil works (site areas / site entrances and access roads), electrical infrastructure works (substation and OHTL) and finalisation, commissioning and site demobilisation, as outlined in the indicative construction schedule provided in **Figure 14**.

TASK ID	TASK	DURATION	MONTH								
			Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25
			Q4 2024			Q1 2025			Q2 2025		
			1	2	3	4	5	6	7	8	9
A	Mobilisation & Site Establishment	1 M									
B	Site Entrances & Access Roads	2 M									
C	Site Areas (Civil)	3 M									
D	Cabling	2 M									
E	Site Areas (Electrical)	4 M									
F	Finalisation / Commissioning / Demobilisation	2 M									

Figure 14 Landers Creek Substation & OHTL – Indicative Construction Schedule

3.3 Proposed Access and Parking

3.3.1 Site Access

As identified in **Figure 12** above, it is proposed that access to the proposed Project site will be gained via two new site access points from Ayr-Dalbeg Road. The northern access is proposed to be located on the eastern side of the road, at TMR Chainage 42.235km, and is understood to be the permanent site access for the substation area and be utilised by both light and heavy vehicle movements.

This access has previously been identified as the proposed site access location for the pump station infrastructure (to be located adjacent to the substation) as part of the Haughton Pipeline Project Stage 2 works, and is noted to include the provision of a new level crossing of the Invicta Mill Cane Rail Line approximately 15m to the east of Ayr-Dalbeg Road.

The second access point is proposed to be located on the western side of the road a further 50m south (TMR Ch. 42.285km) and provide a gated access catering for vehicle movements associated with the construction and then maintenance of the overhead transmission line for the Project.

As part of the Project works it is proposed that these two new site access points will be constructed generally in accordance with the rural property access arrangement for articulated vehicles (Type C) outlined in TMR Standard Drawing 1807.

Based on the temporary nature of the higher construction phase traffic (max 60vpd – 30 inbound / 30 outbound), the infrequent, low volume of ongoing operations phase traffic (2-3 vehicles every 3 months) and the very low background volumes on the adjacent section of Ayr-Dalbeg Road (approx. 150vpd), the

proposed rural property access treatment for both the substation and transmission line access locations are considered more than adequate to cater for vehicle movements associated with the Project.

Further to this, the provision of give-way signage control of the new rail crossing of the Invicta Mill Cane Rail Line as part of the proposed substation area access is also anticipated to be sufficient to cater for the Project traffic volumes forecast, noting that further ALCAM assessment of the crossing point may be required by the relevant rail authority as part of subsequent operational works approvals for the Project.

3.3.2 Internal Site Facilities

The finalisation of the site layout design is expected to be undertaken as part of the Operational Works stage of the Project, however the current layout as shown in **Figure 12** and **Figure 13** is considered clear and legible, with adequate vehicle access arrangements and provision for vehicle circulation throughout the substation and transmission line areas of the Project site.

Further to this, it is noted that whilst not specifically shown on the proposed site layout, suitable on-site workforce parking facilities for the Project will be provided for at both the substation compound and along the overhead transmission line alignment. These workforce parking facilities for the Project will be adequately sized to cater for the expected staff vehicles movements and be designed and constructed in accordance with the requirements of all relevant standards, guidelines and policies.

Based on the proposed provision of adequate parking areas on site, in conjunction with the current setbacks from the external road network, it is not anticipated that either the construction or operations phase of the Project will lead to an overspill of parking or vehicle queuing at site accesses that would lead to negative impacts to the operation of the adjacent section of Ayr-Dalbeg Road or any other section of the surrounding road network.

4.0 Development Traffic

Based on the information provided by Powerlink it is evident that there will be two distinct periods of development traffic generation for the Project, being the construction, and subsequent operations phases. The expected traffic generation and distribution during both these phases of the Project is discussed in the sections below.

4.1 Construction Phase

As outlined above, the construction phase for the Project is anticipated to commence in October 2024 (pending approvals), with all construction activities across the site to be completed in 9 months i.e. by June 2025, with the peak period of construction expected to occur in Q1 2025.

Based on the information provided by Powerlink, it has been identified that the main traffic generating activities occurring during construction include the transport of the various construction materials / equipment to site and the daily construction staff movements. Further details of these activities, including the Project traffic generation and its expected distribution on the surrounding road network, are provided in the following sections.

4.1.1 Materials and Equipment Delivery Movements

Powerlink has provided information and assumptions regarding the expected construction phase of the Project. This information is based on their experience in developing and managing the construction of similar projects, which has been used to calculate the expected material and equipment quantities and the associated vehicle movements for the delivery of these items. In addition, the following general assumptions were also used in the development of the expected Project traffic numbers.

- Gravel and pavement materials will be imported to site from local quarries, in particular the BQC Quarry on Ayr-Dalbeg Road to the north-east of the Project site and transported to the site via Truck & 3 Axle Dog configurations (assumed) via Ayr-Dalbeg Road.
- General construction materials, equipment, componentry, and plant for the proposed facility will be delivered to site via road transport from either Townsville or Ayr, utilising sections of Townsville Port Road and the Bruce Highway.
- Electrical infrastructure and components for the substation are proposed to be delivered to Project site via the Port of Townsville, noting that the larger site transformer and switchroom elements are anticipated to be delivered under permit.

A calculated breakdown of the Project's generated heavy vehicle traffic movements by construction task, is summarised in **Table 4**, while the detailed calculations to establish the heavy vehicle movements are included for reference in **Appendix E**. It is noted that the volumes below are estimates only and the average daily Project traffic volumes may fluctuate slightly depending on the day's activities.

4.1.2 Construction Staff Movements

Powerlink has also provided information and assumptions regarding the anticipated staff movements during the construction phase for the Project, including:

- Maximum or peak construction workforce will comprise approximately 50 staff, with average daily staff numbers in the order of 25 staff.
- Construction staff are expected to commute daily from Townsville, utilising a combination of private light vehicles and standard work trucks (3-axle rigid), with an average capacity of 2 staff per vehicle.

Table 5 below summarises the expected number of staff by construction task and by month, as well as providing an estimate of the expected staff vehicle movement volumes.

Table 4 Summary of Project Heavy Vehicle Movements

TASK ID	TASK	DURATION	MONTH								
			Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25
			Q4 2024			Q1 2025			Q2 2025		
			1	2	3	4	5	6	7	8	9
A	Mobilisation & Site Establishment	1 M	2								
B	Site Entrances & Access Roads	2 M		2	2						
C	Site Areas (Civil)	3 M			1	1	1				
D	Cabling	2 M					1	1			
E	Site Areas (Electrical)	4 M					2	2	2	2	
F	Finalisation / Commissioning / Demobilisation	2 M								2	2
W	Site Water	9M	1	1	1	1	1	1	1	1	1
	Peak Daily HV Movements		3	3	4	2	5	4	3	5	3
	Hourly HV Movements (Assume 12hrs/day)		1	1	1	1	1	1	1	1	1

Table 5 Construction Staff Numbers and Vehicle Forecast

ID	Task	Duration	Month								
			Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25
			Q4 2024			Q1 2025			Q2 2025		
			1	2	3	4	5	6	7	8	9
A	Mobilisation & Site Establishment	15	10								
B	Site Entrances & Access Roads	20		15	15						
C	Site Areas (Civil)	20			15	15	15				
D	Cabling	20					15	15			
E	Site Areas (Electrical)	20					20	20	20	20	
F	Finalisation / Commissioning / Demobilisation	15								15	15
	Total Construction Staff Numbers		10	15	30	15	50	35	20	35	15
	% Staff Travelling by Light Vehicle	80%									
	No. Staff Travelling via Light Vehicle		8	12	24	12	40	28	16	28	12
	Average Staff per Light Vehicle	2									
	No. of Staff Light Vehicles		4	6	12	6	20	14	8	14	6
	% Staff Travelling by Work Truck	20%									
	No. Staff Travelling via Work Truck		2	3	6	3	10	7	4	7	3
	Average Staff per Work Truck	2									
	No. of Staff Work Trucks		1	2	3	2	5	4	2	4	2
	Total No. of Staff Vehciles per day		5	8	15	8	25	18	10	18	8

4.2 Operations Phase

Powerlink has advised that following the completion of the construction phase of the Project, vehicle movements to/from the substation and overhead transmission line facility will be limited to those associated with periodic routine service maintenance on site, which is anticipated to include:

- 3 monthly routine service maintenance – 2 staff members for 1 day.
- Circuit breaker maintenance (every 4 years) – 2-3 staff members for 1 day.
- Voltage transformer maintenance (every 2-4 years) – 2 staff members for 1 day.
- Current transformer maintenance (every 2-4 years) – 2 staff members for 1 day.

- Transformer (oil service) maintenance (every 2 years) – 2 staff members for 1 day.
- Transformer (general) maintenance (every 4 years) – 4 staff members for 1 day.
- Transformer (tapchanger) maintenance (every 6 years) – 3-4 staff members for 2 day.

Based on information provided above, it can be seen that the staff and vehicle movements to/from the Project site during its operation will be limited to periodic (3-monthly) movements, with a maximum of 4 staff members. Based on the previously identified assumptions for staff vehicle configurations, split and capacities, the maximum staff movements equates to approximately 2-3 vehicle movements (round trips) per day from Townsville. Further to this, for the sake of this assessment it has conservatively been assumed that the routine service maintenance will also require 1 heavy vehicle movement to/from site from Townsville.

4.3 Project Traffic Volumes on the Network

The volumes of traffic forecast to be generated by both the construction and operations phase of the Project have been distributed onto the relevant sections of the external road network based upon Project information provided by Powerlink. Further details of the expected Project traffic volumes on the identified road links and at the key Bruce Highway / Ayr-Dalbeg Road intersection are provided below.

4.3.1 Road Links

As previously identified, the use of the external road network by Project traffic is anticipated to be limited to the state controlled network, including sections of Townsville Port Road, the Bruce Highway and Ayr-Dalbeg Road forming the transport routes to/from the Project area.

Calculations were undertaken to establish the peak daily Project traffic volumes on the relevant sections of the road network, with a summary of the expected Project traffic volumes for each identified road link provided in **Table 6**, noting that for the volumes identified volumes are conservatively based on the sum of the individual maximum movements from concurrently scheduled construction works.

Table 6 Forecast Development Traffic – Landers Creek Substation & Overhead Transmission Line

Road Link - AADT Segment			Project Construction			Project Operations		
ID	Start (km)	End (km)	Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Bi-Dir
Townsville Port Road (841)								
92206	0.000	7.336	*2*	*2*	*4*	0	0	0
92236	7.336	7.811	*2*	*2*	*4*	0	0	0
Bruce Highway (10M Townsville – Ingham)								
92177	0.000	2.544	*27*	*27*	*54*	4	4	8
92204	2.544	3.853	*27*	*27*	*54*	4	4	8
92178	3.853	8.635	*27*	*27*	*54*	4	4	8
Bruce Highway (10L Ayr – Townsville)								
91398	0.000	2.150	*28*	*28*	*56*	4	4	8
91399	2.150	6.439	*28*	*28*	*56*	4	4	8
91699	6.439	64.166	*28*	*28*	*56*	4	4	8
92216	64.166	66.821	*28*	*28*	*56*	4	4	8
92201	66.821	77.913	*28*	*28*	*56*	4	4	8
Bruce Highway (10K Bowen – Ayr)								
90004	**105.415**	108.960	*30*	*30*	*60*	4	4	8

Road Link - AADT Segment			Project Construction			Project Operations		
ID	Start (km)	End (km)	Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Bi-Dir
91443	108.960	110.550	*30*	*30*	*60*	4	4	8
91396	110.550	112.120	*30*	*30*	*60*	4	4	8
Ayr-Dalbeg Road (545)								
91502	0.000	**14.620**	*30*	*30*	*60*	4	4	8
90018	**14.620**	36.452	*30*	*30*	*60*	4	4	8
91478	36.452	**42.235**	*30*	*30*	*60*	4	4	8
	42.235	**42.285**	*16*	*15*	*31*	4	4	8

4.3.2 Intersections

From the information regarding the proposed staff and heavy vehicle movement numbers during both the construction and operations phases of the Project, the peak hour Project traffic volumes at the key Bruce Highway / Ayr-Dalbeg Road were established, with a summary of these volumes outlined in **Table 7**.

Further details of the calculations undertaken to establish these volumes are provided for reference in **Appendix B**.

Table 7 Forecast Project Traffic Volumes (AM & PM Peak Hours) - Bruce Highway / Ayr-Dalbeg Road Intersection

Design Scenario	Bruce Highway (N)				Ayr-Dalbeg Road (W)				Bruce Highway (S)			
	Through		Right		Left		Right		Left		Through	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Construction Phase												
AM Peak Project Traffic	0	0	20	6	0	1	0	0	0	0	0	0
PM Peak Project Traffic	0	0	0	1	20	6	0	0	0	0	0	0
Operations Phase												
AM Peak Project Traffic	0	0	3	1	0	0	0	0	0	0	0	0
PM Peak Project Traffic	0	0	0	0	3	1	0	0	0	0	0	0

The impact of these additional mid-block and intersection movement traffic volumes from the Project on the surrounding road network has been assessed, with the results outlined in **Section 5.0** below.

5.0 Traffic Impact Assessment

Based on the information provided above, it was determined that the critical elements of the surrounding road network in terms of the potential impact of the proposed Landers Creek Substation Project were the state-controlled road links of Townsville Port Road, the Bruce Highway (sections of 10K/10L/10M) and Ayr-Dalbeg Road Mount Larcom Road and the key intersection of the Bruce Highway / Ayr-Dalbeg Road, which are expected to be utilised as part of the travel routes for Project traffic to/from the site.

Further details of the assessment of the impact of the development on road network is provided in the following sections.

5.1 With and Without Development Traffic Volumes

5.1.1 Road Link Volumes

Based on the adopted distribution of these development traffic movements identified in **Section 4.3** above, the expected pre and post development traffic volumes on the relevant sections of the road network were established, as shown in **Table 8**.

Table 8 Forecast Pre and Post Development Traffic Volumes (Daily)

Road Link - AADT Segment			2025 Background Traffic Volumes		Project Construction Traffic Volumes		Project Operations Traffic Volumes		2025 Construction Phase Volumes		2025 Operations Phase Volumes	
ID	Start (km)	End (km)	Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz	A-Gaz	Bi-Dir	A-Gaz	Bi-Dir
Townsville Port Road (841)												
92206	0.000	7.336	1,451	1,317	*2*	*2*	*0*	*0*	1,453	1,319	1,451	1,317
92236	7.336	7.811	2,068	1,867	*2*	*2*	*0*	*0*	2,070	1,869	2,068	1,867
Bruce Highway (10M Townsville – Ingham)												
92177	0.000	2.544	7,038	7,001	*27*	*27*	*4*	*4*	7,065	7,028	7,042	7,005
92204	2.544	3.853	7,085	7,364	*27*	*27*	*4*	*4*	7,112	7,391	7,089	7,368
92178	3.853	8.635	18,976	20,408	*27*	*27*	*4*	*4*	19,003	20,435	18,980	20,412
Bruce Highway (10L Ayr – Townsville)												
91398	0.000	2.150	2,522	2,802	*28*	*28*	*4*	*4*	2,550	2,830	2,526	2,806
91399	2.150	6.439	3,546	3,503	*28*	*28*	*4*	*4*	3,574	3,531	3,550	3,507
91699	6.439	64.166	3,050	2,930	*28*	*28*	*4*	*4*	3,078	2,958	3,054	2,934
92216	64.166	66.821	4,400	4,288	*28*	*28*	*4*	*4*	4,428	4,316	4,404	4,292
92201	66.821	77.913	8,361	8,457	*28*	*28*	*4*	*4*	8,389	8,485	8,365	8,461
Bruce Highway (10K Bowen – Ayr)												
90004	105.415	108.960	4,582	4,618	*30*	*30*	*4*	*4*	4,612	4,648	4,586	4,622
91443	108.960	110.550	5,388	5,356	*30*	*30*	*4*	*4*	5,418	5,386	5,392	5,360
91396	110.550	112.120	3,112	2,557	*30*	*30*	*4*	*4*	3,142	2,587	3,116	2,561
Ayr-Dalbeg Road (545)												
91502	0.000	14.620	455	451	*30*	*30*	*4*	*4*	485	481	459	455
90018	14.620	36.452	225	225	*30*	*30*	*4*	*4*	255	255	229	229
91478	36.452	42.235	76	78	*30*	*30*	*4*	*4*	106	108	80	82
	42.235	42.285	76	78	*16*	*15*	*4*	*4*	92	93	80	82

5.1.2 Intersection Volumes

Based on the requirements of TMR's *Guide to Traffic Impact Assessment* as the intersection of the Bruce Highway / Ayr-Dalbeg Road is not the direct access to the site, the assessment of the impacts of the proposed development on its operation are only required for the expected year of opening for the Project. However, to enable an assessment of the impacts of both the construction and operations phase of the Project, analysis of this critical intersection has been undertaken for the period of peak construction phase traffic (2025) and at the year of opening (2025) for the operations phase of the substation.

As such an estimate of the expected peak hour traffic volumes at the key Bruce Highway / Ayr-Dalbeg Road intersection at the relevant design horizon (2025) was established, noting that the relevant construction and operations phase volumes were established by combining the forecast background traffic volumes with the calculated Project traffic volumes identified in **Table 7**, with the resultant volumes are shown in **Table 9** below.

Table 9 Post Development (Operations) Traffic Volumes – 2023 AM & PM Peak

Design Scenario	Bruce Highway (N)				Ayr-Dalbeg Road (W)				Bruce Highway (S)			
	Through		Right		Left		Right		Left		Through	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Construction Phase												
2025 AM Peak	289	28	57	13	67	2	28	15	12	8	454	36
2025 PM Peak	360	38	47	4	84	12	28	6	28	5	368	50
Operations Phase												
2025 AM Peak	289	28	40	8	67	1	28	15	12	8	454	36
2025 PM Peak	360	38	47	3	67	7	28	6	28	5	368	50

5.2 Road Safety Impact Assessment and Mitigation

Based on the road environments (<8,000vpd) of the critical section of Ayr-Dalbeg Road in the vicinity of the site, it was determined that the completion of a lower order road safety assessment would be sufficient to establish the existing and post development road safety risks relevant to the Project, in accordance with the provisions of TMR's *Guide to Traffic Impact Assessment* (Section 9.3.3).

To establish the level of risk regarding the existing and expected Project road safety considerations identified by this assessment, a safety risk score matrix as shown in **Figure 15** was utilised, with the results of the road safety risk assessment summarised in **Table 10**.

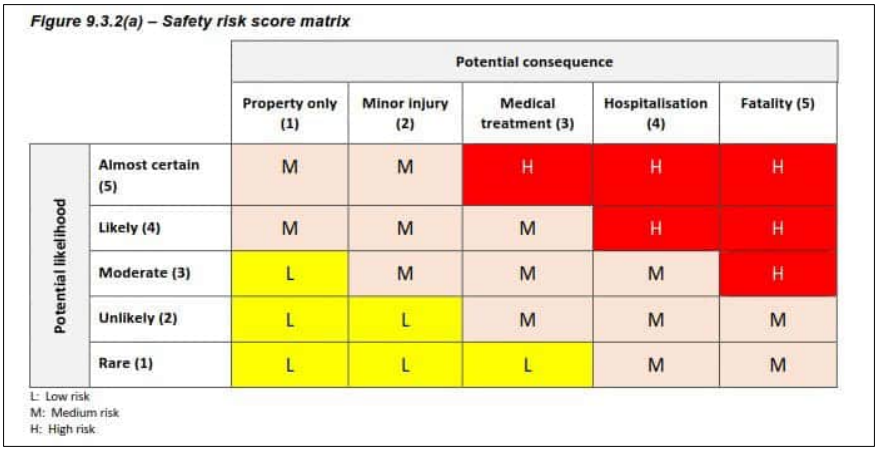


Figure 15 Adopted Risk Score Matrix **[Source: TMR GTIA]**

Table 10 Road Safety Assessment – Landers Creek Substation & Overhead Transmission Line Project

		Existing / Pre-Development			Project				Project with Mitigation		
Risk Item		Likelihood	Consequence	Risk Score	Likelihood	Consequence	Risk Score	Mitigation Measure	Likelihood	Consequence	Risk Score
1	The Project is anticipated to lead to an increase in turning movements at the Bruce Highway / Ayr-Dalbeg Road intersection, which could lead to excessive vehicle queueing, lower intersection performance and potentially additional vehicle conflicts.	Unlikely	Minor Injury / Medical Treatment	**Low / Medium**	Unlikely	Minor Injury / Medical Treatment	**Low / Medium**	Detailed intersection analysis identified that the impact of the increase in traffic volumes at the Bruce Highway / Ayr-Dalbeg Road intersection as a result of the Project was minimal and that all expected vehicle queues would be accommodated in current available storage lengths, with all calculated values for capacity/degree of saturation, delay and level of service all within acceptable limits of operation for a priority-controlled intersection. **As such no mitigation measures are deemed to be required.**	Unlikely	Minor Injury / Medical Treatment	**Low / Medium**
2	The Project is anticipated to lead to an increase in vehicle movements across the existing rail level crossings on Ayr-Dalbeg Road. This has the potential to lead to increased conflict between Project traffic and train movements at the crossings.	Rare	Hospitalisation / Fatality	**Medium**	Unlikely	Hospitalisation / Fatality	**Medium**	Based on the forecast traffic volumes from the construction and operations phases of the Project and the relatively low background traffic volumes on Ayr-Dalbeg Road, the current control measures at the existing rail crossings are anticipated to sufficient to accommodate the temporary increase in traffic during peak construction and the minor, infrequent increase in traffic during ongoing operations phase of the Project. **As such no mitigation measures are deemed to be required.**	Unlikely	Hospitalisation / Fatality	**Medium**

		Existing / Pre-Development			Project				Project with Mitigation		
Risk Item		Likelihood	Consequence	Risk Score	Likelihood	Consequence	Risk Score	Mitigation Measure	Likelihood	Consequence	Risk Score
3	The Project is also expected to lead to an increase in vehicle numbers on sections of the state-controlled road network, in particular Ayr-Dalbeg Road, which in turn may lead to an decrease in road link operation/capacity of the link and increased potential for vehicle accidents.	Unlikely	Medical Treatment / Hopsitalisation	**Medium**	Unlikely	Medical Treatment / Hopsitalisation	**Medium**	Based on the current low background traffic volumes on Ayr-Dalbeg Road, the temporary nature of the larger increase in traffic volumes of the construction phase of the Project and the low, infrequent nature additional volumes from the operational phase, there is not anticipated to be a significant impact on the operation of Ayr-Dalbeg Road based on its current configuration. **As such no mitigation measures are deemed to be required.**	Unlikely	Medical Treatment / Hopsitalisation	**Medium**
4	The Project is also proposing to include the provision of two new site access points on Ayr-Dalbeg Road. The introduction of new access points has the potential to lead to increased vehicle conflicts at these locations.	Unlikely	Medical Treatment / Hopsitalisation	**Medium**	Unlikely	Medical Treatment / Hopsitalisation	**Medium**	**As part of the Project works it is proposed that the two new site access points will be constructed generally in accordance with the rural property access arrangement for articulated vehicles (Type C) outlined in TMR Standard Drawing 1807.** Based on the temporary nature of the higher construction phase traffic (max 60vpd – 30 inbound / 30 outbound), the infrequent, low volume of ongoing operations phase traffic (2-3 vehicles every 3 months) and the very low background volumes on the adjacent section of Ayr-Dalbeg Road (approx. 150vpd), the proposed rural property access treatment for both the substation and transmission line access locations are considered more than adequate to cater for vehicle movements associated with the Project.	Unlikely	Medical Treatment / Hopsitalisation	**Medium**

		Existing / Pre-Development			Project				Project with Mitigation		
Risk Item		Likelihood	Consequence	Risk Score	Likelihood	Consequence	Risk Score	Mitigation Measure	Likelihood	Consequence	Risk Score
5	Existing roadside vegetation is noted to restrict potential sightlines to/from the proposed site access locations on Ayr-Dalbeg Road. This has the potential to lead to lead to increased vehicle conflicts at these locations.	Unlikely	Medical Treatment / Hopsitalisation	**Medium**	Unlikely	Medical Treatment / Hopsitalisation	**Medium**	**Based on the current restrictions to sightlines to/from the proposed access points, it is recommended that roadside vegetation clearing be undertaken to open up/provide suitable sight distances.** **In addition, it is also recommended that advanced warning signage be provided on both Ayr-Dalbeg Road approaches to provide further delineation of the access points to motorists and highlight the potential for vehicle movements entering and exiting at these locations.**	Unlikely	Medical Treatment / Hopsitalisation	**Medium**

5.3 Access and Frontage Impact Assessment and Mitigation

5.3.1 Site Access

As previously identified, it is proposed that access to the proposed Project site will be gained via two new site access points from Ayr-Dalbeg Road. The northern access is proposed to be located on the eastern side of the road, at TMR Chainage 42.235km, and is understood to be the permanent site access for the substation area and be utilised by both light and heavy vehicle movements. This access has previously been identified as the proposed site access location for the pump station infrastructure (to be located adjacent to the substation) as part of the Haughton Pipeline Project Stage 2 works.

The second access point is proposed to be located on the western side of the road a further 50m south (TMR Ch. 42.285km) and provide a gated access catering for vehicle movements associated with the construction and then maintenance of the overhead transmission line for the Project.

As part of the Project works it is proposed that these two new site access points will be constructed generally in accordance with the rural property access arrangement for articulated vehicles (Type C) outlined in TMR Standard Drawing 1807.

Based on the temporary nature of the higher construction phase traffic (max 60vpd – 30 inbound / 30 outbound), the infrequent, low volume of ongoing operations phase traffic (2-3 vehicles every 3 months) and the very low background volumes on the adjacent section of Ayr-Dalbeg Road (approx. 150vpd), the proposed rural property access treatment for both the substation and transmission line access locations are considered more than adequate to cater for vehicle movements associated with the Project.

Further to capacity considerations of the proposed site access points, it is noted that existing sightlines to/from the proposed site access locations are currently restricted due to roadside vegetation on both sides of the Ayr-Dalbeg Road. Therefore as part of the construction works for these access points it is recommended that roadside vegetation clearing be undertaken to provide suitable sight distances to/from the access points.

In addition it is also recommended that advanced warning signage be provided on both Ayr-Dalbeg Road approaches to provide further delineation of the access points to motorists and highlight the potential for vehicle movements entering and exiting at these locations.

5.4 Intersection Impact Assessment and Mitigation

5.4.1 Intersection Operation Analysis

As noted in Section 5.1.2 above, as the intersection of the Bruce Highway / Ayr-Dalbeg Road is not the direct access to the site, the assessment of the impacts on its operation are only required for the expected year of opening for the Project.

Therefore, to enable an assessment of the impacts of both the construction and operations phase of the Project, analysis of this critical intersection has been undertaken for the period of peak construction phase traffic (2025) and at the year of opening (2025) for the operations phase. Further details of the results of this analysis is provided below.

5.4.1.1 Bruce Highway / Ayr-Dalbeg Road Intersection

The forecast post development (construction and operations phase) traffic volumes at the relevant Bruce Highway / Ayr-Dalbeg Road intersection (see **Section 5.1.2**) were utilised to undertake a detailed intersection analysis (using SIDRA software) to establish its operational performance at the nominated design horizons.

A summary of the analysis results for the forecast pre and post Project traffic conditions at the key Bruce Highway / Ayr-Dalbeg Road intersection for both the construction and operations phases of the Project is provided in **Table 11** below, with detailed SIDRA output results included for reference as **Appendix C**.

Table 11 SIDRA Results – Bruce Highway / Ayr-Dalbeg Road Intersection (Existing Configuration)

Analysis Scenario	Intersection Degree of Saturation	Critical Movement Level of Service	Intersection Average Delay (sec)	Maximum 95% Back of Queue Length (m)
Bruce Highway / Ayr-Dalbeg Road				
Pre Development 2025 AM Peak	0.401	LOS C	3.0	12.4
Pre Development 2025 PM Peak	0.292	LOS B	2.4	8.5
"Construction" 2025 AM Peak	0.421	LOS C	3.4	13.1
"Construction" 2025 PM Peak	0.333	LOS C	2.6	10.5
"Operations" 2025 AM Peak	0.404	LOS C	3.1	12.5
"Operations" 2025 PM Peak	0.299	LOS B	2.4	8.9

The results above indicate that the existing priority-controlled intersection configuration of the Bruce Highway / Ayr-Dalbeg Road intersection is expected to operate satisfactorily under all post development traffic conditions assessed for both the peak construction period (2025) and the expected year of opening (operations phase - 2025). This is demonstrated by all values for DOS, LOS, average delay and vehicle queueing calculated being within acceptable limits of operation for a priority-controlled intersection.

As such it can be concluded that the existing configuration of the Bruce Highway / Ayr-Dalbeg Road intersection will be adequate to cater for the additional traffic expected to be generated by the construction and operations phase of the proposed Lander Creek Substation and Overhead Transmission Line Project.

5.5 Road Link Capacity Assessment and Mitigation

As identified in **Section 5.1.1** above, the expected pre and post development link volumes for both the construction and operational phases of the Project were established. Using these volumes an assessment

of the percentage increase in daily traffic volumes as a result of Project was undertaken, with a summary for the both the construction and operations phase provided in **Table 12** and **Table 13**, and further details of the calculations completed provided in **Appendix F**.

Table 12 Road Link Daily Traffic Volume Comparison (Construction Phase)

Road Link - AADT Segment			2025 Background Traffic Volumes			Project Construction Traffic Volumes			% Increase in Daily Traffic Volumes		
ID	Start (km)	End (km)	Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Bi-Dir
Townsville Port Road (841)											
92206	0.000	7.336	1,451	1,317	2,767	2	2	4	0.14%	0.15%	0.14%
92236	7.336	7.811	2,068	1,867	3,935	2	2	4	0.10%	0.11%	0.10%
Bruce Highway (10M Townsville – Ingham)											
92177	0.000	2.544	7,038	7,001	14,039	27	27	54	0.38%	0.39%	0.38%
92204	2.544	3.853	7,085	7,364	14,449	27	27	54	0.38%	0.37%	0.37%
92178	3.853	8.635	18,976	20,408	39,384	27	27	54	0.14%	0.13%	0.14%
Bruce Highway (10L Ayr – Townsville)											
91398	0.000	2.150	2,522	2,802	5,325	28	28	56	1.11%	1.00%	1.05%
91399	2.150	6.439	3,546	3,503	7,049	28	28	56	0.79%	0.80%	0.79%
91699	6.439	64.166	3,050	2,930	5,980	28	28	56	0.92%	0.96%	0.94%
92216	64.166	66.821	4,400	4,288	8,687	28	28	56	0.64%	0.65%	0.64%
92201	66.821	77.913	8,361	8,457	16,818	28	28	56	0.33%	0.33%	0.33%
Bruce Highway (10K Bowen – Ayr)											
90004	**105.415**	108.960	4,582	4,618	9,200	30	30	60	0.65%	0.65%	0.65%
91443	108.960	110.550	5,388	5,356	10,744	30	30	60	0.56%	0.56%	0.56%
91396	110.550	112.120	3,112	2,557	5,669	30	30	60	0.96%	1.17%	1.06%
Ayr-Dalbeg Road (545)											
91502	0.000	**14.620**	455	451	907	30	30	60	**6.59%**	**6.65%**	**6.62%**
90018	**14.620**	36.452	225	225	449	30	30	60	**13.36%**	**13.36%**	**13.36%**
91478	36.452	**42.235**	76	78	155	30	30	60	**39.35%**	**38.31%**	**38.82%**
	42.235	**42.285**	76	78	155	16	15	31	**20.99%**	**19.16%**	**20.06%**

Table 13 Road Link Daily Traffic Volume Comparison (Operations Phase)

Road Link - AADT Segment			2025 Background Traffic Volumes			Project Operations Traffic Volumes			% Increase in Daily Traffic Volumes		
ID	Start (km)	End (km)	Gaz	Gaz	Gaz	Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Bi-Dir
Townsville Port Road (841)											
92206	0.000	7.336	1,451	1,317	2,767	0	0	0	0.00%	0.00%	0.00%
92236	7.336	7.811	2,068	1,867	3,935	0	0	0	0.00%	0.00%	0.00%
Bruce Highway (10M Townsville – Ingham)											
92177	0.000	2.544	7,038	7,001	14,039	4	4	8	0.06%	0.06%	0.06%
92204	2.544	3.853	7,085	7,364	14,449	4	4	8	0.06%	0.05%	0.06%
92178	3.853	8.635	18,976	20,408	39,384	4	4	8	0.02%	0.02%	0.02%
Bruce Highway (10L Ayr – Townsville)											
91398	0.000	2.150	2,522	2,802	5,325	4	4	8	0.16%	0.14%	0.15%
91399	2.150	6.439	3,546	3,503	7,049	4	4	8	0.11%	0.11%	0.11%
91699	6.439	64.166	3,050	2,930	5,980	4	4	8	0.13%	0.14%	0.13%
92216	64.166	66.821	4,400	4,288	8,687	4	4	8	0.09%	0.09%	0.09%
92201	66.821	77.913	8,361	8,457	16,818	4	4	8	0.05%	0.05%	0.05%
Bruce Highway (10K Bowen – Ayr)											
90004	**105.415**	108.960	4,582	4,618	9,200	4	4	8	0.09%	0.09%	0.09%
91443	108.960	110.550	5,388	5,356	10,744	4	4	8	0.07%	0.07%	0.07%
91396	110.550	112.120	3,112	2,557	5,669	4	4	8	0.13%	0.16%	0.14%
Ayr-Dalbeg Road (545)											
91502	0.000	**14.620**	455	451	907	4	4	8	0.88%	0.89%	0.88%
90018	**14.620**	36.452	225	225	449	4	4	8	1.78%	1.78%	1.78%
91478	36.452	**42.235**	76	78	155	4	4	8	**5.25%**	**5.11%**	**5.18%**
	42.235	**42.285**	76	78	155	4	4	8	**5.25%**	**5.11%**	**5.18%**

As can be seen by the results in **Table 12** and **Table 13** above, the addition of the expected construction phase and operations phase traffic volumes from the Project is shown to have an negligible increase in daily volumes on the relevant sections of both Townsville Port Road and the Bruce Highway. Notwithstanding this, the results did indicated that daily traffic volumes on a number of sections of the state-controlled Ayr-Dalbeg Road were increased by more than the standard 5% trigger during both the construction and operations phases of the Project.

While the increase in traffic volumes on these road sections may appear significant, with values exceeding the 5% increase trigger, it should be noted that the high percentages of increase calculated are primarily due to the low background traffic volumes, with the calculated post development traffic volumes during both the construction and operations phase still within the identified capacities of rural local collector road (3,000 vpd).

Further to this it is noted that the increase identified for the construction phase is for the peak period of construction which is only expected to occur for 1-2 months, with lower values of increase expected for the remainder of the overall 9-month construction program.

Further to this, the operations phase was shown to be slightly over the 5% increase trigger for the southern sections of Ayr-Dalbeg Road in the vicinity of the Project site. As the operations phase is expected to only generate traffic movements over a 1-2 day period every 3 months, there Project is not anticipated to lead to any significant ongoing increase in traffic volumes on this link.

As such it is considered that the additional traffic from both the construction and operations phases of the Landers Road Substation and Overhead Transmission Line Project are not anticipated to have a significant impact on the operation of the surrounding road links.

5.6 Pavement Impact Assessment and Mitigation

5.6.1 Construction Phase

The assessment of potential pavement impacts during the construction phase of the Project involved the comparison of the pavement loadings (ESA) associated with the background traffic volumes on the road links to the ESAs estimated to be generated by the heavy vehicle movements across the Project construction period.

Table 14 shows the assumed heavy vehicle classes that are expected to be used throughout the construction phase of the Project and the average loaded and unloaded ESAs/HV values for each configuration, noting that while currently unknown a conservative vehicle arrangement (Prime Mover + 10x8 platform trailer) has been assumed for the transport movements of the larger transformer and switchroom components for the substation site.

Table 14 Assumed Vehicle Class and ESA/HV Values

Vehicle Class	Vehicle Configuration	Task	Average Loaded ESAs / HV	Average Unloaded ESAs / HV
Truck and 3 Axle Dog (GML)		Quarry materials transport	7.66	0.53
6 Axle Semi-trailer (GML)		General material and equipment transport	4.93	0.51
3 Axle Rigid Truck		Staff work trucks	3.57	0.50
Prime Mover and Platform Trailer (10x8)		Transformer and switchroom delivery movements	1.87	8.46

A summary of the comparison of the background and Project traffic generated pavement loadings is provided in **Table 15** overpage, with further details of the Project pavement loading calculations undertaken included for reference in **Appendix G**.

The results in **Table 15** indicate that the heavy vehicle movements associated with the construction phase of the Project are expected to lead to negligible increases in pavement loadings on the majority the identified sections of the State-controlled road network, with the calculated values of loading increase typically below the standard 5% increase trigger threshold.

The results did however indicate that the additional vehicle movements from the construction phase would lead to an increase in pavement loadings greater than 5% on the section of Ayr-Dalbeg Road between TMR Ch.14.620km and Ch.42.285km. It is noted however, that the majority of the increase in loading on this section are due to the road gravel and aggregate transport movements for the Project from the BQC quarry operation (quarry access at TMR Ch. 14.620km). Therefore, the mitigation of the impacts of these movements on the identified sections of the Ayr-Dalbeg Road are expected to fall on the responsibility of

the quarry operator and be covered by the typical maintenance contribution (c/tonne) to TMR as part of the general operation of the quarry.

Based on the above and the fact that the Project will not have an ongoing impact to the road pavements of the identified sections of the surrounding road network, no requirement for the provision of mitigation works or contributions are considered to be required to offset the potential pavement impacts of proposed Landers Creek Substation and Overhead Transmission Line project.

Table 15 Project (Construction Phase) Pavement Loading Comparison

Road Link - AADT Segment			Background Pavement Loading ESAs			Project Construction Traffic Loadings ESAs			% Increase in Pavement Loading ESAs		
ID	Start (km)	End (km)	Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Bi-Dir
Townsville Port Road (841)											
92206	0.000	7.336	371,025	355,934	726,959	2	8	10	0.00%	0.00%	0.00%
92236	7.336	7.811	405,400	473,392	878,792	2	8	10	0.00%	0.00%	0.00%
Bruce Highway (10M Townsville – Ingham)											
92177	0.000	2.544	971,439	507,350	1,478,788	2,259	2,767	5,026	0.23%	0.55%	0.34%
92204	2.544	3.853	897,429	1,198,302	2,095,731	2,259	2,767	5,026	0.25%	0.23%	0.24%
92178	3.853	8.635	441,794	2,722,693	3,164,488	2,259	2,767	5,026	0.51%	0.10%	0.16%
Bruce Highway (10L Ayr – Townsville)											
91398	0.000	2.150	289,395	291,488	580,884	2,259	2,767	5,026	0.78%	0.95%	0.87%
91399	2.150	6.439	376,188	775,762	1,151,950	2,259	2,767	5,026	0.60%	0.36%	0.44%
91699	6.439	64.166	483,009	442,618	925,627	2,259	2,767	5,026	0.47%	0.63%	0.54%
92216	64.166	66.821	805,818	753,615	1,559,433	2,259	2,767	5,026	0.28%	0.37%	0.32%
92201	66.821	77.913	991,906	922,638	1,914,544	2,259	2,767	5,026	0.23%	0.30%	0.26%
Bruce Highway (10K Bowen – Ayr)											
90004	**105.415**	108.960	490,397	465,636	956,032	2,290	3,068	5,357	0.47%	0.66%	0.56%
91443	108.960	110.550	827,649	487,678	1,315,328	2,290	3,233	5,523	0.28%	0.66%	0.42%
91396	110.550	112.120	174,552	62,991	237,542	2,290	3,049	5,339	1.31%	4.84%	2.25%
Ayr-Dalbeg Road (545)											
91502	0.000	**14.620**	72,671	132,947	205,617	3,023	2,290	5,313	4.16%	1.72%	2.58%
90018	**14.620**	36.452	37,890	47,245	85,135	3,390	2,358	5,749	**8.95%**	4.99%	**6.75%**
91478	36.452	**42.235**	3,944	8,774	12,718	3,390	2,358	5,749	**85.96%**	**26.88%**	**45.20%**
	42.235	**42.285**	3,944	8,774	12,718	2,754	2,276	5,029	**69.82%**	**25.94%**	**39.54%**

TMR Chainage 105.415km 10K – Intersection Bruce Highway / Ayr-Dalbeg Road | TMR Chainage 14.620km 454 – Ayr-Dalbeg Road / BQC Quarry Access | TMR Chainage 42.235km 454 – Ayr-Dalbeg Road / Project Access 1 (Landers Creek Substation) | TMR Chainage 42.285km 454 – Ayr-Dalbeg Road / Project Access 2 (OHTL Easement)

5.6.2 Operations Phase

Based on the low and infrequent (3 monthly) volume of heavy vehicles generated by the operations phase of the Project, the pavement impacts of the ongoing operation of the proposed Landers Creek Substation and Overhead Transmission Line project are expected to be minimal. Based on this, no further pavement mitigation measures are considered necessary as part of the ongoing operations of the Project (post construction).

5.7 Transport Infrastructure Impact Assessment and Mitigation

5.7.1 Rail Crossings

As previously identified, Project traffic is expected to travel over four existing rail level crossings on the relevant section of Ayr-Dalbeg Road (including 1x crossing of North Coast Rail Line, 2x crossings of Pioneer Mill Cane Rail Line and 1x crossing of Invicta Mill Cane Rail Line, while a new level crossing of the Invicta Mill Cane Rail Line is also proposed to be constructed as part of the new vehicle access arrangements to the substation area of the Project on the eastern side of Ayr-Dalbeg Road (approx. TMR Ch. 42.235km).

Based on the Project traffic calculations outlined above (refer **Section 4.0**), the peak construction phase is expected to lead to an increase in vehicle movements across the existing rail level crossings on Ayr-Dalbeg Road by up to 60 vpd (30vpd each direction, including 10 HVs per day) with this amount falling to 8vpd (4vpd each direction, including 2 HVs per day) during the ongoing operations phase of the Project, noting that the operations phase would only generate traffic for a period of 1-2 days every 3 months.

Further to this, it is noted that the larger increase in volumes realised during the peak construction phase is only temporary (1-2 months), with lower volumes of Project traffic expected on the network (and on Ayr-Dalbeg Road) during the remainder of the 9-month construction period for the Project.

Therefore based on these low Project traffic volumes and the relatively low traffic volumes on Ayr-Dalbeg Road, the current control measures at the existing rail crossings are anticipated to sufficient to accommodate the temporary increase in traffic during peak construction and the minor, infrequent increase in traffic during ongoing operations phase of the Project.

Further to this, the provision of give-way signage control of the new rail crossing of the Invicta Mill Cane Rail Line as part of the proposed substation area access is also anticipated to be sufficient to cater for the Project traffic volumes forecast, noting that further ALCAM assessment of the crossing point may be required by the relevant rail authority as part of subsequent operational works approvals for the Project.

6.0 Conclusions and Recommendations

6.1 Summary of Impacts and Mitigation Measures Proposed

6.1.1 Traffic Impacts

Based on the identified increase in traffic numbers anticipated as a result of the construction and operational phases, it is anticipated that the proposed Landers Creek Substation and Overhead Transmission Line project will have a minimal impact on the traffic operation of the identified road links and intersections forming part of the relevant road network from a capacity perspective.

Notwithstanding this, the following mitigation treatments are recommended to maximise the safety and operation of the surrounding road network:

- Provision of the Project site accesses from Reid Road at the identified locations, with the configurations of the accesses to be generally in accordance with the rural property access arrangement for articulated vehicles (Type C) outlined in TMR Standard Drawing 1807.
- Provision of give way control to the new level crossing of the Invicta Mill Cane Rail Line approximately 15m to the east of Ayr-Dalbeg Road as part of the proposed site access arrangements for the Project's substation area.
- Completion sight line vegetation clearing of as part of the construction works for the site access points and the installation of advanced warning signage on both Ayr-Dalbeg Road approaches to provide further delineation of the access points to motorists and highlight the potential for vehicle movements entering and exiting at these locations.

6.1.2 Pavement Impacts

The pavement impact assessment undertaken identified that the heavy vehicle movements associated with the construction phase of the Project are expected to lead to negligible increases in pavement loadings on the majority the identified sections of the state-controlled road network, with the calculated values of loading increase typically below the standard 5% increase trigger threshold.

The results did however indicate that the additional vehicle movements from the construction phase would lead to an increase in pavement loadings greater than 5% on the section of Ayr-Dalbeg Road between TMR Ch.14.620km and Ch.42.285km.

It is noted however, that the majority of the increase in loading on this section are due to the road gravel and aggregate transport movements for the Project from the BQC quarry operation (quarry access at TMR Ch. 14.620km). Therefore, the mitigation of the impacts of these movements on the identified sections of the Ayr-Dalbeg Road are expected to fall on the responsibility of the quarry operator and be covered by the typical maintenance contribution (c/tonne) to TMR as part of the general operation of the quarry.

Based on the above and the fact that the Project will not have an ongoing impact to the road pavements of the identified sections of the surrounding road network, no requirement for the provision of mitigation works or contributions are considered to be required to offset the potential pavement impacts of proposed Landers Creek Substation and Overhead Transmission Line project.

6.2 Recommendations

In light of the information provided above, it can be considered that the additional traffic generated by the construction and operations phases of the proposed Landers Creek Substation and Overhead Transmission Line project will have a minor impact on the condition and operation of the surrounding road network.

Therefore, it is recommended that the Project be approved from a traffic engineering viewpoint.

6.3 Certification Statement and Authorisation

A copy of the RPEQ certification and authorisation statement covering this traffic impact assessment of the proposed Landers Creek Substation and Overhead Transmission Line project, is included for reference as **Appendix H.**

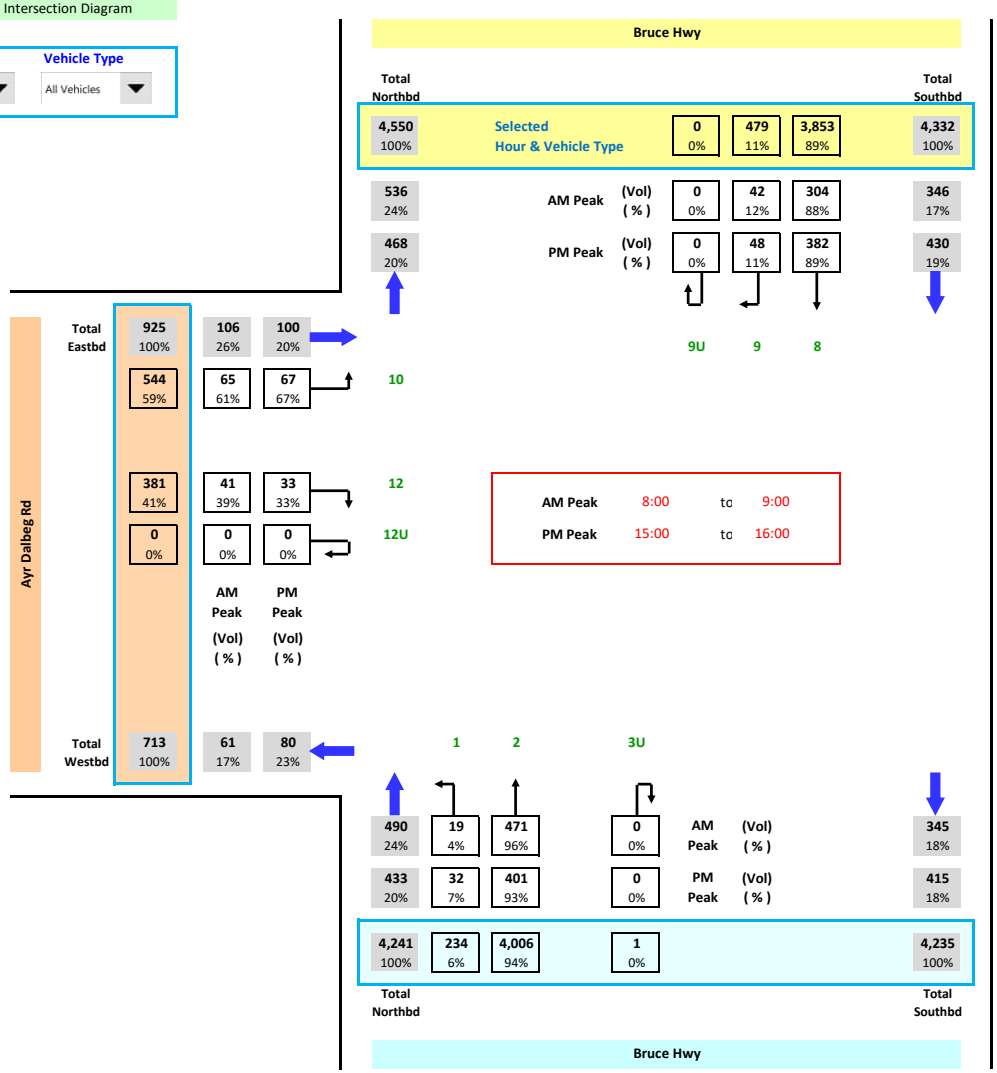
Appendix A – Bruce Highway / Ayr-Dalbeg Road Intersection Count

Job No. : AUQLD904
Client : GHD
Suburb : Ayr
Location : 1. Ayr Dalbeg Rd / Bruce Hwy

Day/Date : Wed, 2nd June 2021
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

MATRIX Traffic and Transport Data

Hour Starting 12hr Totals
Vehicle Type All Vehicles



N

Appendix B – Intersection Volume Forecast Calcualtions

AEC0123-002 | Landers Creek Substation & Overhead Transmission Line

Bruce Highway / Ayr-Dalbeg Road (from Matrix Data Count - Wednesday 2 June 2021)

Peak Hour Intersection Volume Forecasts

AM PEAK (8-9am)

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
YEAR	Bruce Highway - N				Ayr-Dalbeg Road - W				Bruce Highway - S			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2021	277	27	35	7	64	1	27	14	11	8	437	34
2022	280	27	36	7	65	1	27	14	12	8	441	35
2023	283	27	36	7	65	1	27	15	12	8	445	35
2024	286	28	36	7	66	1	27	15	12	8	450	35
2025	289	28	37	7	67	1	28	15	12	8	454	36
PROJECT CONSTRUCTION TRAFFIC	0	0	20	6	0	1	0	0	0	0	0	0
PROJECT "IN CONSTRUCTION"	289	28	57	13	67	2	28	15	12	8	454	36
PROJECT OPERATIONS TRAFFIC	0	0	3	1	0	0	0	0	0	0	0	0
PROJECT "OPERATIONS"	289	28	40	8	67	1	28	15	12	8	454	36

PM PEAK (3-4pm)

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
YEAR	Bruce Highway - N				Ayr-Dalbeg Road - W				Bruce Highway - S			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2021	346	36	45	3	61	6	27	6	27	5	353	48
2022	349	37	46	3	62	6	28	6	27	5	357	48
2023	353	37	46	3	62	6	28	6	28	5	360	49
2024	356	37	46	3	63	6	28	6	28	5	364	49
2025	360	38	47	3	64	6	28	6	28	5	368	50
PROJECT CONSTRUCTION TRAFFIC	0	0	0	1	20	6	0	0	0	0	0	0
PROJECT "IN CONSTRUCTION"	360	38	47	4	84	12	28	6	28	5	368	50
PROJECT OPERATIONS TRAFFIC	0	0	0	0	3	1	0	0	0	0	0	0
PROJECT "OPERATIONS"	360	38	47	3	67	7	28	6	28	5	368	50

Peak Construction Scenario - Schedule Tasks C + D + E + Site Water + Project Staff

Staff Movements - Peak Construction

Task	Bruce Highway - N				Ayr-Dalbeg Road - W				Bruce Highway - S			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak Staff	0	0	20	5	0	0	0	0	0	0	0	0
PM Peak Staff	0	0	0	0	20	5	0	0	0	0	0	0

Staff Movements - Operations

Task	Bruce Highway - N				Ayr-Dalbeg Road - W				Bruce Highway - S			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak Staff	0	0	3	0	0	0	0	0	0	0	0	0
AM HV	0	0	0	1	0	0	0	0	0	0	0	0
PM Peak Staff	0	0	0	0	3	0	0	0	0	0	0	0
PM HV	0	0	0	0	0	1	0	0	0	0	0	0

Heavy Vehicle Movements - Peak Construction

Task	Bruce Highway - N				Ayr-Dalbeg Road - W				Bruce Highway - S			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
C	0	0	0	1	0	1	0	0	0	0	0	0
D	0	0	0	1	0	1	0	0	0	0	0	0
E	0	0	0	2	0	2	0	0	0	0	0	0
Water	0	0	0	1	0	1	0	0	0	0	0	0
Total (12 hrs)	**0**	**0**	**0**	**5**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**
Peak Hour	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**

Appendix C – SIDRA Results – Bruce Highway / Ayr-Dalbeg Road Intersection

MOVEMENT SUMMARY

Site: 1 [EXIST 2024 AM (Site Folder: 1. Bruce Highway / Ayr-Dalbeg Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Bruce Highway / Ayr-Dalbeg Road
Existing Intersection Configuration
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	21	40.0	21	40.0	0.014	7.7	LOS A	0.0	0.0	0.00	0.63	0.00	53.4
2	T1	All MCs	511	7.2	511	7.2	0.271	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			532	8.5	532	8.5	0.271	0.4	NA	0.0	0.0	0.00	0.02	0.00	78.3
North: Bruce Highway															
8	T1	All MCs	331	8.9	331	8.9	0.177	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	45	16.3	45	16.3	0.069	10.9	LOS A	0.2	2.0	0.54	0.77	0.54	54.2
Approach			376	9.8	376	9.8	0.177	1.3	NA	0.2	2.0	0.07	0.09	0.07	75.6
West: Ayr-Dalbeg Road															
10	L2	All MCs	71	1.5	71	1.5	0.387	10.9	LOS A	1.5	12.0	0.76	0.98	1.03	47.1
12	R2	All MCs	44	35.7	44	35.7	0.387	35.2	LOS C	1.5	12.0	0.76	0.98	1.03	41.8
Approach			115	14.7	115	14.7	0.387	20.3	LOS B	1.5	12.0	0.76	0.98	1.03	44.9
All Vehicles			1022	9.7	1022	9.7	0.387	3.0	NA	1.5	12.0	0.11	0.16	0.14	71.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 1 [EXIST 2024 PM (Site Folder: 1. Bruce Highway / Ayr-Dalbeg Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Bruce Highway / Ayr-Dalbeg Road
Existing Intersection Configuration
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	35	15.2	35	15.2	0.021	7.2	LOS A	0.0	0.0	0.00	0.63	0.00	59.9
2	T1	All MCs	435	11.9	435	11.9	0.238	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			469	12.1	469	12.1	0.238	0.6	NA	0.0	0.0	0.00	0.05	0.00	77.9
North: Bruce Highway															
8	T1	All MCs	414	9.4	414	9.4	0.223	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	52	6.1	52	6.1	0.065	9.7	LOS A	0.2	1.8	0.50	0.73	0.50	55.5
Approach			465	9.0	465	9.0	0.223	1.1	NA	0.2	1.8	0.06	0.08	0.06	76.1
West: Ayr-Dalbeg Road															
10	L2	All MCs	73	8.7	73	8.7	0.285	9.4	LOS A	1.1	8.3	0.68	0.88	0.80	48.9
12	R2	All MCs	36	17.6	36	17.6	0.285	27.5	LOS B	1.1	8.3	0.68	0.88	0.80	47.2
Approach			108	11.7	108	11.7	0.285	15.4	LOS B	1.1	8.3	0.68	0.88	0.80	48.3
All Vehicles			1043	10.7	1043	10.7	0.285	2.4	NA	1.1	8.3	0.10	0.15	0.11	72.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 1 [PRE 2025 AM (Site Folder: 1. Bruce Highway / Ayr-Dalbeg Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Bruce Highway / Ayr-Dalbeg Road
Existing Intersection Configuration
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	21	40.0	21	40.0	0.014	7.7	LOS A	0.0	0.0	0.00	0.63	0.00	53.4
2	T1	All MCs	516	7.3	516	7.3	0.274	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			537	8.6	537	8.6	0.274	0.4	NA	0.0	0.0	0.00	0.02	0.00	78.3
North: Bruce Highway															
8	T1	All MCs	334	8.8	334	8.8	0.179	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	46	15.9	46	15.9	0.071	11.0	LOS A	0.3	2.0	0.55	0.77	0.55	54.2
Approach			380	9.7	380	9.7	0.179	1.4	NA	0.3	2.0	0.07	0.09	0.07	75.5
West: Ayr-Dalbeg Road															
10	L2	All MCs	72	1.5	72	1.5	0.401	11.2	LOS A	1.6	12.4	0.77	0.99	1.06	46.8
12	R2	All MCs	45	34.9	45	34.9	0.401	35.9	LOS C	1.6	12.4	0.77	0.99	1.06	41.7
Approach			117	14.4	117	14.4	0.401	20.8	LOS B	1.6	12.4	0.77	0.99	1.06	44.7
All Vehicles			1034	9.7	1034	9.7	0.401	3.0	NA	1.6	12.4	0.11	0.16	0.14	71.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 1 [PRE 2025 PM (Site Folder: 1. Bruce Highway / Ayr-Dalbeg Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Bruce Highway / Ayr-Dalbeg Road
Existing Intersection Configuration
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	35	15.2	35	15.2	0.021	7.2	LOS A	0.0	0.0	0.00	0.63	0.00	59.9
2	T1	All MCs	440	12.0	440	12.0	0.241	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			475	12.2	475	12.2	0.241	0.6	NA	0.0	0.0	0.00	0.05	0.00	77.9
North: Bruce Highway															
8	T1	All MCs	419	9.5	419	9.5	0.226	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	53	6.0	53	6.0	0.067	9.8	LOS A	0.2	1.8	0.51	0.73	0.51	55.5
Approach			472	9.2	472	9.2	0.226	1.1	NA	0.2	1.8	0.06	0.08	0.06	76.1
West: Ayr-Dalbeg Road															
10	L2	All MCs	74	8.6	74	8.6	0.292	9.5	LOS A	1.1	8.5	0.68	0.89	0.82	48.7
12	R2	All MCs	36	17.6	36	17.6	0.292	28.3	LOS B	1.1	8.5	0.68	0.89	0.82	47.0
Approach			109	11.5	109	11.5	0.292	15.6	LOS B	1.1	8.5	0.68	0.89	0.82	48.1
All Vehicles			1056	10.8	1056	10.8	0.292	2.4	NA	1.1	8.5	0.10	0.15	0.11	72.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 1 [CONSTRUCTION 2025 AM (Site Folder: 1. Bruce Highway / Ayr-Dalbeg Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Bruce Highway / Ayr-Dalbeg Road
Existing Intersection Configuration
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	21	40.0	21	40.0	0.014	7.7	LOS A	0.0	0.0	0.00	0.63	0.00	53.4
2	T1	All MCs	516	7.3	516	7.3	0.274	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			537	8.6	537	8.6	0.274	0.4	NA	0.0	0.0	0.00	0.02	0.00	78.3
North: Bruce Highway															
8	T1	All MCs	334	8.8	334	8.8	0.179	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	75	15.5	75	15.5	0.114	11.1	LOS A	0.4	3.3	0.56	0.80	0.56	54.1
Approach			408	10.1	408	10.1	0.179	2.1	NA	0.4	3.3	0.10	0.15	0.10	73.5
West: Ayr-Dalbeg Road															
10	L2	All MCs	72	1.5	72	1.5	0.421	11.5	LOS A	1.7	13.1	0.78	1.01	1.10	46.1
12	R2	All MCs	45	34.9	45	34.9	0.421	38.3	LOS C	1.7	13.1	0.78	1.01	1.10	41.1
Approach			117	14.4	117	14.4	0.421	21.9	LOS B	1.7	13.1	0.78	1.01	1.10	44.1
All Vehicles			1062	9.8	1062	9.8	0.421	3.4	NA	1.7	13.1	0.12	0.18	0.16	70.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 1 [CONSTRUCTION 2025 PM (Site Folder: 1. Bruce Highway / Ayr-Dalbeg Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Bruce Highway / Ayr-Dalbeg Road
Existing Intersection Configuration
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	35	15.2	35	15.2	0.021	7.2	LOS A	0.0	0.0	0.00	0.63	0.00	59.9
2	T1	All MCs	440	12.0	440	12.0	0.241	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			475	12.2	475	12.2	0.241	0.6	NA	0.0	0.0	0.00	0.05	0.00	77.9
North: Bruce Highway															
8	T1	All MCs	419	9.5	419	9.5	0.226	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	53	6.0	53	6.0	0.067	9.8	LOS A	0.2	1.8	0.51	0.73	0.51	55.5
Approach			472	9.2	472	9.2	0.226	1.1	NA	0.2	1.8	0.06	0.08	0.06	76.1
West: Ayr-Dalbeg Road															
10	L2	All MCs	102	10.3	102	10.3	0.333	9.9	LOS A	1.4	10.5	0.67	0.90	0.86	48.9
12	R2	All MCs	36	17.6	36	17.6	0.333	29.3	LOS C	1.4	10.5	0.67	0.90	0.86	47.4
Approach			138	12.2	138	12.2	0.333	14.9	LOS B	1.4	10.5	0.67	0.90	0.86	48.5
All Vehicles			1084	10.9	1084	10.9	0.333	2.6	NA	1.4	10.5	0.11	0.17	0.13	71.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 1 [OPERATIONS 2025 AM (Site Folder: 1. Bruce Highway / Ayr-Dalbeg Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Bruce Highway / Ayr-Dalbeg Road
Existing Intersection Configuration
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	21	40.0	21	40.0	0.014	7.7	LOS A	0.0	0.0	0.00	0.63	0.00	53.4
2	T1	All MCs	516	7.3	516	7.3	0.274	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			537	8.6	537	8.6	0.274	0.4	NA	0.0	0.0	0.00	0.02	0.00	78.3
North: Bruce Highway															
8	T1	All MCs	334	8.8	334	8.8	0.179	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	51	16.7	51	16.7	0.078	11.0	LOS A	0.3	2.2	0.55	0.78	0.55	54.1
Approach			384	9.9	384	9.9	0.179	1.5	NA	0.3	2.2	0.07	0.10	0.07	75.2
West: Ayr-Dalbeg Road															
10	L2	All MCs	72	1.5	72	1.5	0.404	11.2	LOS A	1.6	12.5	0.77	0.99	1.07	46.7
12	R2	All MCs	45	34.9	45	34.9	0.404	36.3	LOS C	1.6	12.5	0.77	0.99	1.07	41.6
Approach			117	14.4	117	14.4	0.404	20.9	LOS B	1.6	12.5	0.77	0.99	1.07	44.6
All Vehicles			1038	9.7	1038	9.7	0.404	3.1	NA	1.6	12.5	0.11	0.16	0.15	71.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 1 [OPERATIONS 2025 PM (Site Folder: 1. Bruce Highway / Ayr-Dalbeg Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Bruce Highway / Ayr-Dalbeg Road
Existing Intersection Configuration
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	35	15.2	35	15.2	0.021	7.2	LOS A	0.0	0.0	0.00	0.63	0.00	59.9
2	T1	All MCs	440	12.0	440	12.0	0.241	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			475	12.2	475	12.2	0.241	0.6	NA	0.0	0.0	0.00	0.05	0.00	77.9
North: Bruce Highway															
8	T1	All MCs	419	9.5	419	9.5	0.226	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	53	6.0	53	6.0	0.067	9.8	LOS A	0.2	1.8	0.51	0.73	0.51	55.5
Approach			472	9.2	472	9.2	0.226	1.1	NA	0.2	1.8	0.06	0.08	0.06	76.1
West: Ayr-Dalbeg Road															
10	L2	All MCs	78	9.5	78	9.5	0.299	9.6	LOS A	1.1	8.9	0.68	0.89	0.83	48.6
12	R2	All MCs	36	17.6	36	17.6	0.299	28.5	LOS B	1.1	8.9	0.68	0.89	0.83	47.1
Approach			114	12.0	114	12.0	0.299	15.5	LOS B	1.1	8.9	0.68	0.89	0.83	48.1
All Vehicles			1060	10.8	1060	10.8	0.299	2.4	NA	1.1	8.9	0.10	0.15	0.11	72.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

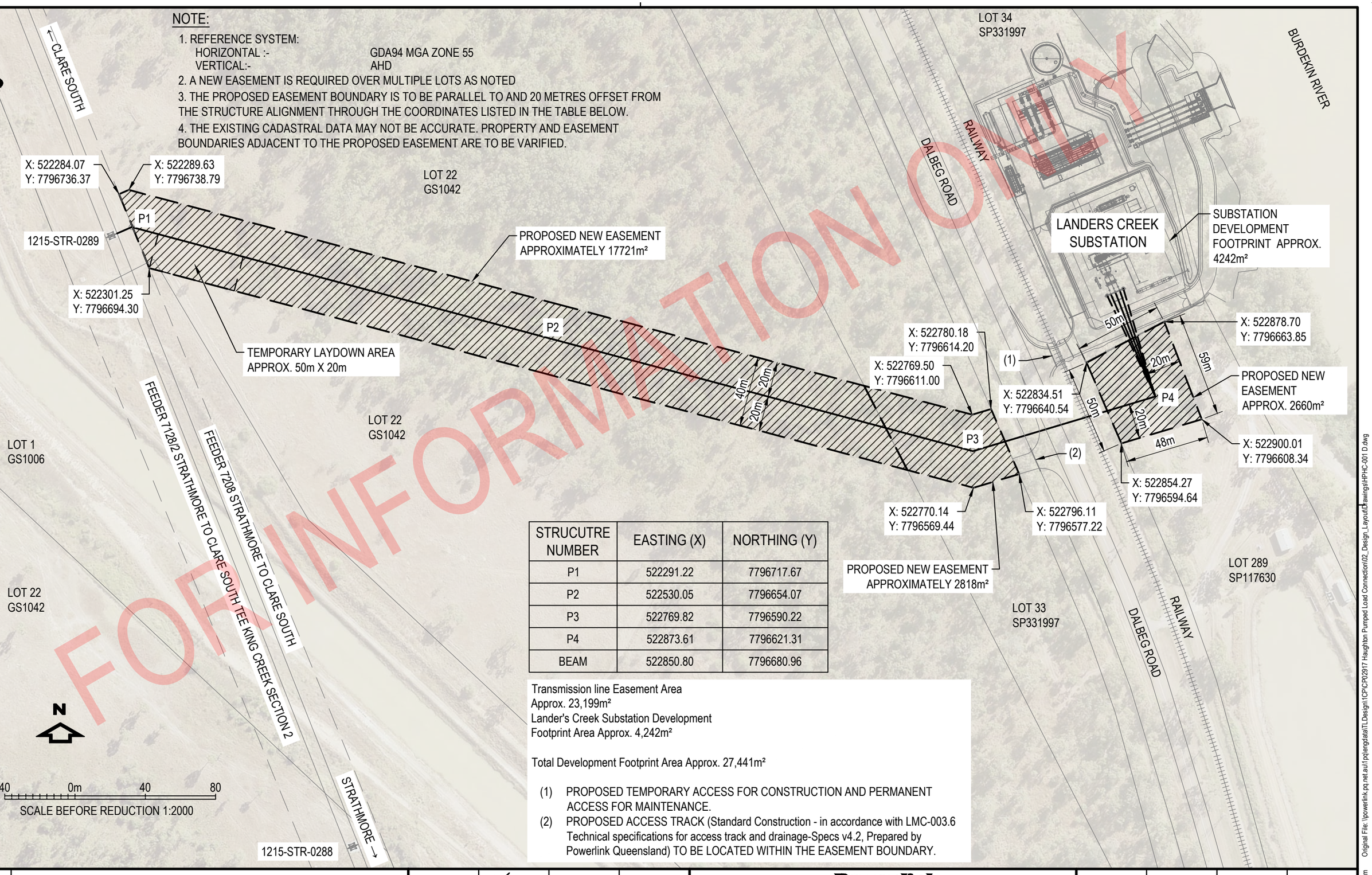
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Appendix D – Plan of Development

NOTE:

1. REFERENCE SYSTEM:
   HORIZONTAL :- GDA94 MGA ZONE 55
   VERTICAL:- AHD
2. A NEW EASEMENT IS REQUIRED OVER MULTIPLE LOTS AS NOTED
3. THE PROPOSED EASEMENT BOUNDARY IS TO BE PARALLEL TO AND 20 METRES OFFSET FROM THE STRUCTURE ALIGNMENT THROUGH THE COORDINATES LISTED IN THE TABLE BELOW.
4. THE EXISTING CADASTRAL DATA MAY NOT BE ACCURATE. PROPERTY AND EASEMENT BOUNDARIES ADJACENT TO THE PROPOSED EASEMENT ARE TO BE VARIFIED.



STRUCUTRE NUMBER	EASTING (X)	NORTHING (Y)
P1	522291.22	7796717.67
P2	522530.05	7796654.07
P3	522769.82	7796590.22
P4	522873.61	7796621.31
BEAM	522850.80	7796680.96

Transmission line Easement Area
Approx. 23,199m²
Lander's Creek Substation Development
Footprint Area Approx. 4,242m²

Total Development Footprint Area Approx. 27,441m²

(1) PROPOSED TEMPORARY ACCESS FOR CONSTRUCTION AND PERMANENT ACCESS FOR MAINTENANCE.
(2) PROPOSED ACCESS TRACK (Standard Construction - in accordance with LMC-003.6 Technical specifications for access track and drainage-Specs v4.2, Prepared by Powerlink Queensland) TO BE LOCATED WITHIN THE EASEMENT BOUNDARY.

CAD 283x394

A	ORIGINAL ISSUE DATE: 20/12/2022				
DRAWN		DESIGN CHKD			
CHECKED		APP ELEC RPEQ No.			
DESIGNED		APP STRUC RPEQ No.			
ORIGIN	PSD				
CIRCULATION	-				

Powerlink QUEENSLAND

LANDERS CREEK SUBSTATION CUT-IN
132kV TRANSMISSION LINE
PROPOSED NEW EASEMENT PLAN

LOCATION	CONT/ORDER	PROJECT	DRG CLASS
7208, 7182/2	-	CP.02917	A0

HPHC-001

NEXT SHEET ---

A B C D

Appendix E – Project Traffic Volume Calculations

AEC0123-002 | Landers Creek Substation & Overhead Transmission Line

Site Properties

Site Components

Element	Qty	Unit
Length of Substation Access Road (via SA1)	130	m
Length of Internal Access Tracks (via SA2)	555	m
Number of Substations (via SA1)	1	ea
Number of Site Laydown Areas (via SA2)	1	ea
Number OHTL Poles (via SA1)	1	ea
Number OHTL Poles (via SA2)	3	ea
Length of OHTL (via SA1)	130	m
Length of OHTL (via SA2)	555	m
% of Gravel Materials Sourced Onsite	0%	%
% of Gravel Materials Imported	100%	%
% of Aggregate Materials Sourced Onsite	0%	%
% of Aggregate Materials Imported	100%	%
% of Water Sourced Onsite	0%	%
% of Water Imported	100%	%

Site Areas

Element	Number	Hardstand Area	Unit	% Concrete	Concrete Area	Unit	Gravel Area	Unit
Substation Area (via SA1)	1	4,250	m2	10%	425	m2	3,825	m2
Site Laydown Area (via SA3)	1	1,000	m2	0%	0	m2	1,000	m2

Concrete Composition

Element	Composition	Unit
Aggregates & Sand	75%	%
Cement	15%	%
Steel	5%	%
Water	5%	%
Total	100%	%

Material Assumptions

Element	Qty	Unit
Substation Access Road Width	8	m
Substation Access Road Pavement Depth	0.4	m
Internal Access Track Width	5	m
Internal Access Track Pavement Depth	0.2	m
Substation / Switching Station Area Slab Concrete Depth	0.2	m
Substation Area Gravel Depth	0.15	m
Site Laydown Area Gravel Depth	0.15	m
Concrete Sand/Aggregates Mass	1.8	t/m3
Concrete Cement Mass	1.51	t/m3
Concrete Steel Mass	7.8	t/m3
Concrete Water Mass	1	t/m3
Wet Concrete Mass	2.5	t/m3
Power Line Length per Roll / Drum	250	m
Power Line Mass per Roll / Drum	2.925	tonnes

Movements

Components & Equipment

Element	Task	Qty per Turbine	Unit	Qty	Transp. Qty	Vehicle Type	Vehicle Capacity	Movements
Transformer (via SA1)	E	-	each	1	1	Special	1	1
Switchroom (via SA1)	E	-	each	1	1	Special	1	1
Electrical Components (via SA1 - Substation)	E	-	each	25	25	Semi	1	25
							Total	**27**

Mobilisation / Site Establishment

Element	Task	Qty per Area	Unit	Qty	Transp. Qty	Vehicle Type	Vehicle Capacity	Movements
Construction Mobilisation - Ancilliary Equipment (via SA1)	A	10	each	10	10	Semi / Low Loader	1	10
Construction Mobilisation - Ancilliary Equipment (via SA2)	A	10	each	10	10	Semi / Low Loader	1	10
Construction Mobilisation - EW Plant (via SA1)	A	5	each	5	5	Semi / Low Loader	1	5
Construction Mobilisation - EW Plant (via SA2)	A	5	each	5	5	Semi / Low Loader	1	5
Construction Compound Establishment & Buildings (via SA2)	A	5	each	5	5	Semi / Low Loader	1	5
Substation Area Establishment & Buildings (via SA1)	E	10	each	10	10	Semi	1	10
							Total	**45**

Demobilisation / Commissioning

Element	Task	Qty per Area	Unit	Qty	Transp. Qty	Vehicle Type	Vehicle Capacity	Movements
Construction Mobilisation - Ancilliary Equipment (via SA1)	F	10	each	10	10	Semi / Low Loader	1	10
Construction Mobilisation - Ancilliary Equipment (via SA2)	F	10	each	10	10	Semi / Low Loader	1	10
Construction Mobilisation - EW Plant (via SA1)	F	5	each	5	5	Semi / Low Loader	1	5
Construction Mobilisation - EW Plant (via SA2)	F	5	each	5	5	Semi / Low Loader	1	5
Construction Compound Establishment & Buildings (via SA2)	F	5	each	5	5	Semi / Low Loader	1	5
							Total	**35**

Construction Materials

Element	Task	Qty per Unit	Unit	Volume (m3)	Site Qty (tonnes)	Site Trasnport Qty (tonnes)	Vehicle Type	Vehicle Capacity (tonnes)	Movements
Substation Access Road Gravel Pavement Materials (via SA1)	B	1.8	t/m3	416	749	749	Truck & 3 Axle Dog	29.5	26
Internal Access Track Gravel Pavement Materials (via SA2)	B	1.8	t/m3	555	999	999	Truck & 3 Axle Dog	29.5	34
Site Access SA1 Upgrade Pavement Materials (via SA1)	B	1.8	t/m3	100	180	180	Truck & 3 Axle Dog	29.5	7
Site Access SA2 Upgrade Pavement Materials (via SA2)	B	1.8	t/m3	100	180	180	Truck & 3 Axle Dog	29.5	7
Substation Access Road - Concrete for K&C (via SA1)	B						Concrete Truck	-	5
Substation Access Road - Surfacing (via SA1)	B						Semi	-	5
Substation (SA1) Slab Wet Concrete	C	2.5	t/m3	85	213	213	Concrete Truck	14.4	15
Substation (SA1) Slab Reinforcing Steel	C	7.8	t/m3	4	33	33	Semi	26.5	2
Substation Area Gravel (via SA1)	C	1.8	t/m3	574	1,033	1,033	Truck & 3 Axle Dog	29.5	36
Site Laydown Area Gravel (via SA2)	C	1.8	t/m3	150	270	270	Truck & 3 Axle Dog	29.5	10
Formwork (via SA1)	C						Semi	1	1
Overhead Powerline Cable (via SA1)	D				6	6	Semi	26.5	1
OHTL Pole Foundation Concrete (via SA1)	D						Concrete Truck	-	2
Overhead Powerline Cable (via SA2)	D				26	26	Semi	26.5	1
OHTL Pole Foundation Concrete (via SA2)	D						Concrete Truck	-	6
Site Water (via SA1)	W						Semi Water Truck	-	20
Site Water (via SA2)	W						Semi Water Truck	-	10
								Total	**188**

AEC0123-002 | Landers Creek Substation & Overhead Transmission Line

Site Vehicle Movement Summary

Assumed Work Days per Month 24 days

TASK A - MOBILISATION AND ESTABLISHMENT

Task Transport Duration (over 6 days) 1 month

Activity Description	Project Volume	Vehicle	Project Vol Distrib	Origin	Route
Construction Mobilisation - Ancilliary Equipment (via SA1)	10	Semi / Low Loader	100%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA1
Construction Mobilisation - Ancilliary Equipment (via SA2)	10	Semi / Low Loader	100%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA2
Construction Mobilisation - EW Plant (via SA1)	5	Semi / Low Loader	100%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA1
Construction Mobilisation - EW Plant (via SA2)	5	Semi / Low Loader	100%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA2
Construction Compound Establishment & Buildings (via SA2)	5	Semi / Low Loader	100%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA2

Road Section	Total Trips	Trips / Month	Max. Trips / Day
Townsville Port Road (Port to Bruce Highway)	0	0	0
Bruce Highway 10L (10M to Townsville Port Road)	35	35	2
Bruce Highway 10L (Townsville Port Road to Ayr)	35	35	2
Bruce Highway 10K (Ayr to Ayr-Dalbeg Road)	35	35	2
Ayr-Dalbeg Road (Bruce Highway to BQC Quarries)	35	35	2
Ayr-Dalbeg Road (BQC Quarries to SA1)	35	35	2
Ayr-Dalbeg Road (SA1 to SA2)	20	20	1

TASK B - SITE ENTRANCES & ACCESS ROADS

Task Transport Duration 2 months

Activity Description	Project Volume	Vehicle	Project Vol Distrib	Origin	Route
Substation Access Road Gravel Pavement Materials (via SA1)	26	Truck & 3 Axle Dog	100%	BQC Quarries	Ayr-Dalbeg Road - SA1
Internal Access Track Gravel Pavement Materials (via SA2)	34	Truck & 3 Axle Dog	100%	BQC Quarries	Ayr-Dalbeg Road - SA2
Site Access SA1 Upgrade Pavement Materials (via SA1)	7	Truck & 3 Axle Dog	100%	BQC Quarries	Ayr-Dalbeg Road - SA1
Site Access SA2 Upgrade Pavement Materials (via SA2)	7	Truck & 3 Axle Dog	100%	BQC Quarries	Ayr-Dalbeg Road - SA2
Substation Access Road - Concrete for K&C (via SA1)	5	Concrete Truck	100%	Ayr	Bruce Highway - Ayr-Dalbeg Road - SA1
Substation Access Road - Surfacing (via SA1)	5	Semi	100%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA1

Road Section	Total Trips	Trips / Month	Max. Trips / Day
Townsville Port Road (Port to Bruce Highway)	0	0	0
Bruce Highway 10L (10M to Townsville Port Road)	5	3	1
Bruce Highway 10L (Townsville Port Road to Ayr)	5	3	1
Bruce Highway 10K (Ayr to Ayr-Dalbeg Road)	10	5	1
Ayr-Dalbeg Road (Bruce Highway to BQC Quarries)	10	5	1
Ayr-Dalbeg Road (BQC Quarries to SA1)	84	42	2
Ayr-Dalbeg Road (SA1 to SA2)	41	21	1

TASK C - SITE AREAS (CIVIL WORKS)

Task Transport Duration 3 months

Activity Description	Project Volume	Vehicle	Project Vol Distrib	Origin	Route
Substation (SA1) Slab Wet Concrete	15	Concrete Truck	100%	Ayr	Bruce Highway - Ayr-Dalbeg Road - SA1
Substation (SA1) Slab Reinforcing Steel	2	Semi	100%	Ayr	Bruce Highway - Ayr-Dalbeg Road - SA1
Substation Area Gravel (via SA1)	36	Truck & 3 Axle Dog	100%	BQC Quarries	Ayr-Dalbeg Road - SA1
Site Laydown Area Gravel (via SA2)	10	Truck & 3 Axle Dog	100%	BQC Quarries	Ayr-Dalbeg Road - SA2
Formwork (via SA1)	1	Semi	100%	Ayr	Bruce Highway - Ayr-Dalbeg Road - SA1

Road Section	Total Trips	Trips / Month	Max. Trips / Day
Townsville Port Road (Port to Bruce Highway)	0	0	0
Bruce Highway 10L (10M to Townsville Port Road)	0	0	0
Bruce Highway 10L (Townsville Port Road to Ayr)	0	0	0
Bruce Highway 10K (Ayr to Ayr-Dalbeg Road)	18	6	1
Ayr-Dalbeg Road (Bruce Highway to BQC Quarries)	18	6	1
Ayr-Dalbeg Road (BQC Quarries to SA1)	64	22	1
Ayr-Dalbeg Road (SA1 to SA2)	10	4	1

TASK D - CABLING

Task Transport Duration 1 months

Activity Description	Project Volume	Vehicle	Project Vol Distrib	Origin	Route
Overhead Powerline Cable (via SA1)	1	Semi	100%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA1
OHTL Pole Foundation Concrete (via SA1)	2	Concrete Truck	100%	Ayr	Bruce Highway - Ayr-Dalbeg Road - SA1
Overhead Powerline Cable (via SA2)	1	Semi	100%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA2
OHTL Pole Foundation Concrete (via SA2)	6	Concrete Truck	100%	Ayr	Bruce Highway - Ayr-Dalbeg Road - SA2

Road Section	Total Trips	Trips / Month	Max. Trips / Day
Townsville Port Road (Port to Bruce Highway)	0	0	0
Bruce Highway 10L (10M to Townsville Port Road)	2	2	1
Bruce Highway 10L (Townsville Port Road to Ayr)	2	2	1
Bruce Highway 10K (Ayr to Ayr-Dalbeg Road)	10	10	1
Ayr-Dalbeg Road (Bruce Highway to BQC Quarries)	10	10	1
Ayr-Dalbeg Road (BQC Quarries to SA1)	10	10	1
Ayr-Dalbeg Road (SA1 to SA2)	7	7	1

TASK E - SITE AREAS (ELECTRICAL WORKS)

Task Transport Duration 1 months

Activity Description	Project Volume	Vehicle	Project Vol Distrib	Origin	Route
Transformer (via SA1)	1	Special	100%	Townsville Port	Bruce Highway - Ayr-Dalbeg Road - SA1
Switchroom (via SA1)	1	Special	100%	Townsville Port	Bruce Highway - Ayr-Dalbeg Road - SA2
Electrical Components (via SA1 - Substation)	25	Semi	100%	Townsville Port	Bruce Highway - Ayr-Dalbeg Road - SA3
Substation Area Establishment & Buildings (via SA1)	10	Semi	100%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA4

Road Section	Total Trips	Trips / Month	Max. Trips / Day
Townsville Port Road (Port to Bruce Highway)	27	27	2
Bruce Highway 10L (10M to Townsville Port Road)	10	10	1
Bruce Highway 10L (Townsville Port Road to Ayr)	37	37	2
Bruce Highway 10K (Ayr to Ayr-Dalbeg Road)	37	37	2
Ayr-Dalbeg Road (Bruce Highway to BQC Quarries)	37	37	2
Ayr-Dalbeg Road (BQC Quarries to SA1)	37	37	2
Ayr-Dalbeg Road (SA1 to SA2)	0	0	0

TASK F - FINALISATION / COMMISSIONING / DEMOBILISATION

Task Transport Duration 1 month

Activity Description	Project Volume	Vehicle	Project Vol Distrib	Origin	Route
Construction Mobilisation - Ancilliary Equipment (via SA1)	10	Semi / Low Loader	50%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA1
Construction Mobilisation - Ancilliary Equipment (via SA2)	10	Semi / Low Loader	50%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA2
Construction Mobilisation - EW Plant (via SA1)	5	Semi / Low Loader	50%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA1
Construction Mobilisation - EW Plant (via SA2)	5	Semi / Low Loader	50%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA2
Construction Compound Establishment & Buildings (via SA2)	5	Semi / Low Loader	50%	Townsville	Bruce Highway - Ayr-Dalbeg Road - SA2

Road Section	Total Trips	Trips / Month	Max. Trips / Day
Townsville Port Road (Port to Bruce Highway)	0	0	0
Bruce Highway 10L (10M to Townsville Port Road)	35	35	2
Bruce Highway 10L (Townsville Port Road to Ayr)	35	35	2
Bruce Highway 10K (Ayr to Ayr-Dalbeg Road)	35	35	2
Ayr-Dalbeg Road (Bruce Highway to BQC Quarries)	35	35	2
Ayr-Dalbeg Road (BQC Quarries to SA1)	35	35	2
Ayr-Dalbeg Road (SA1 to SA2)	20	20	1

TASK W - SITE WATER

Task Transport Duration 3 months

Activity Description	Project Volume	Vehicle	Project Vol Distrib	Origin	Route
Site Water (via SA1)	20	Semi Water Truck	100%	Ayr	Bruce Highway - Ayr-Dalbeg Road - SA1
Site Water (via SA2)	10	Semi Water Truck	100%	Ayr	Bruce Highway - Ayr-Dalbeg Road - SA2

Road Section	Total Trips	Trips / Month	Max. Trips / Day
Townsville Port Road (Port to Bruce Highway)	0	0	0
Bruce Highway 10L (10M to Townsville Port Road)	0	0	0
Bruce Highway 10L (Townsville Port Road to Ayr)	0	0	0
Bruce Highway 10K (Ayr to Ayr-Dalbeg Road)	30	10	1
Ayr-Dalbeg Road (Bruce Highway to BQC Quarries)	30	10	1
Ayr-Dalbeg Road (BQC Quarries to SA1)	30	10	1
Ayr-Dalbeg Road (SA1 to SA2)	10	4	1

AEC0123-002 | Landers Creek Substation & Overhead Transmission Line

Project Staff Movements

Project Timeframe

Element	Qty	Unit
Hours per day	12	hrs
Working days per week	6	days
Working days per month	24	days
Expected project length	9	months

Construction Workforce

Element	Qty	Unit
Peak Workforce	50	staff
Local Workforce	100%	%

Construction Workforce Distribution

Location	Distribution	Unit	Qty	Vehicle Type	% Vehicle	Staff No. per Vehicle Type	Average Vehicle Capacity	Movements Round Trip (per day)
Local Workforce								
Townsville	100%	%	50	LV	80%	40	2	20
				Work Truck (3-Axle Rigid)	20%	10	2	5
							Total	**25**
							via SA1	**13**
							via SA2	**13**

Operations Workforce

Element	Qty	Unit
Peak Operations Workforce	4	staff
Local Workforce	100%	%

Construction Workforce Distribution

Location	Distribution	Unit	Qty	Vehicle Type	% Vehicle	Staff No. per Vehicle Type	Average Vehicle Capacity	Movements Round Trip (per day)
Local Workforce								
Townsville	100%	%	4	LV	80%	3	2	2
				Work Truck (3-Axle Rigid)	20%	1	2	1
							Total	**3**
							via SA1	**2**
							via SA2	**2**

Appendix F – Project Traffic Impact Calculations

ACCESS TRAFFIC CONSULTING

AEC0123-002 | Landers Creek Substation & Overhead Transmission Line

Project Traffic Impact % Calculations

Road ID	Road Description	AADT Segment	AADT Segment		Base Data Year	Base Year AADT			Base Year HV%		Base Year HV		10 Yr GR%	2025 AADT			2025 HV	
			Start (km)	End (km)		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz
841	Townsville Port Road (Bruce Hwy to Port)	92206	0.000	7.336	2022	1,408	1,278	2,686	29.17%	30.83%	411	394	*1.00%*	1,451	1,317	2,767	423	406
		92236	7.336	7.811	2022	2,007	1,812	3,819	22.36%	28.92%	449	524	*1.00%*	2,068	1,867	3,935	462	540
10M	Bruce Highway (Townsville - Ingham)	92177	0.000	2.544	2022	6,807	6,771	13,578	17.37%	9.12%	1,182	618	1.12%	7,038	7,001	14,039	1,223	638
		92204	2.544	3.853	2022	6,877	7,147	14,024	15.94%	20.48%	1,096	1,464	*1.00%*	7,085	7,364	14,449	1,129	1,508
		92178	3.853	8.635	2022	17,280	18,584	35,864	2.93%	16.79%	506	3,120	3.17%	18,976	20,408	39,384	556	3,426
10L	Bruce Highway (Ayr - Townsville)	91398	0.000	2.150	2022	2,448	2,720	5,168	14.44%	13.09%	353	356	*1.00%*	2,522	2,802	5,325	364	367
		91399	2.150	6.439	2022	3,442	3,400	6,842	13.35%	27.87%	460	948	*1.00%*	3,546	3,503	7,049	473	976
		91699	6.439	64.166	2022	2,928	2,813	5,741	19.93%	19.01%	584	535	1.37%	3,050	2,930	5,980	608	557
		92216	64.166	66.821	2022	4,163	4,057	8,220	23.05%	22.12%	960	897	1.86%	4,400	4,288	8,687	1,014	948
		92201	66.821	77.913	2022	7,502	7,588	15,090	14.93%	13.73%	1,120	1,042	*3.68%*	8,361	8,457	16,818	1,248	1,161
10K	Bruce Highway (Bowen-Ayr)	90004	**105.415**	108.960	2022	4,447	4,482	8,929	13.47%	12.69%	599	569	*1.00%*	4,582	4,618	9,200	617	586
		91443	108.960	110.550	2022	5,230	5,198	10,428	19.33%	11.46%	1,011	596	*1.00%*	5,388	5,356	10,744	1,042	614
		91396	110.550	112.120	2022	3,020	2,482	5,502	7.06%	3.10%	213	77	*1.00%*	3,112	2,557	5,669	220	79
545	Ayr - Dalbeg Road	91502	0.000	**14.620**	2022	442	438	880	18.20%	33.60%	80	147	*1.00%*	455	451	907	83	152
		90018	**14.620**	36.452	2022	218	218	436	19.24%	23.99%	42	52	*1.00%*	225	225	449	43	54
		91478	36.452	**42.235**	2022	74	76	150	5.90%	12.78%	4	10	*1.00%*	76	78	155	4	10
			42.235	**42.285**	2022	74	76	150	5.90%	12.78%	4	10	*1.00%*	76	78	155	4	10

Project Operations Volumes		
Gaz	A-Gaz	Bi-Dir
0	0	0
0	0	0
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8
4	4	8

In Operations Volumes		
Gaz	A-Gaz	Bi-Dir
1,451	1,317	2,767
2,068	1,867	3,935
7,042	7,005	14,047
7,089	7,368	14,457
18,980	20,412	39,392
2,526	2,806	5,333
3,550	3,507	7,057
3,054	2,934	5,988
4,404	4,292	8,695
8,365	8,461	16,826
4,586	4,622	9,208
5,392	5,360	10,752
3,116	2,561	5,677
459	455	915
229	229	457
80	82	163
80	82	163

Dev Traffic % Impact - Construction		
Gaz %	A-Gaz %	Bi-Dir %
0.00%	0.00%	0.00%
0.00%	0.00%	0.00%
0.06%	0.06%	0.06%
0.06%	0.05%	0.06%
0.02%	0.02%	0.02%
0.16%	0.14%	0.15%
0.11%	0.11%	0.11%
0.13%	0.14%	0.13%
0.09%	0.09%	0.09%
0.05%	0.05%	0.05%
0.09%	0.09%	0.09%
0.07%	0.07%	0.07%
0.13%	0.16%	0.14%
0.88%	0.89%	0.88%
1.78%	1.78%	1.78%
5.25%	**5.11%**	**5.18%**
5.25%	**5.11%**	**5.18%**

** Max Daily Volumes expected for peak construction period which includes Tasks C,D & E as well as general water and peak staff movements.

Road ID	Road Description	AADT Segment	AADT Segment		Project Traffic																		
			Start (km)	End (km)	Gazettal									A-Gazettal									Bi-Dir
					A	B	C	D	E	F	Water	Staff	Max	A	B	C	D	E	F	Water	Staff	Max	
841	Townsville Port Road (Bruce Hwy to Port)	92206	0.000	7.336	0	0	0	0	2	0	0	0	**2**	0	0	0	0	2	0	0	0	**2**	**4**
		92236	7.336	7.811	0	0	0	0	2	0	0	0	**2**	0	0	0	0	2	0	0	0	**2**	**4**
10M	Bruce Highway (Townsville - Ingham)	92177	0.000	2.544	2	1	0	1	1	2	0	25	**27**	2	1	0	1	1	2	0	25	**27**	**54**
		92204	2.544	3.853	2	1	0	1	1	2	0	25	**27**	2	1	0	1	1	2	0	25	**27**	**54**
		92178	3.853	8.635	2	1	0	1	1	2	0	25	**27**	2	1	0	1	1	2	0	25	**27**	**54**
10L	Bruce Highway (Ayr - Townsville)	91398	0.000	2.150	2	1	0	1	2	2	0	25	**28**	2	1	0	1	2	2	0	25	**28**	**56**
		91399	2.150	6.439	2	1	0	1	2	2	0	25	**28**	2	1	0	1	2	2	0	25	**28**	**56**
		91699	6.439	64.166	2	1	0	1	2	2	0	25	**28**	2	1	0	1	2	2	0	25	**28**	**56**
		92216	64.166	66.821	2	1	0	1	2	2	0	25	**28**	2	1	0	1	2	2	0	25	**28**	**56**
		92201	66.821	77.913	2	1	0	1	2	2	0	25	**28**	2	1	0	1	2	2	0	25	**28**	**56**
10K	Bruce Highway (Bowen-Ayr)	90004	**105.415**	108.960	2	1	1	1	2	2	1	25	**30**	2	1	1	1	2	2	1	25	**30**	**60**
		91443	108.960	110.550	2	1	1	1	2	2	1	25	**30**	2	1	1	1	2	2	1	25	**30**	**60**
		91396	110.550	112.120	2	1	1	1	2	2	1	25	**30**	2	1	1	1	2	2	1	25	**30**	**60**
545	Ayr - Dalbeg Road	91502	0.000	**14.620**	2	1	1	1	2	2	1	25	**30**	2	1	1	1	2	2	1	25	**30**	**60**
		90018	**14.620**	36.452	2	2	1	1	2	2	1	25	**30**	2	2	1	1	2	2	1	25	**30**	**60**
		91478	36.452	**42.235**	2	2	1	1	2	2	1	25	**30**	2	2	1	1	2	2	1	25	**30**	**60**
			42.235	**42.285**	1	1	1	1	0	1	1	13	**16**	1	1	0	1	0	0	1	13	**15**	**31**

Dev Traffic % Impact - Construction		
Gaz %	A-Gaz %	Bi-Dir %
0.14%	0.15%	0.14%
0.10%	0.11%	0.10%
0.38%	0.39%	0.38%
0.38%	0.37%	0.37%
0.14%	0.13%	0.14%
1.11%	1.00%	1.05%
0.79%	0.80%	0.79%
0.92%	0.96%	0.94%
0.64%	0.65%	0.64%
0.33%	0.33%	0.33%
0.65%	0.65%	0.65%
0.56%	0.56%	0.56%
0.96%	1.17%	1.06%
6.59%	**6.65%**	**6.62%**
13.36%	**13.36%**	**13.36%**
39.35%	**38.31%**	**38.82%**
20.99%	**19.16%**	**20.06%**

In Construction Volumes		
Gaz	A-Gaz	Bi-Dir
1,453	1,319	2,771
2,070	1,869	3,939
7,065	7,028	14,093
7,112	7,391	14,503
19,003	20,435	39,438
2,550	2,830	5,381
3,574	3,531	7,105
3,078	2,958	6,036
4,428	4,316	8,743
8,389	8,485	16,874
4,612	4,648	9,260
5,418	5,386	10,804
3,142	2,587	5,729
485	481	967
255	255	509
106	108	215
92	93	186

Appendix G – Project Pavement Impact Calculations

AEC0123-002 | Landers Creek Substation & Overhead Transmission Line

Project Pavement Loadings

TASK A - MOBILISATION AND ESTABLISHMENT

Activity Description	Project Volume	Vehicle	Origin
Construction Mobilisation - Ancilliary Equipment (via SA1)	10	Semi / Low Loader	Townsville
Construction Mobilisation - Ancilliary Equipment (via SA2)	10	Semi / Low Loader	Townsville
Construction Mobilisation - EW Plant (via SA1)	5	Semi / Low Loader	Townsville
Construction Mobilisation - EW Plant (via SA2)	5	Semi / Low Loader	Townsville
Construction Compound Establishment & Buildings (via SA2)	5	Semi / Low Loader	Townsville

Semi Unloaded (0%)	0.51	ESAs
Semi Loaded (100%)	4.93	ESAs

Route Summary	Loaded	Unloaded
Townsville to Site Access 1	74	8
Townsville to Site Access 2	99	10

TASK B - SITE ENTRANCES & ACCESS ROADS

Activity Description	Project Volume	Vehicle	Origin
Substation Access Road Gravel Pavement Materials (via SA1)	26	Truck & 3 Axle Dog	BQC Quarries
Internal Access Track Gravel Pavement Materials (via SA2)	34	Truck & 3 Axle Dog	BQC Quarries
Site Access SA1 Upgrade Pavement Materials (via SA1)	7	Truck & 3 Axle Dog	BQC Quarries
Site Access SA2 Upgrade Pavement Materials (via SA2)	7	Truck & 3 Axle Dog	BQC Quarries
Substation Access Road - Concrete for K&C (via SA1)	5	Concrete Truck	Ayr
Substation Access Road - Surfacing (via SA1)	5	Semi	Townsville

Truck & 3 Axle Dog Unloaded (0%)	0.57	ESAs
Truck & 3 Axle Dog Loaded (100%)	7.06	ESAs
Semi Unloaded (0%)	0.51	ESAs
Semi Loaded (100%)	4.93	ESAs

Route Summary	Loaded	Unloaded
Townsville to Site Access 1	25	3
Ayr to Site Access 1	25	3
BQC Quarry to Site Access 1	233	19
BQC Quarry to Site Access 2	289	23

TASK C - SITE AREAS (CIVIL WORKS)

Activity Description	Project Volume	Vehicle	Origin
Substation (SA1) Slab Wet Concrete	15	Concrete Truck	Ayr
Substation (SA1) Slab Reinforcing Steel	2	Semi	Ayr
Substation Area Gravel (via SA1)	36	Truck & 3 Axle Dog	BQC Quarries
Site Laydown Area Gravel (via SA2)	10	Truck & 3 Axle Dog	BQC Quarries
Formwork (via SA1)	1	Semi	Ayr

Truck & 3 Axle Dog Unloaded (0%)	0.57	ESAs
Truck & 3 Axle Dog Loaded (100%)	7.06	ESAs
Semi Unloaded (0%)	0.51	ESAs
Semi Loaded (100%)	4.93	ESAs

Route Summary	Loaded	Unloaded
Ayr to Site Access 1	89	9
BQC Quarry to Site Access 1	254	21
BQC Quarry to Site Access 2	71	6

TASK D - CABLING

Activity Description	Project Volume	Vehicle	Origin
Overhead Powerline Cable (via SA1)	1	Semi	Townsville
OHTL Pole Foundation Concrete (via SA1)	2	Concrete Truck	Ayr
Overhead Powerline Cable (via SA2)	1	Semi	Townsville
OHTL Pole Foundation Concrete (via SA2)	6	Concrete Truck	Ayr

Semi Unloaded (0%)	0.51	ESAs
Semi Loaded (100%)	4.93	ESAs

Route Summary	Loaded	Unloaded
Townsville to Site Access 1	5	1
Ayr to Site Access 1	10	1
Townsville to Site Access 2	5	1
Ayr to Site Access 2	30	3

TASK E - SITE AREAS (ELECTRICAL WORKS)

Activity Description	Project Volume	Vehicle	Origin
Transformer (via SA1)	1	Special	Townsville Port
Switchroom (via SA1)	1	Special	Townsville Port
Electrical Components (via SA1 - Substation)	25	Semi	Townsville Port
Substation Area Establishment & Buildings (via SA1)	10	Semi	Townsville

Transformer Unloaded (0%)	1.87	ESAs
Transformer Loaded (100%)	8.46	ESAs
Switchroom Unloaded (0%)	1.87	ESAs
Switchroom Loaded (100%)	8.46	ESAs
Semi Unloaded (0%)	0.51	ESAs
Semi Loaded (100%)	4.93	ESAs

Route Summary	Loaded	Unloaded
Townsville Port to Site Access 1	8	2
Townsville to Site Access 2	181	20

TASK F - FINALISATION / COMMISSIONING / DEMOBILISATION

Activity Description	Project Volume	Vehicle	Origin
Construction Mobilisation - Ancilliary Equipment (via SA1)	10	Semi / Low Loader	Townsville
Construction Mobilisation - Ancilliary Equipment (via SA2)	10	Semi / Low Loader	Townsville
Construction Mobilisation - EW Plant (via SA1)	5	Semi / Low Loader	Townsville
Construction Mobilisation - EW Plant (via SA2)	5	Semi / Low Loader	Townsville
Construction Compound Establishment & Buildings (via SA2)	5	Semi / Low Loader	Townsville

Semi Unloaded (0%)	0.51	ESAs
Semi Loaded (100%)	4.93	ESAs

Route Summary	Loaded	Unloaded
Townsville to Site Access 1	74	8
Townsville to Site Access 2	99	10

TASK W - SITE WATER

Activity Description	Project Volume	Vehicle	Origin
Site Water (via SA1)	20	Semi Water Truck	Ayr
Site Water (via SA2)	10	Semi Water Truck	Ayr

Semi Unloaded (0%)	0.51	ESAs
Semi Loaded (100%)	4.93	ESAs

Route Summary	Loaded	Unloaded
Ayr to Site Access 1	99	10
Ayr to Site Access 2	49	5

STAFF MOVEMENTS - Note Assume 50% Loaded both to/from site

Activity Description	Project Volume	Vehicle	Origin
Staff Trucks to Site	1,080	3 Axle Rigid	Townsville

3 Axle Rigid Truck (0%)	0.50	ESAs
3 Axle Rigid Truck (50%)	2.04	ESAs
3 Axle Rigid Truck (100%)	3.57	ESAs

Route Summary	Loaded	Unloaded
Townsville to Site	2,198	2,198

AEC0123-002 | Landers Creek Substation & Overhead Transmission Line

Project Pavement Impact % Calculations

Road ID	Road Description	AADT Segment	AADT Segment		Base Data Year	Base Year AADT			Base Year HV%		Base Year HV		10 Yr GR%	2025 AADT			2025 HV		Project Duration (Days)	ESAs per HV	Background Loading ESAs		
			Start (km)	End (km)		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz			Gaz	A-Gaz	Bi-Dir
841	Townsville Port Road (Bruce Hwy to Port)	92206	0.000	7.336	2022	1,408	1,278	2,686	29.17%	30.83%	411	394	*1.00%*	1,451	1,317	2,767	423	406	274	3.2	371,025	355,934	726,959
		92236	7.336	7.811	2022	2,007	1,812	3,819	22.36%	28.92%	449	524	*1.00%*	2,068	1,867	3,935	462	540	274	3.2	405,400	473,392	878,792
10M	Bruce Highway (Townsville - Ingham)	92177	0.000	2.544	2022	6,807	6,771	13,578	17.37%	9.12%	1,182	618	1.12%	7,038	7,001	14,039	1,223	638	274	2.9	971,439	507,350	1,478,788
		92204	2.544	3.853	2022	6,877	7,147	14,024	15.94%	20.48%	1,096	1,464	*1.00%*	7,085	7,364	14,449	1,129	1,508	274	2.9	897,429	1,198,302	2,095,731
		92178	3.853	8.635	2022	17,280	18,584	35,864	2.93%	16.79%	506	3,120	3.17%	18,976	20,408	39,384	556	3,426	274	2.9	441,794	2,722,693	3,164,488
10L	Bruce Highway (Ayr - Townsville)	91398	0.000	2.150	2022	2,448	2,720	5,168	14.44%	13.09%	353	356	*1.00%*	2,522	2,802	5,325	364	367	274	2.9	289,395	291,488	580,884
		91399	2.150	6.439	2022	3,442	3,400	6,842	13.35%	27.87%	460	948	*1.00%*	3,546	3,503	7,049	473	976	274	2.9	376,188	775,762	1,151,950
		91699	6.439	64.166	2022	2,928	2,813	5,741	19.93%	19.01%	584	535	1.37%	3,050	2,930	5,980	608	557	274	2.9	483,009	442,618	925,627
		92216	64.166	66.821	2022	4,163	4,057	8,220	23.05%	22.12%	960	897	1.86%	4,400	4,288	8,687	1,014	948	274	2.9	805,818	753,615	1,559,433
		92201	66.821	77.913	2022	7,502	7,588	15,090	14.93%	13.73%	1,120	1,042	*3.68%*	8,361	8,457	16,818	1,248	1,161	274	2.9	991,906	922,638	1,914,544
10K	Bruce Highway (Bowen-Ayr)	90004	**105.415**	108.960	2022	4,447	4,482	8,929	13.47%	12.69%	599	569	*1.00%*	4,582	4,618	9,200	617	586	274	2.9	490,397	465,636	956,032
		91443	108.960	110.550	2022	5,230	5,198	10,428	19.33%	11.46%	1,011	596	*1.00%*	5,388	5,356	10,744	1,042	614	274	2.9	827,649	487,678	1,315,328
		91396	110.550	112.120	2022	3,020	2,482	5,502	7.06%	3.10%	213	77	*1.00%*	3,112	2,557	5,669	220	79	274	2.9	174,552	62,991	237,542
545	Ayr - Dalbeg Road	91502	0.000	**14.620**	2022	442	438	880	18.20%	33.60%	80	147	*1.00%*	455	451	907	83	152	274	3.2	72,671	132,947	205,617
		90018	**14.620**	36.452	2022	218	218	436	19.24%	23.99%	42	52	*1.00%*	225	225	449	43	54	274	3.2	37,890	47,245	85,135
		91478	36.452	**42.235**	2022	74	76	150	5.90%	12.78%	4	10	*1.00%*	76	78	155	4	10	274	3.2	3,944	8,774	12,718
			42.235	**42.285**	2022	74	76	150	5.90%	12.78%	4	10	*1.00%*	76	78	155	4	10	274	3.2	3,944	8,774	12,718

** Max Daily Volumes expected for peak construction period which includes Tasks C,D & E as well as general water and peak staff movements.

Road ID	Road Description	AADT Segment	AADT Segment		Project Traffic																		Bi-Dir
			Start (km)	End (km)	Gazettal									A-Gazettal									
					A	B	C	D	E	F	Water	Staff	Total	A	B	C	D	E	F	Water	Staff	Total	
841	Townsville Port Road (Bruce Hwy to Port)	92206	0.000	7.336	0	0	0	0	2	0	0	0	**2**	0	0	0	0	8	0	0	0	**8**	**10**
		92236	7.336	7.811	0	0	0	0	2	0	0	0	**2**	0	0	0	0	8	0	0	0	**8**	**10**
10M	Bruce Highway (Townsville - Ingham)	92177	0.000	2.544	18	3	0	1	22	18	0	2,198	**2259**	173	25	0	10	189	173	0	2,198	**2767**	**5026**
		92204	2.544	3.853	18	3	0	1	22	18	0	2,198	**2259**	173	25	0	10	189	173	0	2,198	**2767**	**5026**
		92178	3.853	8.635	18	3	0	1	22	18	0	2,198	**2259**	173	25	0	10	189	173	0	2,198	**2767**	**5026**
10L	Bruce Highway (Ayr - Townsville)	91398	0.000	2.150	18	3	0	1	22	18	0	2,198	**2259**	173	25	0	10	189	173	0	2,198	**2767**	**5026**
		91399	2.150	6.439	18	3	0	1	22	18	0	2,198	**2259**	173	25	0	10	189	173	0	2,198	**2767**	**5026**
		91699	6.439	64.166	18	3	0	1	22	18	0	2,198	**2259**	173	25	0	10	189	173	0	2,198	**2767**	**5026**
		92216	64.166	66.821	18	3	0	1	22	18	0	2,198	**2259**	173	25	0	10	189	173	0	2,198	**2767**	**5026**
		92201	66.821	77.913	18	3	0	1	22	18	0	2,198	**2259**	173	25	0	10	189	173	0	2,198	**2767**	**5026**
10K	Bruce Highway (Bowen-Ayr)	90004	**105.415**	108.960	18	5	9	5	22	18	15	2,198	**2290**	173	49	89	49	189	173	148	2,198	**3068**	**5357**
		91443	108.960	110.550	18	5	9	5	22	18	15	2,198	**2290**	173	49	254	49	189	173	148	2,198	**3233**	**5523**
		91396	110.550	112.120	18	5	9	5	22	18	15	2,198	**2290**	173	49	71	49	189	173	148	2,198	**3049**	**5339**
545	Ayr - Dalbeg Road	91502	0.000	**14.620**	173	49	89	49	189	173	148	2,198	**3023**	18	5	9	5	22	18	15	2,198	**2290**	**5313**
		90018	**14.620**	36.452	173	572	414	49	189	173	148	2,198	**3390**	18	47	35	5	22	18	15	2,198	**2358**	**5749**
		91478	36.452	**42.235**	173	572	414	49	189	173	148	2,198	**3390**	18	47	35	5	22	18	15	2,198	**2358**	**5749**
			42.235	**42.285**	99	289	71	35	181	99	49	2,198	**2754**	10	23	6	4	20	10	5	2,198	**2276**	**5029**

Dev Loading % Increase - Construction		
Gaz %	A-Gaz %	Bi-Dir %
0.00%	0.00%	0.00%
0.00%	0.00%	0.00%
0.23%	0.55%	0.34%
0.25%	0.23%	0.24%
0.51%	0.10%	0.16%
0.78%	0.95%	0.87%
0.60%	0.36%	0.44%
0.47%	0.63%	0.54%
0.28%	0.37%	0.32%
0.23%	0.30%	0.26%
0.47%	0.66%	0.56%
0.28%	0.66%	0.42%
1.31%	4.84%	2.25%
4.16%	1.72%	2.58%
8.95%	4.99%	**6.75%**
85.96%	**26.88%**	**45.20%**
69.82%	**25.94%**	**39.54%**

Appendix H – TIA RPEQ Certification and Authorisation

Certification of Traffic Impact Assessment Report

Registered Professional Engineer Queensland

for

Project Title:	Landers Creek Substation & Overhead Transmission Line

As a professional engineer registered by the Board of Professional Engineers of Queensland pursuant to the *Professional Engineers Act 2002* as competent in my areas of nominated expertise, I understand and recognise:

- the significant role of engineering as a profession, and that
- the community has a legitimate expectation that my certification affixed to this engineering work can be trusted, and that
- I am responsible for ensuring its preparation has satisfied all necessary standards, conduct and contemporary practice.

As the responsible RPEQ, I certify:

i) I am satisfied that all submitted components comprising this traffic impact assessment, listed in the following table, have been completed in accordance with the *Guide to Traffic Impact Assessment* published by the Queensland Department of Transport and Main Roads and using sound engineering principles, and

ii) where specialised areas of work have not been under my direct supervision, I have reviewed the outcomes of the work and consider the work and its outcomes as suitable for the purposes of this traffic impact assessment, and that

iii) the outcomes of this traffic impact assessment are a true reflection of results of assessment, and that

iv) I believe the strategies recommended for mitigating impacts by this traffic impact assessment,

v) embrace contemporary practice initiatives and will deliver the desired outcomes.

Name:	Andrew Barrie	**RPEQ No:**	12801
RPEQ Competencies:	Civil		
Signature:		**Date:**	22/02/2024
Postal Address:	PO Box 9864, Frenchville QLD 4701		
Email:	andrew.barrie@accesstraffic.com.au		

Traffic impact assessment components to which this certification applies	✓
1. Introduction	
Background	✓
Scope and study area	✓
Pre-lodgement meeting notes	N/A
2. Existing Conditions	
Land use and zoning	✓
Adjacent land uses / approvals	✓
Surrounding road network details	✓
Traffic volumes	✓
Intersection and network performance	✓
Road safety issues	✓
Site access	✓
Public transport (if applicable)	N/A
Active transport (if applicable)	N/A
Parking (if applicable)	N/A
Pavement (if applicable)	✓
Transport infrastructure (if applicable)	✓
3. Proposed Development Details	
Development site plan	✓
Operational details (including year of opening of each stage and any relevant catchment / market analysis)	✓
Proposed access and parking	✓
4. Development Traffic	
Traffic generation (by development stage if relevant and considering light and heavy vehicle trips)	✓
Trip distribution	✓
Development traffic volumes on the network	✓
5. Impact Assessment and Mitigation	
With and without development traffic volumes	✓
Construction traffic impact assessment and mitigation (if applicable)	✓
Road safety impact assessment and mitigation	✓
Access and frontage impact assessment and mitigation	✓
Intersection delay impact assessment and mitigation	✓
Road link capacity assessment and mitigation	✓
Pavement impact assessment and mitigation	✓
Transport infrastructure impact assessment and mitigation	✓
Other impacts assessment relevant to the specific development type / location (if applicable)	N/A
6. Conclusions and Recommendations	
Summary of impacts and mitigation measures proposed	✓
Certification statement and authorisation	✓

Appendix F

Noise and Vibration Report

Prepared for
Powerlink Queensland
ABN: 82078849233

Burdekin River Pump Station Project

Noise and Vibration Assessment

13-Dec-2023
Burdekin River Pump Station
Doc No. 60714900-RPNV-01_A
Commercial-in-Confidence

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Delivering a better world

Burdekin River Pump Station Project

Noise and Vibration Assessment

Client: Powerlink Queensland

ABN: 82078849233

Prepared by

AECOM Australia Pty Ltd
Wulgurukaba of Gurambilbarra and Yunbenun, Bindal, Gugu Badhun and Nywaigi Country, Lvl 5, 7 Tomlins Street, South Townsville QLD 4810, PO Box 5423, Townsville QLD 4810, Australia
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13-Dec-2023

Job No.: 60714900

Quality Information

Document Burdekin River Pump Station Project

Ref 60714900

Date 13-Dec-2023

Prepared by Peter Dimou

Reviewed by Aloysius Chang

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	24-Nov-2023	Draft for client review	Rouven Lau Project Manager	
1	13-Dec-2023	Final report	Rouven Lau Project Manager	

Table of Contents

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been commissioned by Powerlink Queensland (Powerlink) to conduct a noise and vibration impact assessment for the proposed Burdekin River Pump Station (the Project).

This Project seeks to provide a power supply to the approved Burdekin River Pump Station.

The Project comprises the following components:

- A new 132kV Substation (adjoining the approved pump station).
- A new Overhead Transmission Line (OHTL) to establish a 132kV single circuit tee off into the new Landers Creek Substation. The OHTL will be located within a proposed new easement within Lot 289 on SP117630, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 22 on GS1042.
- The proposed new easement is 40 metres (m) wide, being 20 m either side of the OHTL centreline, with one partial section being 50 m.

This report describes the potential noise impacts associated with the construction, operation and decommissioning of the Project, as well as noise mitigation and management strategies. This report assesses the potential noise impacts of the preferred OHTL and substation equipment.

This assessment is intended to satisfy the requirements of the Project Terms of Reference (ToR) contained in the document *Generic Terms of Reference for an Environmental Assessment Report* dated 2023.

The site layout is shown in Appendix B.

1.1 Scope of this Assessment

The scope of the noise assessment is intended to satisfy the requirements of the ToR and is comprised of:

Preparation and Review

- Review relevant studies within the assessment area, including development assessment acoustic conditions for other known existing and proposed developments.
- Establish performance criteria for noise and vibration emissions:
  - Review relevant legislation and guidelines and establish suitable noise and vibration emission criteria for construction, operation and decommissioning phases
  - Identify noise and vibration-sensitive receptors within the study area.

Construction / Decommissioning Noise and Vibration Assessment

- Review the proposed works to be undertaken during the construction and decommissioning phases of the Project.
- Characterise noise and vibration emission data for the proposed construction/decommissioning works from Powerlink and previous acoustic studies.
- Conduct a desktop study of potential construction/decommissioning noise and vibration impacts. Determine buffer distances beyond which noise and vibration emission from construction/decommissioning activities associated with the Project are forecast to be within construction noise and vibration targets.
- Overlay buffer distances onto a map of the study area, highlighting sensitive receptors which fall within the defined criteria/buffer distances.
- Recommend in-principle methods to reduce noise and vibration impacts.

Operational Phase Noise

- Gather noise emission data for typical operational activities from Powerlink.

- Conduct a desktop modelling study of potential operational noise impacts. Determine buffer distances beyond which noise emission from these works is forecast to be within the applicable noise criteria.
- Overlay buffer distances onto a map of the study area, highlighting sensitive receptors which fall within the defined criteria/buffer distances.
- Review the noise source data and limits for the OHTL and substation, and assess the cumulative noise impacts from the Project.
- Recommend in-principle methods to reduce noise impacts.

1.2 Limitations

The findings of this report are based on the information provided to date and assumptions which have been made and may vary once design is finalised. Should the final design or equipment selections differ from that which is currently available, the impact to nearby receptors may require additional evaluation. In addition, the construction/decommissioning and operation of the Project is not envisaged to give rise to perceptible levels of vibration at nearby sensitive receptors. As vibration impacts associated with the Project are not envisaged to be perceptible at nearby receptors, this approach is considered to satisfy the Project's ToR.

Dwellings which have been identified in consultation with Powerlink are located within 2 km from the Project site, and have been considered in this report.

The assessment of noise impacts on local fauna has been excluded from this assessment.

No other significant noise generating developments/activities (existing and possible future developments) apart from what has been determined in Section 5.5 have been considered as part of the cumulative noise impact assessment.

The noise and vibration section of the Project's ToR (Section 4.16) has been reproduced in Table 1, alongside the sections of this report in which the ToR have been addressed.

Table 1 ToR requirements and relevant report sections

ToR requirement	Report Section
Describe the noise and vibration emissions (point source and general emissions) that may occur during all stages of the Project (i.e. construction, operation and decommissioning as relevant).	The construction noise and vibration emissions have been described in Section 4.1 and Section 4.5 respectively. It is expected that decommissioning will use similar equipment to the construction phase, hence decommissioning does not require any additional consideration. Noise generated by the operational phase of the Project has been considered in Section 5.1. No significant vibration-generating equipment is expected to be used during the operation of the Project.
Provide a description of the location of sensitive receptors within the study corridor.	Sensitive receptors have been identified in consultation with Powerlink. The nearest receptor is approximately 1000 m south-east of the site and has been identified in Section 2.1
Consider the cumulative impact of noise with other known emissions of noise associated with existing development and proposed future developments.	Cumulative noise impacts have been considered for both the construction and operational phases of the Project in Sections 4.4 and 5.5 respectively.
The assessment must include reference to all performance criteria relevant to the Project under the *Environment Protection Act 1994* (EP Act), Environment Protection Regulation 2019 (EP	The relevant noise requirements of the EP Act, EP Regulation and EPP Noise have been summarised in Section 2.0 and discussed in Appendix E. The relevant vibration criteria are summarised in Section 3.0.

ToR requirement	Report Section
Regulation) and Environmental Protection (Noise) Policy 2019 (EPP Noise).	

2.0 Noise Criteria

2.1 Noise Sensitive Receptors

Noise sensitive receptors (as defined in Schedule 1 of EPP (Noise) near the Project are illustrated in Appendix B. Residential receptors with the potential to be affected by the Project exist to the north and south of the site, with the closest receptors located approximately 1000 m to the south-east and 2000 m to the north of the Project site. These receptors are classified a rural residential dwelling. For the purposes of this noise and vibration assessment only the nearest residential receptor to the south of the site has been considered. Compliance at this receptor implies compliance at residential receptors located further from the Project site.

2.2 Construction/Decommissioning and Operation Noise Emission Documentation

A review of environmental noise emission criteria has been undertaken as part of this assessment and the most appropriate criteria, as outlined below, have been adopted. The criteria were derived from:

- Queensland *Environmental Protection Act 1994* (EP Act).
- Queensland *Environmental Protection Regulation 2019* (EP Regulation).
- Queensland *Environmental Protection (Noise) Policy 2019* (EPP (Noise)).
- Queensland *Common Conditions – Prescribed environmentally relevant activities 2019.*

These documents are discussed in detail in Appendix E.

The ToR states the following as objectives and performance outcomes of the Project:

> *The assessment must include reference to all performance criteria relevant to the Project under the Environment Protection Act 1994, Environment Protection Regulation 2008 and Environmental Protection (Noise) Policy 2008.*

Schedule 8, Part 3, Division 1 of the EP Regulation lists the following performance outcomes:

1. sound from the activity is not audible at a sensitive receptor;
2. the release of sound to the environment from the activity is managed so that adverse effects on environmental values including health and wellbeing and sensitive ecosystems are prevented or minimised.

As clarified in EP Regulation, either Item 1 or Item 2 of the Performance Outcomes is to be achieved. Due to the relative proximity of some Project-related activities to sensitive receptors, the Project is unlikely to achieve the first performance outcome during some activities and under some meteorological conditions. In this instance, the assessment has focused on the second Performance Outcome, as clarified in Part 3 of the EP Regulation (and discussed further in Appendix E.)

The environmental values associated with this second Performance Outcome are detailed in the EPP (Noise). For dwellings (all nearby sensitive receptors), the environmental values are “health and wellbeing” during the day and evening periods, and “health and wellbeing, in relation to the ability to sleep” during the night. This document further provides Acoustic Quality Objectives for enhancing or protecting these environmental values, and provides a framework for making decisions in relation to the acoustic environment. Schedule 3, Part 3, Division 1 of the EP Regulation also refers to these Acoustic Quality Objectives. These Acoustic Quality Objectives are designed to be long-term noise limits and are not applied to any individual project or enterprise; however, they can inform the decision-making process around the limits and can assist in identifying whether the environmental values are protected.

A detailed discussion of the requirements of the EPP (Noise) is provided in Appendix E.

Noise criteria derived from the above documents are summarised in Table 2. These criteria have been separated into two groups; namely:

- Criteria for quasi-steady (i.e. continuous) noise emissions which are generally assessed with the $L_{Aeq(T)}$ noise descriptor. This noise descriptor is generally used to assess against background creep criteria and acoustic quality objectives or similar amenity requirements.
- Criteria for discrete (i.e. maximum or "one off") noise emissions which are generally assessed with the $L_{Amax(T)}$ or $L_{A1(T)}$ noise descriptors. These noise descriptors are generally used to assess against acoustic quality objectives or similar amenity requirements, particularly in relation to sleep disturbance.

2.3 Summary of Noise Limits

Applicable noise emission limits at nearby sensitive receptors for the construction and operation of the Landers Creek Substation are outlined in Table 2 and Table 3 respectively. The criteria adopted are the most stringent of applicable noise limits identified in the above documentation.

2.3.1 Construction noise criteria

Relevant noise criteria for construction noise is provided in Table 2 below.

Table 2 Construction noise criteria

Noise source	Noise criteria	External noise limit	Time of day[2]	Sensitive receptor
Construction equipment	EP (Noise) Policy acoustic quality objectives	$L_{Aeq,adj,1hr}$ 50 dB(A)	Daytime and evening	Residential buildings
		$L_{Aeq,adj,1hr}$ 37[1] dB(A)	Night-time	Residential buildings

Note:

1. Noise limit includes a 7 dB correction to allow for the assessment of noise levels as measured outdoors, assuming a façade with partially open windows (as per Queensland *Common Conditions – Prescribed environmentally relevant activities* 2019)
2. The EP (Noise) Policy defines the following:
   Daytime means the period after 7 am on a day to 6 pm on the day;
   Evening means the period after 6 pm on a day to 10 pm on the day;
   Night-time means the period after 10 pm on a day to 7 am on the next day.

Based on information provided by Powerlink, construction noise impacts have only been assessed against day and evening noise criteria.

2.3.2 Operational noise criteria

Table 3 Operational noise criteria

Noise source	Noise criteria	External noise limit	Time of day	Location
Corona discharge and operation/ maintenance of substation and OHTL	EP (Noise) Policy acoustic quality objectives	$L_{Aeq,adj,1hr}$ 50 dB(A)	Daytime and evening	Residential buildings (external)
		$L_{Aeq,adj,1hr}$ 37[1] dB(A)	Night-time	Residential buildings (external)

Note:

1. Noise limit includes a 7 dB correction to allow for the assessment of noise levels as measured outdoors, assuming a façade with partially open windows (as per Queensland *Common Conditions – Prescribed environmentally relevant activities* 2019)
2. The EP (Noise) Policy defines the following:
   Daytime means the period after 7 am on a day to 6 pm on the day;
   Evening means the period after 6 pm on a day to 10 pm on the day;
   Night-time means the period after 10 pm on a day to 7 am on the next day.

Maintenance works involving the use of regulated devices (assumed to be the 'worst-case noise generating equipment' used in the assessment) are restricted to the hours of 7am to 7pm.

3.0 Vibration Criteria

3.1 Construction Vibration Objectives

The relevant standards and guidelines for the assessment of construction vibration are summarised in Table 4.

Table 4 Standards/guidelines used for assessing construction vibration

Item	Standard/guideline
Structural damage	German Standard DIN 4150 – Part 3 – *Structural Vibration in Buildings – Effects on Structures* (DIN 4150)
Human comfort (tactile vibration)	Transport Noise Management Code of Practice: Volume 2 – *Construction Noise and Vibration, Department of Transport and Main Roads*[1]

Note:
1. This document is based upon the guidelines contained in British Standard 5228-2:2009 *"Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (BS 5228)

Vibration of sufficient magnitude has the potential to cause damage to structures and to disrupt human comfort. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent as follows.

- Continuous vibration continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities.
- Impulsive vibration is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with durations of typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities.
- Intermittent vibration occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration which varies significantly in magnitude. This may include intermittent construction activity, impact pile driving and jack hammers.

3.1.1 Structural damage

At present, no Australian Standard exists for the assessment of building damage caused by vibration. The German Standard (DIN 4150) provides recommended maximum levels of vibration which reduce the likelihood of building damage caused by vibration, and these are presented in Table 5. The use of DIN 4150 for the adoption of construction vibration limits has precedent in Australia. DIN 4150 states that higher levels of vibration than the recommended limits would not necessarily result in damage at buildings exposed to vibration. In this assessment, the DIN 4150 limits have been adopted for all buildings.

Table 5 Structural damage safe limits (DIN 4150) for building vibration

Type of structure	At foundation – Less than 10 Hz
Dwellings and buildings of similar design and/or use	5 mm/s

3.1.2 Human comfort

Humans are sensitive to vibration such that they can detect vibration levels well below those required to cause any risk of damage to a building or its contents. Criteria to avoid annoyance are therefore more stringent than those to prevent structural damage.

3.1.2.1 Intermittent vibration

The assessment of intermittent vibration outlined in *Assessing Vibration: A Technical Guideline* is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods.

Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in Table 6. The VDV criteria are based on the likelihood that a person would be annoyed by the level of vibration over the entire assessment period.

Table 6 Preferred and maximum vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Day time		Night-time	
	Preferred	Max	Preferred	Max
Residences	0.20	0.40	0.13	0.26

3.1.2.2 Continuous and impulsive vibration

Acceptable levels of human exposure to continuous and impulsive vibration are dependent on the time of day and the activity taking place in the occupied space. *Assessing Vibration: A Technical Guideline* provides the preferred values for continuous and impulsive vibration. These are presented in Table 7**.**

There is low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values in Table 7. Situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short duration. Vibration levels above those indicated in Table 7 may be dealt with through negotiation with the regulator of the affected community.

Table 7 Peak particle velocity for continuous and impulsive vibration (mm/s)

Location	Assessment period	Preferred	Maximum
Continuous vibration			
Residences	Day Night	0.28 0.20	0.56 0.40
Impulsive vibration			
Residences	Day Night	8.60 2.80	17.0 5.60

3.2 Operational Vibration Objectives

Operational vibration objectives for structural and human comfort are identical to that of the construction vibration requirements and therefore should be referenced from section 3.1.

4.0 Construction Noise and Vibration Impact Assessment

4.1 Construction Noise Modelling Scenarios

Table 8 provides a summary of the construction stage noise modelling scenarios including the representative worst-case construction equipment and associated sound power levels. All stages have been considered, however only the worst-case construction scenarios have been assessed.

Table 8 Landers Creek Substation construction stages and worst-case equipment

Construction stage	Worst-case noise generating equipment	Sound power level, dB(A)[3]
Site set-out	Light vehicles	90
Flora and fauna surveys	Light vehicles	90
Installation of gates, grids, wash downs and access tracks	Roller	105
Access track construction	Excavators	98
Vegetation clearing	Mulcher	116
Benching of substation station pads	Excavators	98
Benching of pad sites, cut/fill	Tipper truck	105
Excavation for foundations	Excavators	98
Foundations, substation electrical equipment and OHTL	Bored piling rig[1]	105
Steel assembly and erection	Cranes	98
Electrical plant erection	Cranes	98
Lines assembly	Cranes	98
Test and commissioning	Light vehicles	90
Rehabilitation of disturbed areas	Excavators	98

Note:

1. It has been advised by *Powerlink* Queensland that impact piling is not expected, therefore bored piling has been assessed. Impact piling sound power levels would be approximately 11 dB(A) higher.
2. The construction stages shaded light green are considered to be the worst-case construction stages given their worst-case sound power levels, location of equipment and duration.
3. Sound power levels have been derived from a combination of *BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites. Noise (+A1:2014)* and previous noise measurements conducted by AECOM.

It is assumed that decommissioning would comprise similar activities to the construction stages, hence a separate assessment has not been considered.

4.2 Methodology

Setback distances at which construction noise is expected to achieve the relevant criteria have been calculated for the above construction scenarios. The setback distances have been calculated from the site boundary.

4.2.1 Propagation methodology

The CONCAWE noise propagation calculation method was originally developed for predicting the long-distance propagation of noise from petrochemical complexes. It is especially suited to predicting noise propagation over large distances because it accounts for a range of atmospheric conditions which can significantly influence the propagation of noise over large distances. The CONCAWE method has been used to predict noise emissions in this assessment.

Calculations were carried out to represent 'reasonable' worst-case periods of construction works. The following features were included in the noise calculations:

- Flat ground topography.
- Ground absorption of 50%.
- Receptors.
- Worst-case construction noise sources which are conservatively assumed to operate on the site boundary.

It can be expected that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment.

4.2.2 Construction calculation assumptions

The following assumptions have been made in modelling all construction noise scenarios.

- Equipment is assumed to be operating at the closest point on the site boundary to each receptor, in order to present the worst-case scenario for each receptor. In reality the equipment would only be at the closest point to each receptor for a limited period.
- 3m/s source to receptor wind with Pasquil stability category F (Meteorological Category 6).

4.3 Predicted Construction Noise Setback Distances

Predicted setback distances at which construction noise associated with the Project is expected to comply with the relevant limits are presented in Table 9, as well as the number of residential receptor locations at which exceedance of the noise limit is predicted to occur. Construction noise setback distance maps are provided in Appendix C and are arranged by the representative worst-case equipment.

Table 9 Predicted construction noise setback distances

Scenario	Representative worst-case equipment	Noise limit, $L_{Aeq,adj,1hr}$ dB(A)	Setback distance, (metres)	Number of exceedances	Appendix figure reference
Installation of gates, grids, wash downs and access tracks	Vibratory roller	50	250	0	Appendix C – Figure 1
Access track construction Benching of substation pads Excavation for foundations Rehabilitation of disturbed areas	Excavator	50	110	0	Appendix C – Figure 2

Scenario	Representative worst-case equipment	Noise limit, $L_{Aeq,adj,1hr}$ dB(A)	Setback distance, (metres)	Number of exceedances	Appendix figure reference
Benching of pad sites, cut/fill	Tipper truck	50	210	0	Appendix C – Figure 3
Vegetation clearing	Mulcher	50	500	0	Appendix C – Figure 4
Foundations, substation electrical equipment and OHTL	Bored piling rig	50	220	0	Appendix C – Figure 5
Steel assembly and erection Electrical plant erection Lines assembly	Crane	50	120	0	Appendix C – Figure 6

4.3.1 Discussion of results

Setback distances which are compliant with the established daytime noise limits have been calculated. The construction activities are predicted to not exceed the noise limits at any sensitive for all construction scenarios considering worst case meteorological conditions.

4.4 Cumulative Construction Noise Impacts

Cumulative construction noise from the Burdekin River Pump Station has been considered. It is anticipated that there may be an overlap of construction time frames between the Project and the Burdekin River Pump Station which may lead to a cumulative construction noise impact. However specific construction timeframes and methodology are not available at this point for either Project.

Additionally, a Solar Farm has been proposed at Lot 22 of GS1042. Details and scheduling of the proposed solar farm's construction are not available at this stage. Cumulative construction noise impacts may occur if construction scheduling overlaps with the Project, although the scale of construction for the Project is expected to be much smaller.

No other significant, concurrent construction activities (existing and possible future developments) have been identified.

In the event that noisy construction activities may occur at the same time in close proximity to each other, it is possible that predicted noise levels may increase by up to 3 dB(A). Although 3 dB(A) is generally considered just discernible, the cumulative impact of noise would be managed as far as possible by the contractor to ensure that the potential for adverse impacts at sensitive receivers is minimised. It is not anticipated that a 3 dB increase will lead to non-compliance at any of the nearby noise sensitive receptors.

4.5 Construction Vibration Assessment

The only significant vibration-intensive works expected to take place during the proposed works would be pile boring and the use of vibratory rollers. Safe working distances to minimise disturbance to occupants of nearby buildings have been recommended and are based on the British Standards *BS 6472 'Evaluation of human exposure to vibration in buildings'* and *BS 7385 'Evaluation and*

measurement for vibration in buildings'. In lieu of similar Australian guidelines, the following safe working distances for vibration-intensive equipment listed in Table 10 below have been adopted.

Table 10 Recommended safe working distances for vibration-intensive plant

Plant	Rating/Description	Safe Working Distance, metres	
		Cosmetic Damage	Human Response
Pile Boring	≤ 800 mm	2 m (nominal)	N/A
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	40 m
	< 200 kN (Typically 4-6 tonnes)	12 m	100 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m

There are no vibration-sensitive receptors within these structural damage or human response safe working distances for pile boring rigs and vibratory rollers. Vibration setback distances have not been included in the maps as no receptors are located within the human response safe working distance.

Nevertheless, care should be taken during the construction stage as to not encroach on the safe working distances as specified. These safe working distances should also be used to guide the plant selection for the construction of the Project.

4.6 Construction Noise Mitigation Measures

4.6.1 Powerlink – Standard Environmental Controls – Specification

All construction activities associated with the Project will be subject to the standard noise mitigation measures described in Powerlink Queensland's *Standard Environmental Controls – Specification Document*.

4.6.2 General construction noise mitigation measures

The contractor should, where risk assessment deems necessary apply best-practice noise mitigation measures including the following.

- Appropriate plant and equipment to be selected for each task to minimise the noise contributions.
- Plant to be turned off when not in use.
- Plant is to be regularly maintained, and repaired or replaced if it becomes noisier.
- Emphasis should be placed during driver training and site induction sessions on the potential adverse impact of reversing alarms and exhaust brakes and the need to minimise their use.
- Wherever feasible, turning circles to be created at the end points of vehicle work legs, which should allow trucks to turn and avoid the need for reversing.
- Non-tonal reversing alarms to be used where practicable.
- It is recommended that works that generate substantial noise should commence from 7am as to not encroach on the night-time period. It is recommended that the operation of all significant noise generating equipment is restricted to this time period.

5.0 Operational Noise Assessment

5.1 Operational Noise Sources

A list of operational noise sources obtained from Powerlink and research papers is presented in Table 11 below. It is assumed that the Project will be operational at all hours, every day of the year. Maintenance activities are expected to occur during daytime hours only for corrective and preventative maintenance activities. Hence the daytime noise limits have been used in the operational maintenance acoustic assessment and the night-time noise limits have been used for the operation of the Project.

The assessed items of equipment are presumed to be steady noise sources, as such the L_{Aeq} noise levels are assumed to be equivalent.

Table 11 Landers Creek Substation operational noise sources

Scenario	Equipment	SWL, dB(A)	Quantity	Description
Operation	132/11kV Power Transformer	98[1]	1	One power transformer for the substation as advised by Powerlink.
	Corona discharge	94[2]	-	Continuous along the OHTL length.
Maintenance	Mulcher	116	1	Vegetation clearing as part of regular maintenance.

Notes

1. Noise levels for the specific power transformer for the Project could not be provided at this early design stage, therefore noise levels from previous measurements conducted by AECOM have been used. This measurement is based on a 375 MVA 3-phase transformer which is considerably larger than the transformer proposed for the Project, therefore the use of this noise data for the operational noise assessment is considered conservative. As noise from fans are expected to be the dominant noise source from the power transformer, noise is expected to be broadband in nature and therefore should not carry any tonality penalties.
2. Sound power level derived from L_{10} sound pressure level measurements of a 1000 kV powerline in rainy weather documented in research paper *Audible Noise Performance of Conductor Bundles Based on Cage Test Results and Comparisons with Long Term Data* (Baoquan Wan 2017), therefore the assessment is considered conservative.

5.1.1 Corona discharge

Noise associated with the power lines themselves is primarily due to corona discharge. The intensity of the corona discharge and the resulting noise is dependent on meteorological conditions (such as humidity, rain, fog and wind), the concentration of airborne particles (dust, ash) and the state of the conductor surface. As the power lines are primarily to be located in sparsely-populated rural areas and the 132kV line is to be designed as a twin conductor set, the acoustic effect of corona discharge is expected to be minimal on nearby sensitive receptors. In addition line fittings (such as hardware corona rings) and insulator arrangements are to be designed to minimise corona discharge.

OHTL audible noise (corona discharge) is typically represented by L_{50} sound pressure level values. This value represents an average noise level present during rainy or otherwise wet conditions. Higher noise levels corresponding to L_{10} or L_5 sound pressure level values can be calculated, however these values typically coincide with higher rain rates when background ambient noise is higher, and does not necessarily coincide with maximum annoyance at the noise receptor.

It is also noted in the Powerlink *Transmission Line Design – Guideline* that annoyance can still occur during fog conditions, hence the sound power level of a corona discharge in this assessment was conservatively derived using available measured L_{10} sound pressure level values with the assumption of heavy fog conditions which is indicative of lower background noise levels hence providing a conservative approach.

5.2 Methodology

Noise compliant setback distances have been calculated for the above operational equipment. The substation setback distances have been calculated from the power transformer, the corona discharge setback distances have been calculated approximately from the proposed OHTL easement, and the mulcher setback distances have been calculated approximately from the Project corridor. As with the construction noise assessment, the CONCAWE method was used for the operational noise predictions.

Calculations were carried out to represent 'reasonable' worst-case periods of operation and maintenance. It can be expected that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment.

5.2.1 Operational calculation assumptions

The following assumptions have been made in assessing all operational noise scenarios.

- All operational equipment would be operating simultaneously with the exception of maintenance activities.
- Only the power transformer has been assessed within the substation as it is the dominant noise source as advised by Powerlink. Sound power levels were not provided so noise levels from a previous project as measured by AECOM have been utilised. These measurements are from a much larger (400MVA) transformer therefore the assessment is considered conservative.
- 3m/s source to receptor wind speed with Pasquil stability category F. It is noted that noise due to corona discharge has been calculated using this worst-case noise propagation meteorological condition. The meteorological condition conducive to the occurrence of corona discharge may not be conducive to noise propagation; therefore, this is considered a conservative assumption.

5.3 Predicted Operational Noise Setback Distances

Predicted compliant operational noise setback distances associated with the Project are presented in Table 12. Operational noise setback distance maps are provided in Appendix D and are arranged by the representative worst-case equipment.

Table 12 Predicted operational noise setback distances

Scenario	Representative worst-case equipment	External noise limit, $L_{Aeq,adj,1hr}$, dB(A)	Setback distance, (metres)	Number of exceedances	Appendix figure reference
Operation	Power transformer	Day: 50	120[1]	0	Appendix D – Figure 7
		Night: 37	380	0	Appendix D – Figure 8
	Corona discharge	Day: 50	70[1]	0	Appendix D – Figure 7
		Night: 37	300	0	Appendix D – Figure 8
Maintenance activities – Vegetation clearing	Mulcher	50[2]	500	0	Appendix D – Figure 9

Note:
1. The CONCAWE method has not been validated at ranges near to 100m, hence this distance has been determined via geometric noise spreading calculations.
2. It is assumed that inspection and routine maintenance activities will be restricted to daytime hours only due to safety and practical considerations; hence it has been assessed against the daytime criteria.

5.4 Discussion of Results

Setback distances at which the most stringent established noise limits are expected to be achieved have been calculated. Noise emission from operational activities is predicted to comply with the established noise limits at nearby sensitive receptors across all operational scenarios.

5.5 Cumulative Operational Noise Impact

Cumulative operational noise from the Burdekin River Pump Station has been considered. The closest noise-sensitive receptors are around one kilometre to the south-east. The operational noise contribution of the Project to these receptors is predicted to be almost 10 dB(A) below the applicable daytime and night-time operational noise limits, therefore cumulative noise impacts are unlikely to be an issue as the total noise levels from the two Projects combined will not increase to higher than the Burdekin River Pump Station Project alone.

A Solar Farm has been proposed at Lot 22 of GS1042. Details and scheduling of the proposed solar farm's operation are not available at this stage. Solar farms generally contain large numbers of transformers and inverters, which are typically louder than noises associated with the operation of the Project. Assuming that the proposed solar farm spans the entirely of Lot 22 GS 1042, the overall noise environment in the area is envisaged to be dictated heavily by the operation of the proposed solar farm, with the operational noise generated by the Project predicted to the significantly lesser contributor.

No other significant noise generating developments/activities (existing and possible future developments) have been identified, hence a cumulative operational noise impact assessment is not warranted.

5.6 Operational Vibration Assessment

No significant vibration-generating equipment is expected to be used during the operation of the Project hence an assessment is not required.

5.7 Operational Noise Mitigation Measures

All operational activities associated with the Project will be subject to the standard noise mitigation measures described in Powerlink Queensland's *Standard Environmental Controls – Specification Document* which has been listed in Section 4.6 of this report.

Additional mitigation measures proposed include:

- Appropriate plant and equipment to be selected for each task to minimise the noise contributions.
- Plant to be turned off when not in use.
- Plant is to be regularly maintained and repaired or replaced if it becomes noisier.
- Emphasis should be placed during driver training and site induction sessions on the potential adverse impact of reversing alarms and the need to minimise their use.
- Non-tonal reversing alarms to be used where practicable.
- It is recommended that works that generate substantial noise should commence from 7am as to not encroach on the night-time period. Maintenance works between 6:30am and 7am should include setting up site, toolbox talks and any other works that do not generate a significant level of noise. It is recommended that the operation of all significant noise generating equipment is restricted to 7am to 7pm.

6.0 Conclusion

This report presents the results of an assessment of the potential noise and vibration impacts of the proposed Burdekin River Pump Station Project. AECOM has prepared this acoustic assessment of the construction / decommissioning and operational noise and vibration associated with the establishment of the Project.

Construction / decommissioning noise and vibration

The construction and decommissioning activities have been assessed against the established noise limits. Compliant setback distances have been calculated based on these. The construction scenarios assessed are not predicted to exceed the noise limit at any sensitive receptor across all scenarios.

Vibration-intensive works are expected to take place well within safe working distances for building damage and human comfort criteria. It is recommended that these safe working distances be used to guide the plant selection for the construction of the Project.

Operational noise and vibration

Results show that all of the noise-sensitive receptors in the area are beyond the predicted operational noise setback distances from the Project and comply with the most stringent operational noise limits across the Project.

Setback distances around the substation at which the noise limits can be achieved have also been calculated.

The cumulative noise impacts from the Burdekin River Pump Station and the Project have been considered, and the noise contribution of the Project to the pump station’s receptors are predicted to be negligible, therefore cumulative noise impacts are unlikely to be an issue.

It is recommended that the substation and OHTL are properly maintained to ensure that the noise emission from the Project is not adversely affected by wear and tear on operational items of plant.

Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

The following is a brief description of acoustic terminology used in this report.

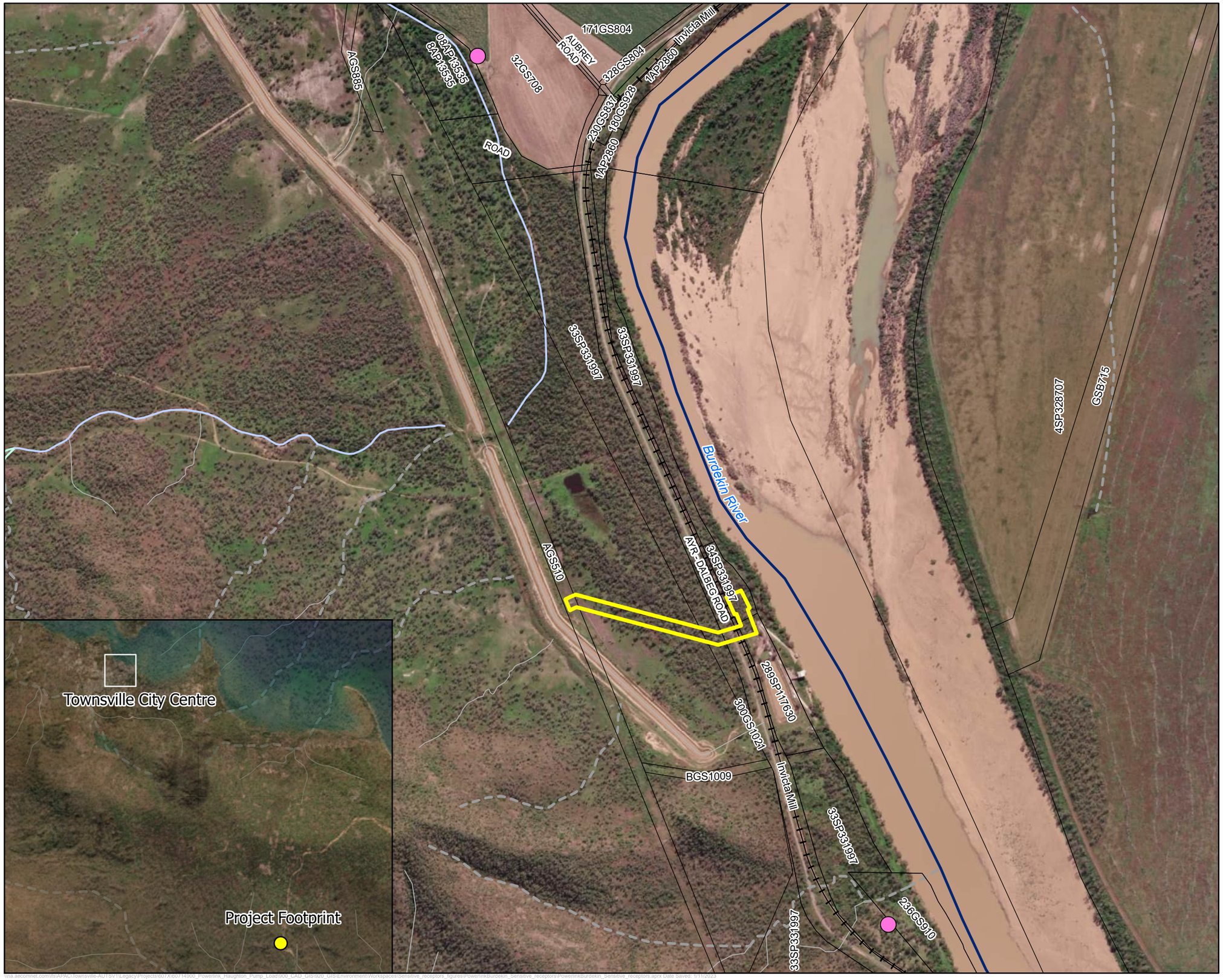
Sound power level	The total sound emitted by a source.
Sound pressure level	The amount of sound at a specified point.
Decibel dB	The measurement unit of sound.
A Weighted decibels, dB(A)	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:
	0dB(A) Threshold of human hearing
	30dB(A) A quiet country park
	40dB(A) Whisper in a library
	50dB(A) Open office space
	60dB(A) Lunch time at Queens Street Mall
	70dB(A) Inside a car on a freeway
	80dB(A) Outboard motor
	90dB(A) Heavy truck pass-by
	100dB(A) Jackhammer/Subway train
	110 dB(A) Rock Concert
	120dB(A) 747 take off at 250 metres
Frequency	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level, L_{eq}	The constant sound level which, when occurring over the same period of time, would result in the receptor experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period.
L_{min}	The minimum sound pressure level measured over the measurement period.
L_1	The sound pressure level exceeded for 1% of the measurement period. For 1% of the measurement period it was louder than the L_1.

L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 “Acoustics – Glossary of terms and related symbols”

Appendix B

Project Site Map and Receptor Locations



AECOM

N

0 0.3 0.5 km

Legend

- Project Footprint
- Property Boundaries
- Railway
- Sensitive receptors within 2 km

Watercourses

- 0
- 1
- 2
- 3
- 9

Service Layer Credits: Queensland Government 2023, World Imagery: Earthstar Geographics
World Imagery: Maxar

Burdekin Pump Station Project
Haughton Pump Load

Sensitive Receptor Mapping

FIGURE X

PROJECT ID	60714900
LAST MODIFIED	01-Nov-2023
VERSION	4

Appendix C

Construction Noise Setback Distance Maps

Appendix C Construction Noise Setback Distance Maps – Vibratory Roller

Noise Compliant Setback Distance Map - Figure 1

Legend

- Power Transformer
- Nearest Receptor
- Transmission Line Alignment
- Buffer - Vibratory Roller

N

0 180 360 Meters

AECOM

This map is to be read in conjunction with Landers Creek Substation Noise and Vibration Assessment - 60714900

Appendix C Construction Noise Setback Distance Maps - Excavator

Noise Compliant Setback Distance Map - Figure 2

Legend

- Power Transformer
- Nearest Receptor
- Transmission Line Alignment
- Buffer - Excavator

N

0 180 360 Meters

AECOM

This map is to be read in conjunction with Landers Creek Substation Noise and Vibration Assessment - 60714900

Appendix C Construction Noise Setback Distance Maps - Tipper Truck

Noise Compliant Setback Distance Map - Figure 3

Legend

- Power Transformer
- Nearest Receptor
- Transmission Line Alignment
- Buffer - Tipper Truck

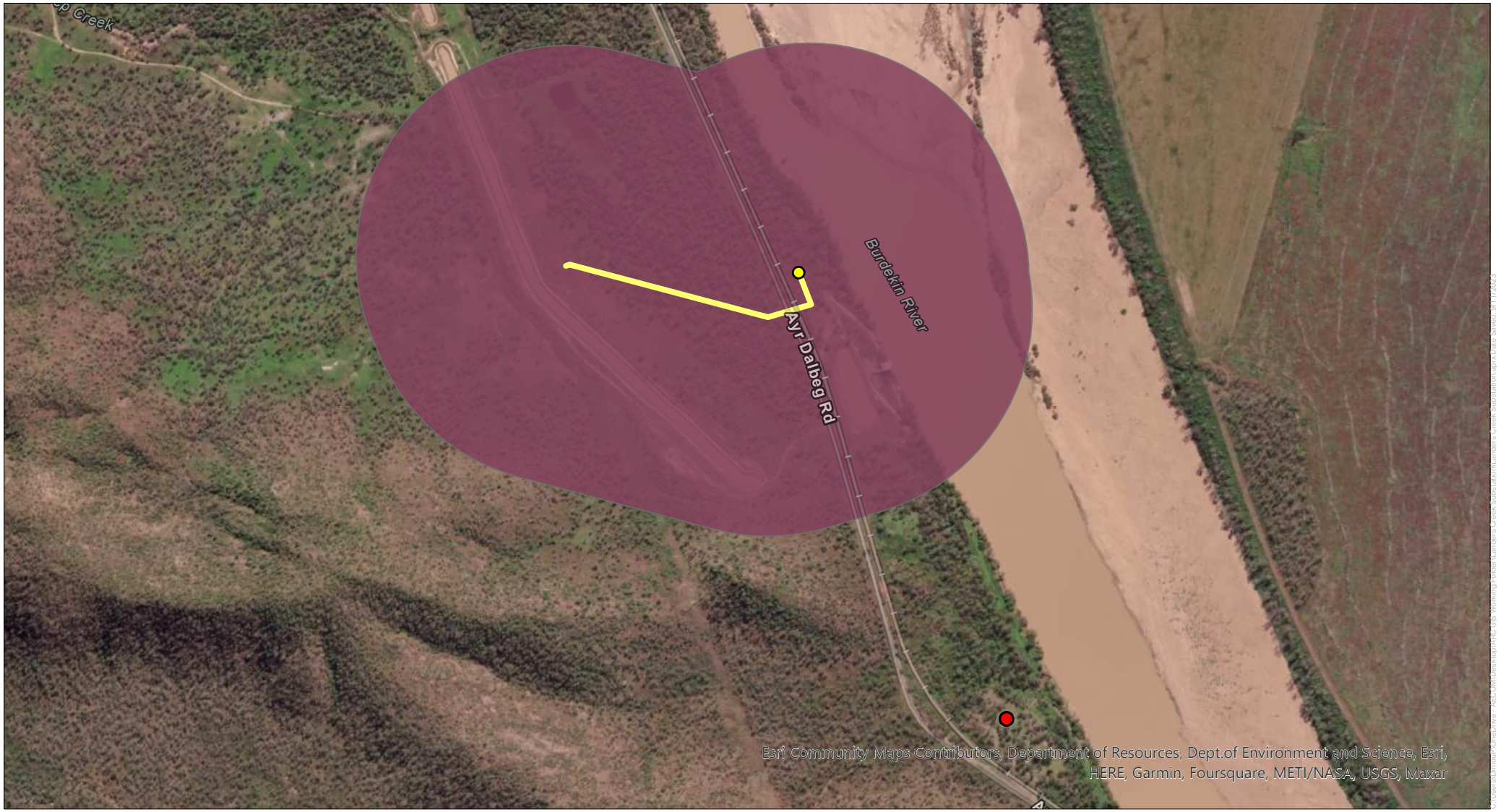
N

0 180 360 Meters

AECOM

This map is to be read in conjunction with Landers Creek Substation Noise and Vibration Assessment - 60714900

Appendix C Construction Noise Setback Distance Maps - Mulcher



Noise Compliant Setback Distance Map - Figure 4

Legend

- Power Transformer
- Nearest Receptor
- Transmission Line Alignment
- Buffer - Mulcher

N

0 180 360 Meters

AECOM

This map is to be read in conjunction with Landers Creek Substation Noise and Vibration Assessment - 60714900

Appendix C Construction Noise Setback Distance Maps - Bored piling rig

Noise Compliant Setback Distance Map - Figure 5

Legend

- Power Transformer
- Nearest Receptor
- Transmission Line Alignment
- Buffer - Bored Piling Rig

N

0 180 360 Meters

AECOM

This map is to be read in conjunction with Landers Creek Substation Noise and Vibration Assessment - 60714900

Appendix C Construction Noise Setback Distance Maps - Crane

Noise Compliant Setback Distance Map - Figure 6

Legend

- Power Transformer
- Nearest Receptor
- Transmission Line Alignment
- Buffer - Crane

N

0 180 360 Meters

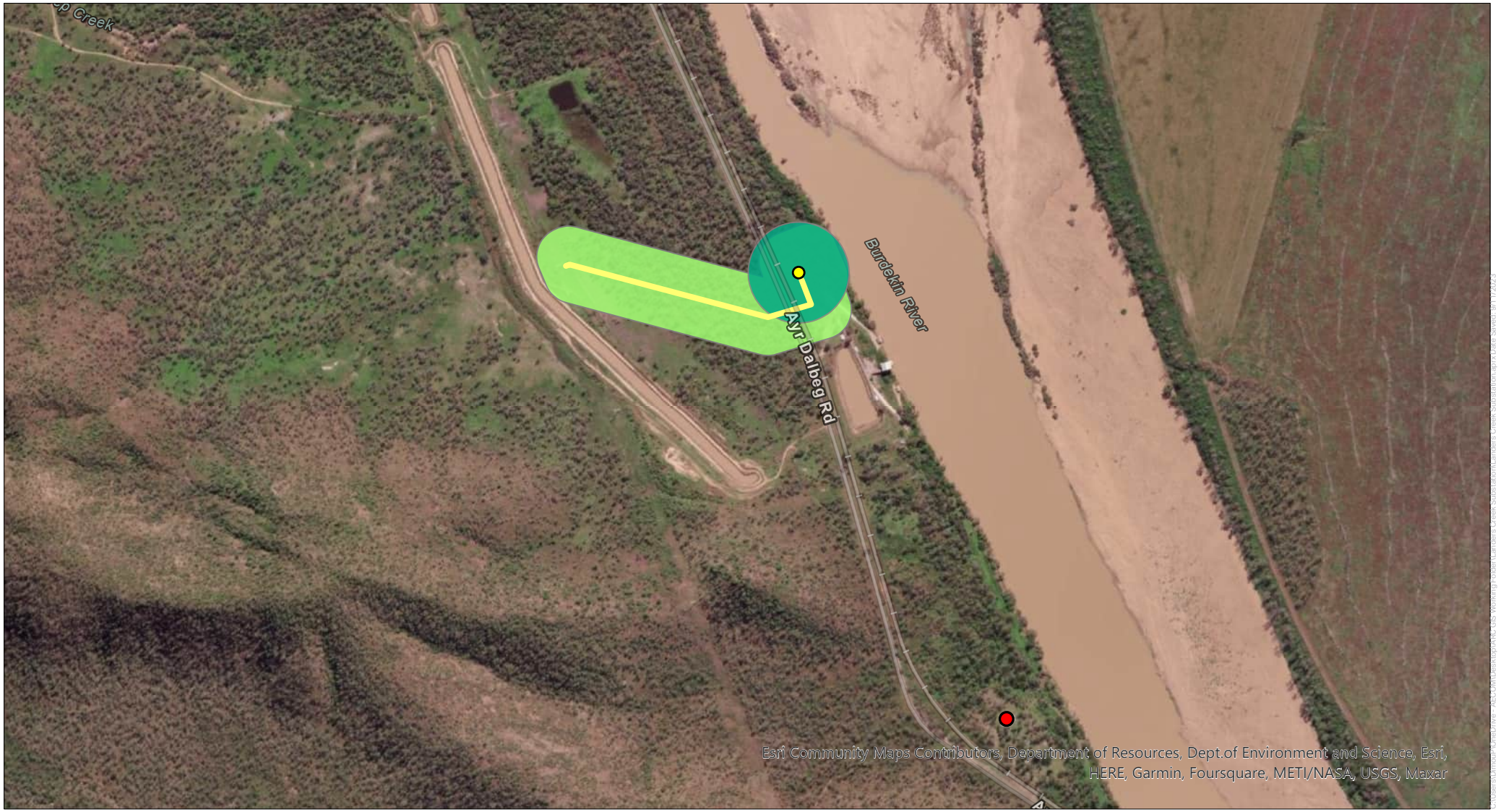
AECOM

This map is to be read in conjunction with Landers Creek Substation Noise and Vibration Assessment - 60714900

Appendix D

Operational Noise Setback Distance Maps

Appendix D Operational Noise Setback Distance Maps - Corona discharge and substation (day)



Noise Compliant Setback Distance Map - Figure 7

Legend

- Power Transformer
- Nearest Receptor
- Transmission Line Alignment
- Buffer - Corona Discharge - Day
- Buffer - Power Transformer - Day

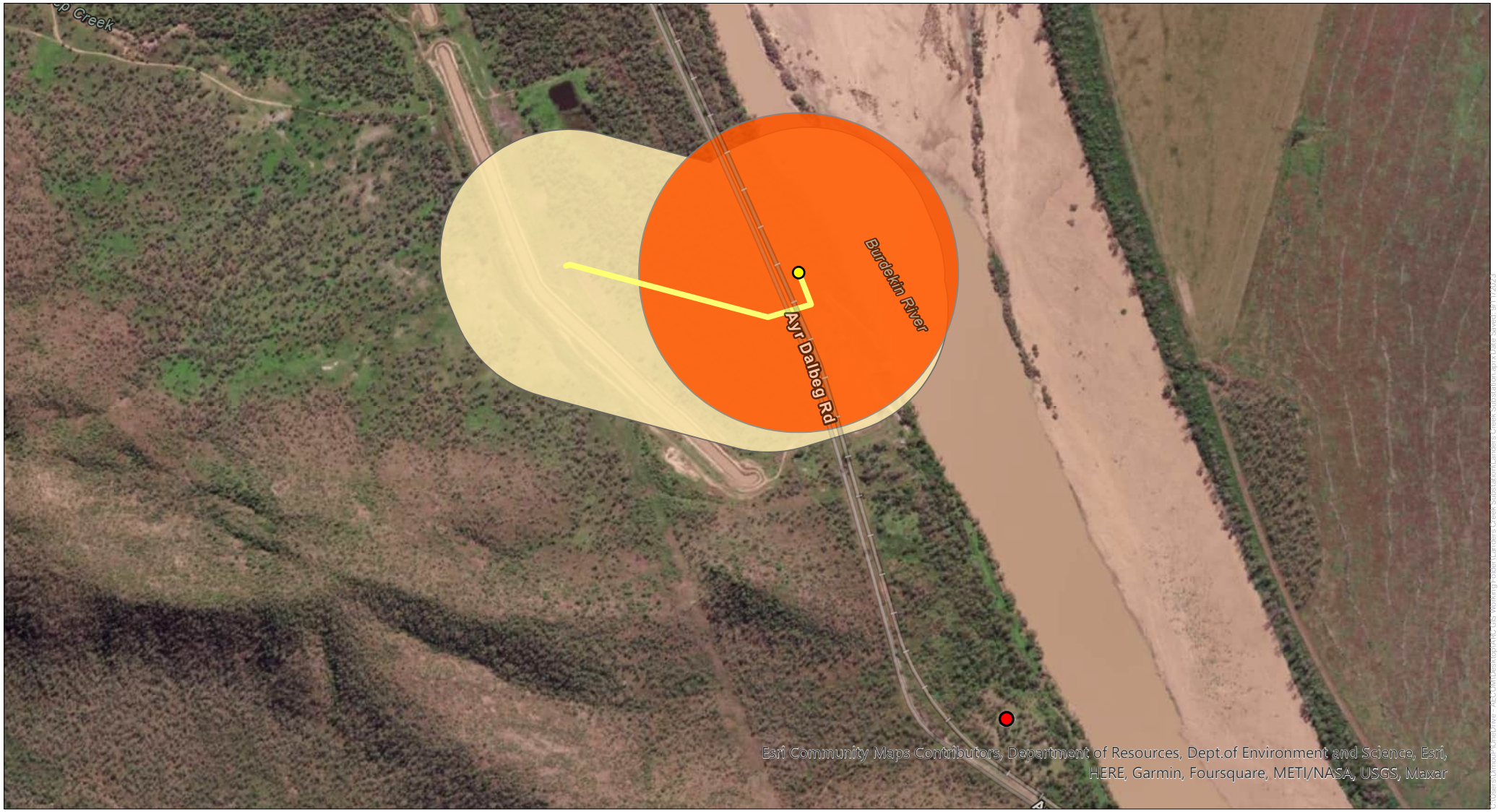
N

0 180 360 Meters

AECOM

This map is to be read in conjunction with Landers Creek Substation Noise and Vibration Assessment - 60714900

Appendix D Operational Noise Setback Distance Maps - Corona discharge and substation (night)



Noise Compliant Setback Distance Map - Figure 8

Legend

- Power Transformer
- Nearest Receptor
- Transmission Line Alignment
- Buffer - Power Transformer - Night
- Buffer - Corona Discharge - Night

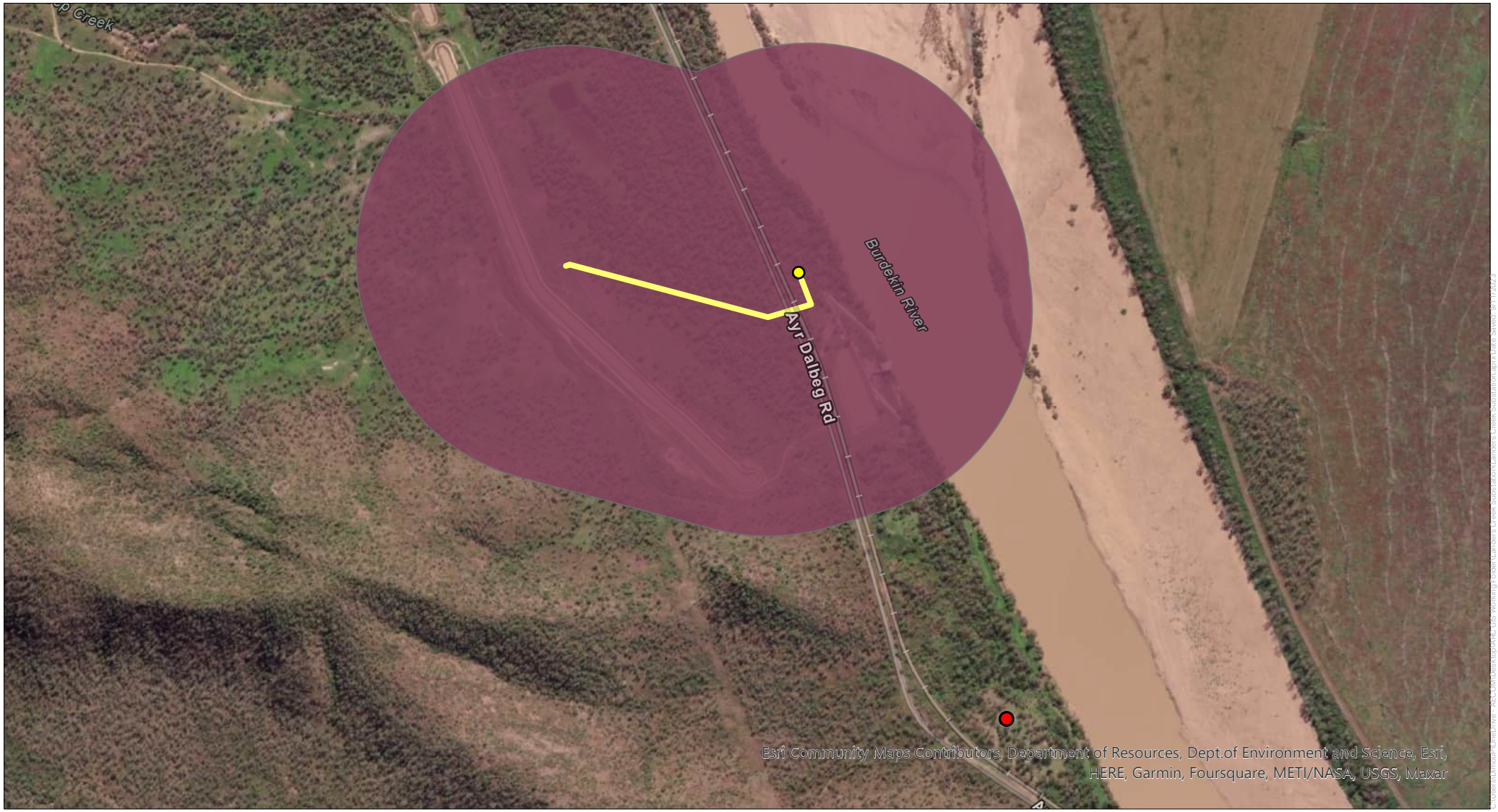
N

0 180 360 Meters

AECOM

This map is to be read in conjunction with Landers Creek Substation Noise and Vibration Assessment - 60714900

Appendix D Operational Noise Setback Distance Maps - Mulcher



Noise Compliant Setback Distance Map - Figure 9

Legend

- Power Transformer
- Nearest Receptor
- Transmission Line Alignment
- Buffer - Mulcher

N

0 180 360 Meters

AECOM

This map is to be read in conjunction with Landers Creek Substation Noise and Vibration Assessment - 60714900

Appendix E

Relevant legislation and guidelines

Appendix E Relevant legislation and guidelines

Environmental Protection Act 1994

The key piece of legislation in Queensland for assessing potential environmental impacts associated with development is the *Environmental Protection Act 1994* (EP Act). Under the Act, a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm (the general environmental duty). Failure to do this is an offence under the Act. The acoustic objectives of the EP Act are achieved through the Environmental Protection Regulation 2019 and the Environmental Protection (Noise) Policy 2019

Terms of Reference

The ToR state the objective and performance outcomes as follows:

> *The environmental objective to be met under the EP Act is that the activity will be operated in a way that protects the environmental values of the acoustic environment.*
>
> *The performance outcomes corresponding to these objectives are in Schedule 5, Table 1 of the EP Regulation. The Proponent should supply sufficient evidence (including through studies and proposed management measures) that show these outcomes can be achieved.*

EP Regulation was updated in September 2019 with the performance outcomes now provided in Schedule 8, Part 3, Division 1. There is no change in wording for the Environmental Objective or Performance Outcomes for Noise between the previous 2008 and current 2019 version. The relevant sections of the EP Regulation are discussed below.

Environmental Protection Regulation 2019

The noise objective of the Environmental Protection Regulation 2019 (EP Regulation) is to protect the environmental values of the acoustic environment. The Regulation lists two performance outcomes:

1. Sound from the activity is not audible at a sensitive receptor.
2. The release of sound to the environment from the activity is managed so that adverse effects on environmental values including health and wellbeing and sensitive ecosystems are prevented or minimised.

Schedule 8 Part 2 of the EP Regulation clarifies the following in relation to the above performance outcomes

> *Part 2 General matters to be addressed by environmental objective assessment*
>
> *General information*
>
> *1 the assessor must decide the extent to which the application achieves each environmental objective relevant to the application*
>
> *2 In assessing whether the application achieves the relevant environmental objective, the assessor must decide whether the activity the subject of the application achieves item 1 of the performance outcome stated for the environmental objective.*
>
> *3 If the assessor is not satisfied the activity the subject of the application achieves item 1 of the performance outcome for the relevant environmental objective, the assessor must decide whether the activity achieves the relevant item 2 performance outcomes stated for the environmental objective.*
>
> *4 the application achieves the relevant environmental objective if the assessor is satisfied the activity the subject of the application achieves –*
>
> *(a) item 1 of the performance outcome for the relevant environmental objective: or*
>
> *(b) item 2 of the performance outcomes for the relevant environmental objective*

5 *If the assessor is not satisfied the application achieves a performance outcome for the relevant environmental objective, the assessor may still decide the application achieves the relevant environment objective if the application includes alternative measures for the activity the subject of the application to achieve the environmental objective.*

As discussed in Clause 4 above, either Item 1 or Item 2 of the performance outcomes is to be achieved. In this instance that item 1 may not be achievable for some scenarios (due to receptor proximity), the assessment has focused on satisfying Item 2 of the performance outcome. The environmental values discussed in this performance outcome are detailed in EPP (Noise).

Environmental Protection (Noise) Policy 2019

The purpose of the Environmental Protection (Noise) Policy (EP (Noise) Policy) is to achieve the objectives of the EP Act in relation to the acoustic environment. The purpose of this policy is achieved by:

- Identifying environmental values to be enhanced or protected; and
- Stating acoustic quality objectives for enhancing or protecting the environmental values; and
- Providing a framework for making consistent, equitable and informed decisions in relation to the acoustic environment.

Environmental values to be enhanced or protected under this policy that are relevant to this assessment are:

> *"the qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following:*
>
> - *sleep*
> - *study or learn*
> - *be involved in recreation, including relaxation and conversation*
> - *the qualities of the acoustic environment that are conducive to protecting the amenity of the community"*

Acoustic quality objectives

Schedule 1 of the EP (Noise) Policy details acoustic quality objectives. The applicable objectives to dwellings are summarised in Table 13. These limits are designed to be long-term noise limits and are not applied to any individual project or enterprise. They can, however, inform the decision-making process around the limits and can assist in identifying whether the environmental values are protected.

Table 13 EP (Noise) Policy acoustic quality objectives

Sensitive receptor	Time of day	Acoustic quality objectives, dB(A)			Environmental value
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	
Dwelling (for outdoors)	Daytime and evening	50	55	65	Health and wellbeing
Dwelling (for indoors)	Daytime and evening	35	40	45	Health and wellbeing
Dwelling (for indoors)	Night-time	30	35	40	Health and wellbeing, in relation to the ability to sleep

Note:

The EP (Noise) Policy defines the following:

Daytime means the period after 7 am on a day to 6 pm on the day;

Evening means the period after 6 pm on a day to 10 pm on the day;

Night-time means the period after 10 pm on a day to 7 am on the next day.

The acoustic quality objectives have been adopted as noise limits for construction noise and the night time $L_{A1,adj,1hr}$ acoustic quality objectives have also been adopted for the assessment of sleep disturbance due to operational noise.

In addition to the Acoustic Quality objectives, the EPP (Noise) provides a hierarchy for the management of activities involving noise; reproduced below:

Part 4 Avoiding, minimising or managing noise

9 Management hierarchy for noise

1. *This section states the management hierarchy for an activity involving noise*
2. *To the extent that it is reasonable to do so , noise must be dealt with in the following order of preference:*
    a. *Firstly – avoid:*

        Example for paragraph (a)

        Locating an industrial activity in an area that is not near a sensitive receptors

    b. *Secondly – minimise, in the following order of preference –*

        i. *Firstly-orientate an activity to minimise noise*

            Example for subparagraph (i)- Facing a part of an activity that makes noise away from a sensitive receptors

        ii. *Secondly – use best available technology*

    c. *Thirdly-manage*

        Example for paragraph (c) - using heavy machinery only during business hours

Appendix F

References

Appendix F References

Baoquan Wan, Wangling He, Chunming Pei, Xiaorui Wu, Yuchao Chen, Yemao Zhang. 2017. “Audible Noise Performance of Conductor Bundles.” *Energies* 1-12.

Appendix G

Ecology Technical Report

Prepared for
Powerlink Queensland
ABN: 82 078 849 233

AECOM

Ecology Technical Report

23-Feb-2024
Burdekin River Pump Station

aecom.com

Delivering a better world

Ecology Technical Report

Client: Powerlink Queensland

ABN: 82 078 849 233

Prepared by

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23-Feb-2024

Job No.: 60714900

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

Quality Information

Document	Ecology Technical Report
Ref	60714900
Date	23-Feb-2024
Originator	Taruna Venkatachalam and Cameron Adams
Checker/s	Kate Brodie
Verifier/s	Chris Todd

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
0	01-Dec-2023	Draft	Rouven Lau Project Manager	
1	23-Feb-2024	Final	Rouven Lau Project Manager	

Table of Contents

1.0 Introduction

1.1 Project Context

AECOM Australia Pty Ltd (AECOM) has been commissioned by Powerlink Queensland (Powerlink) to undertake an ecology field survey to identify the existing ecological values, potential project impacts, mitigation measures and associated legislative requirements for the Burdekin River Pump Station connection into Powerlink's transmission network.

The Project comprises the following components:

- A new 132kV Substation (adjoining the approved pump station).
- A new Overhead Transmission Line (OHTL) to establish a 132kV single circuit tee off into the new Landers Creek Substation. The OHTL will be located within a proposed new easement within Lot 289 on SP117630, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 22 on GS1042.
- The proposed new easement is 40 metres (m) wide, being 20 m either side of the OHTL centreline, with one partial section being 50 m.

The proposed OHTL and Lander's Creek substation will be collectively referred to as the Burdekin River Pump Station Project (the Project). The Project is located on Ayr Dalbeg Road, 15.7 km south of the town of Clare in the Burdekin Shire Regional Council.

This report documents the outcomes of this ecology survey, identifies potential Project risk of impact on existing ecological values listed under State and Commonwealth legislation and recommends management and mitigation measures to reduce potential impacts as a result of project activities.

The Project supports the broader Townsville City Council (TCC) Haughton Pipeline Stage 2 Project which includes the pump station at the Burdekin River, a 28.5 km pipeline connecting the Burdekin River pump to the Ross River Dam in Townsville and other ancillary works.

The Haughton Pipeline Stage 2 has been referred to the Department of Climate Change, Energy the Environment and Water (DCCEEW) and was considered as a 'Controlled Action' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as it was considered likely to result in a residual significant impact on listed threatened species and communities (EPBC 2021/9133). The Haughton Pipeline Stage 2 was approved with conditions in March 2023.

Any future EPBC approval conditions outside of this report should be considered during construction and operation phase of the Project.

1.2 Project Area and Study Area

The Project is located on Ayr Dalbeg Road, approximately 15 km south of the town of Clare in the Burdekin Shire Regional Council Local Government Area. The Project Area is considered as the maximum clearing footprint for Project activities and the direct impact area; which includes the substation, the OHTL, and a 40 m clearing corridor along the transmission line (Figure 1).

The Project Area is approximately 3.2 ha representing a conservative maximum clearing footprint for the Project. The Project Area is abutted by the Burdekin River immediately adjacent to the east and intersects a waterway in the western part of the Project. The Ayr Dalbeg Road intersects the Project Area towards the east.

The Study Area considered during the field survey includes the Project Area with and additional 100m buffer to understand the ecological values in the broader area (Figure 1). The Study Area includes part of the Burdekin River to the east and is intersected by a canal to the west. The Study Area is approximately 22 ha.

1.3 Objectives and Investigation Scope

The objective of this ecological assessment is to identify the ecological values within the Study Area, assess the potential Project impacts to these values and recommend mitigation measures to reduce the

likelihood of impact. The ecological values assessed include Matters of National Environmental Significance (MNES) under Commonwealth legislation and listed Matters of State Environmental Significance (MSES) under Queensland legislation.

Specifically, the scope of work for the ecological assessment comprises:

- **Flora**:
  - Desktop and field assessments addressing presence, extent and condition of Commonwealth and State flora values including:
    - validation of the floristic composition
    - type and extent of vegetation communities
    - flora habitat types
    - Regulated Vegetation and Regional Ecosystems (REs)
    - presence and condition of threatened ecological communities (TECs) as per the Commonwealth Listing and Conservation Advice diagnostic and condition threshold criteria for each TEC
    - targeted searches of threatened flora species
    - ground truthing of additional MSES, including regulated vegetation within a defined distance of a watercourse
    - other MNES and MSES values.
- **Fauna**:
  - Desktop and field assessments addressing presence, extent and condition of Commonwealth and State fauna values including:
    - general and species-specific habitat assessments to field-validate habitat types and condition (including conservation significant fauna species habitat)
    - identification of threatened fauna species and migratory species
    - identification of the presence and values of waterways and wetlands
    - other MNES and MSES values
- a significant residual impact assessment for any MSES identified as potentially present.
- Introduced flora and fauna species occurring within the Study Area are addressed in this report briefly and introduced flora species (weeds) are presented in detail in a separate Weed Survey Report.

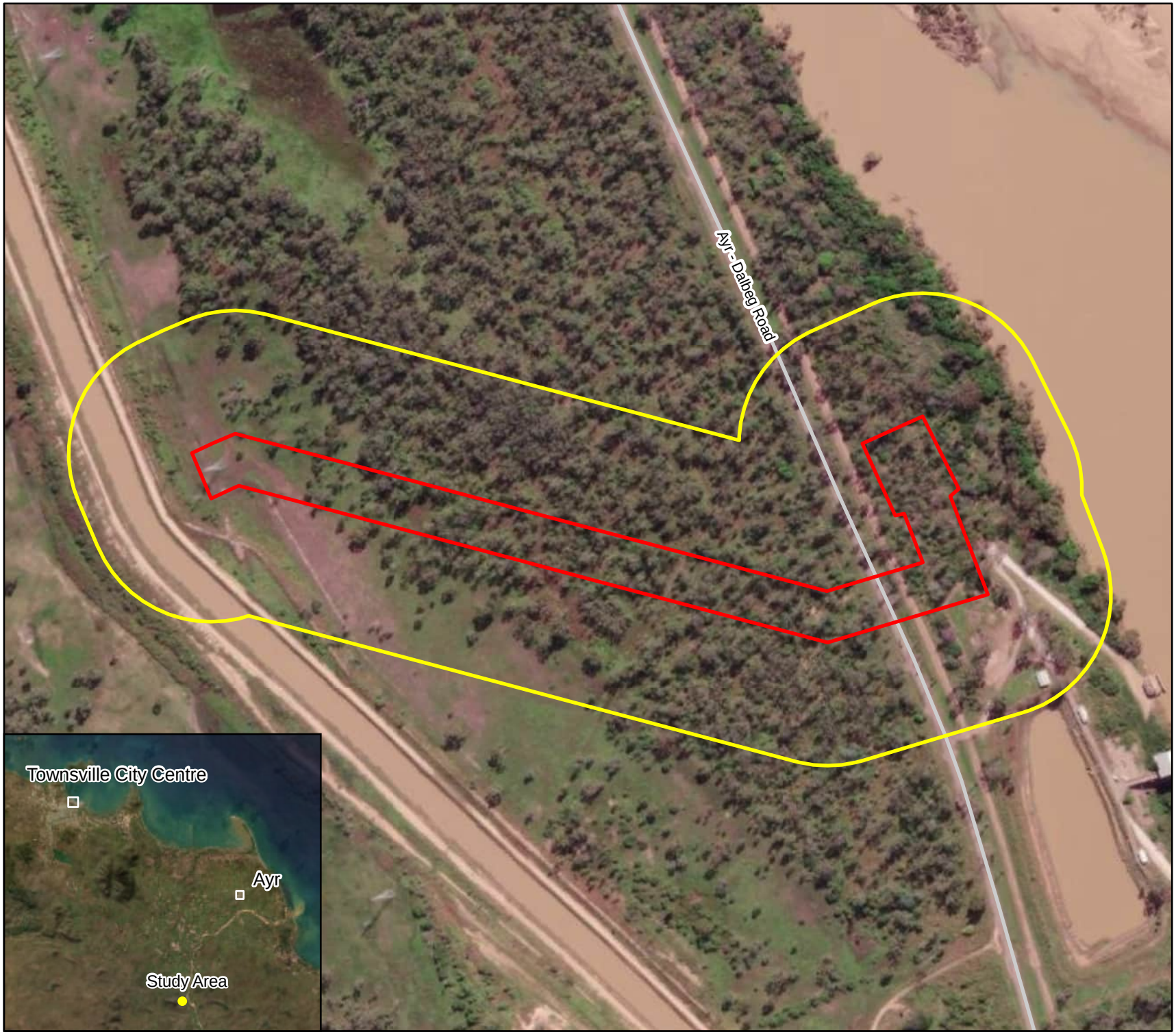
1.4 Structure of this Report

This report is structured as follows:

- Section 2.0: Legislative and Policy Context
- Section 3.0: Assessment Methods
- Section 3.5: Ecological Values
- Section 5.0: Matters of National Environmental Significance
- Section 6.0: Matters of State Environmental Significance
- Section 7.0: Potential Environmental Impacts
- Section 8.0: Avoidance, Minimisation, Mitigation and Management
- Section 9.0: MSES Significant Residual Impact Assessment
- Section 10.0: Summary and Conclusions.

This report is supported by the following appendices:

- Appendix A: Desktop Assessment Reports
- Appendix B: Flora and Fauna Species Lists
- Appendix C: Likelihood of Occurrence Assessment
- Appendix D: MSES Significant Residual Impact Assessments.



AECOM

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Legend

- Project Area
- Study Area

Powerlink Burdekin Haughton Pump Load Ecology Technical Report

Figure 1
Project Area & Study Area

Service Layer Credits: Queensland Government 2023, World Imagery: Earthstar Geographics
World Imagery: Maxar

2.0 Legislative and Policy Context

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act 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 or on Commonwealth land.

MNES comprise:

- World Heritage Properties
- National Heritage Places
- Wetlands of International Importance (listed under the Ramsar Convention)
- The Great Barrier Reef Marine Park
- Commonwealth Marine Areas
- Listed Threatened Species
- Listed TECs
- Migratory Species (listed under international agreements)
- Nuclear Actions (including uranium mines)
- A Water Resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act also covers actions on, or impacting on, Commonwealth land or actions by Commonwealth agencies.

Under the EPBC Act, conservation significant species are assigned a conservation status of:

- extinct
- extinct in the wild
- critically endangered
- endangered.
- vulnerable
- migratory.

TECs are assigned to one of three conservation categories:

- critically endangered
- endangered
- vulnerable.

Migratory species listed under the EPBC Act includes bird species, which are:

- migratory species which are native to Australia and are included in the appendices to the Bonn Convention
- migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA)
- native, migratory species identified in a list established under an international agreement such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

2.1.2 Weeds of National Significance

One of the primary objectives of the EPBC Act is to conserve Australian biodiversity which includes provisions for managing invasive species as threatening processes. The Australian Weeds Strategy

was developed by the Commonwealth in conjunction with all State and Territory governments to provide a national framework for the management of weeds and to reduce associated impacts on the environment. Under the strategy, 32 of Australia's most significant weed species are listed as Weeds of National Significance (WoNS) based on their invasiveness and potential for spread, as well as environmental, social and economic impacts. National management strategies and manuals have been published for all WoNS. WoNS identified within the Study Area are listed in Section 4.2.10. A separate Weed Survey Report has been produced for this Project that discuss WoNS occurring in the Study Area in more detail.

2.2 Queensland

2.2.1 Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) prohibits the taking or destruction, without authorisation, of protected flora and fauna species in the wild. All native plants and animals in Queensland are protected under Section 71 of the NC Act. This Act also provides for an integrated and comprehensive approach to conserve nature. The Act provides a legislative basis for research, community education, dedicating, declaring, and managing protected areas, and protecting native wildlife and its habitat.

Threatened species are listed under the NC Act in the NC (Animals) Regulation 2020 and the NC (Plants) Regulation 2020 in the following categories:

- near threatened
- vulnerable
- endangered
- critically endangered
- extinct in the wild.

Additionally, Special Least Concern species are protected under the NC Act for their cultural significance or their inclusion within international migratory bird agreements, and include:

- echidna (*Tachyglossus aculeatus*)
- platypus (*Ornithorhynchus anatinus)*
- flora species identified in Schedule 2 of the NC (Plants) Regulation 2020
- migratory bird species listed under the Bonn Convention, JAMBA, and CAMBA.

Appropriate authorisations or permits under the NC Act are required prior to clearing of listed conservation significant flora species, interfering with an animal breeding place, or removing protected animals unless the activity is exempt.

2.2.1.1 Protected plants framework

Within the NC Act, provisions exist for the regulation or restricted taking or using of protected plants. Section 89 of the Act states that ‘a person, other than an authorised person, must not take a protected plant that is in the wild unless the plant is taken under:

- a conservation plan applicable to the plant; or
- a licence, permit or other authority issued or given under a regulation; or
- an exemption under a regulation.

Activities that affect protected plants are regulated under the NC (Plants) Regulation 2020 which requires a flora survey be carried out where areas of clearing are to occur within ‘High Risk Areas’ shown on the ‘Flora Survey Trigger Map’. High Risk Areas are generally considered to occur in natural areas, such as regional ecosystems, within 2 km of known locations of critically endangered, endangered, vulnerable, or near threatened plants (threatened plants or near threatened plants).

2.2.2 Environmental Protection Act 1994

The objective of the *Environmental Protection Act 1994* (EP Act) is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

The EP Act provides the key legislative framework for the protection of the environment in Queensland. Section 319 of the EP Act imposes a 'general environmental duty', which specifies that a person must not undertake any activity that may harm the environment without taking reasonable and practical measures to prevent or minimise the harm. Potential avoidance and mitigation measures have been developed to inform the concept design to reduce potential harm caused by the Project where practicable.

2.2.3 Vegetation Management Act 1999

The VM Act regulates the clearing of native vegetation in Queensland and is administered by the Department of Resources (DoR). The purpose of the VM Act is to regulate the clearing of vegetation in a way that:

a. conserves remnant vegetation

b. conserves vegetation in declared areas

c. ensures that clearing does not cause land degradation

d. prevents the loss of biodiversity

e. maintains ecological processes

f. manages the environmental effects of the clearing to achieve the matters mentioned in paragraphs (a) to (e)

g. reduces greenhouse gas emissions

h. allows for sustainable land use.

The VM Act categorises and defines native vegetation as remnant (Category B), high value regrowth (HVR) (Category C), reef regrowth watercourse vegetation (Category R) and non-remnant (Category X). Remnant vegetation is further classified into a RE based on bioregion, landform, and dominant canopy species.

Under the VM Act all REs are assigned a Vegetation Management Class of endangered, of concern, or least concern. This is based on the current extent remaining compared to its pre-clearing extent, as gazetted under the VM Act and listed in the Regional Ecosystem Description Database (REDD) maintained by the Queensland Herbarium, Department of Environment and Science (DES).

The classes of REs are declared under the VM Act as:

- Endangered regional ecosystem:
  - less than 10% of its pre-clearing extent remaining; or
  - 10% to 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 ha
- Of concern regional ecosystem:
  - 10% to 30% of its pre-clearing extent remaining; or
  - more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 ha
- Least concern regional ecosystem:
  - more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is more than 10,000 ha.

Regulated vegetation and REs within the Study Area are discussed in Sections 4.2.1 and 4.2.2

2.2.3.1 Essential habitat

Essential habitat is regulated under the VM Act. Remnant (Category B) and HVR (Category C) vegetation in which 'Endangered' and 'Vulnerable' species listed under the NC Act have been known to occur are classified as essential habitat. Specifically, Section 20AC, Sub-Section 2 states:

'Essential habitat, for protected wildlife, is a Category A area, a Category B area or Category C area shown on the regulated vegetation management map -

a. that has at least three essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or

b. in which the protected wildlife, at any stage of its life cycle, is located'.

2.2.4 Biosecurity Act 2014

The *Biosecurity Act 2014* (Biosecurity Act) is administered by the Department of Agriculture and Fisheries (DAF). The Act provides management measures to protect agricultural and tourism industries and the environment from pests, diseases and contaminants.

Under the Act, invasive plants and animals are categorised as either a 'Prohibited Matter' or a 'Restricted Matter'. Restricted matter (flora) is discussed within Section 4.2.10 and restricted matter (fauna) is discussed within Section 4.3.4.

2.2.5 Fisheries Act 1994

The *Fisheries Act 1994* (Fisheries Act) and the Fisheries Regulation 1995 govern both commercial and recreational fishing activities and provide for the management, use, development and protection of fisheries resources and fish habitats, and the management of aquaculture activities. The Fisheries Act holds provisions for the following:

- removal, damage, or disturbance to marine plants, including mangroves
- works in a declared fish habitat
- waterway barrier works.

Aquatic values are discussed in Section 4.3.5.

Waterway barrier works are regulated under the *Fisheries Act 1994* when barriers to fish movement, including partial barriers, are installed across waterways. Common waterway barriers include dams, weirs, road crossings (culverts and causeways), bunds, sand dams, riffle structures, floodgates, trash racks and sediment curtains.

A Development Permit must be obtained through the Department of Agriculture and Fisheries (DAF) to construct or raise a waterway barrier unless the works are considered 'Accepted Development'.

2.2.6 Queensland Environmental Offsets Framework

The environmental offsets framework in Queensland includes the *Environmental Offsets Act 2014* (EO Act), the Environmental Offsets Regulation 2014 (EO Regulation) and the Queensland Environmental Offsets Policy (EO Policy).

MSES are defined under the EO Regulation and comprise:

- regulated vegetation
- connectivity areas (non-urban areas)
- wetlands and watercourses
- designated precincts in strategic environmental areas
- protected wildlife habitat
- protected areas (national parks, regional parks; and nature refuges)
- declared fish habitat areas and highly protected zones of state marine parks

- waterways providing for fish passage
- marine plants
- legally secured offsets areas.

A self-assessment using the Queensland Significant Residual Impact Guideline is required to determine whether the Project will have a significant residual impact on MSES. An environmental offset condition may be imposed under various State assessment frameworks (such as the *Planning Act 2016* and EP Act for an activity prescribed under the EO Act), if the Project will, or is likely to have a significant residual impact on a prescribed environmental matter that is a MSES.

3.0 Assessment Methods

3.1 Desktop Assessment

A desktop assessment was undertaken in August 2023 and repeated in November 2023 to characterise and identify potential flora and fauna values that may be present in the Study Area. Desktop searches included a review of the following searches of publicly available datasets and online mapping:

- EPBC Act Online Protected Matters Search Tool (PMST) to identify MNES that may occur within the Study Area (Department of Climate Change Energy the Environment and Water, 2023a)
- Wildlife Online database to identify flora and fauna species recorded within the Study Area (Department of Environment and Science, 2023a) (Appendix A)
- Atlas of Living Australia (ALA) database to identify locations of previously recorded flora and fauna species within the Study Area (Atlas of Living Australia, 2023)
- Regulated Vegetation Management Map to determine the extent of Category A, Category B, Category C and Category R vegetation within the Study Area (Department of Resources, 2023b)
- Department of Natural Resources Mines and Environment Vegetation Management map including essential habitat, watercourse and wetland mapping (Department of Natural Resources Mines and Energy, 2023)
- Queensland Herbarium REDD for current RE descriptions and geological and land zone descriptions (Queensland Herbarium, 2023)
- DES map of Queensland wetland environmental values to identify high ecological significance wetlands and general ecological significance wetlands (Department of Environment and Science, 2023b)
- DES Protected Plants Flora Survey Trigger Map to identify the high-risk areas for protected plants (Department of Environment and Science, 2023c)
- Species distribution maps from various current field guides.

Information collected as part of the desktop assessment was reviewed and used in the preparation of the field survey, to understand potential species presence and determine appropriate survey techniques.

A 20 km search radius was applied for the PMST and Wildlife Online databases. This radius was applied to a shapefile of the Project Area for the PMST search and to a central coordinate (-19.9263, 147.2162) for the Wildlife Online search.

3.2 Likelihood of Occurrence Assessment

Conservation significant communities and species identified during the desktop review were subject to a likelihood of occurrence assessment. Communities and species identified as potential or likely to occur were targeted during field surveys to collect more information on presence, habitat suitability and utilisation.

During the desktop assessment each community or species was assessed against the categories defined below. The likelihood of occurrence assessment was refined after field surveys utilising field validated information and understanding of the Study Area.

The likelihood of occurrence categories are defined as:

- **Known**: Species was positively identified and recorded in the survey area during the field surveys; or previous, reliable records occur within the Study Area.
- **Likely**: Species was not recorded in the survey area during the field surveys or previously, however there are known records within the nearby surrounding area and suitable habitat exists in the Study Area.

- **Potential**: Species was not recorded during the field surveys or previously, however known records occur in the surrounding area and habitat in the Study Area is marginal or degraded.
- **Unlikely**: Habitat in the Study Area might be marginally suitable; however, species was not recorded during the field surveys, and no known records of the species exist within the surrounding area.

This process is to be used as a guide and is not to be used as indicating species presence or absence other than where species were observed during field surveys.

3.3 Field Assessment

3.3.1 Flora

3.3.1.1 Vegetation Community Assessment

The extent, classification and condition of ground-truthed vegetation communities within the Study Area was validated in accordance with the Methodology for surveying and mapping regional ecosystem and vegetation communities in Queensland (Neldner et al., 2022). This involved traversing vegetation communities on foot throughout the Study Area and undertaking tertiary level assessments. In addition, flora observations were utilised to assist in the classification, mapping and identification of regional ecosystems and flora species across the Study Area.

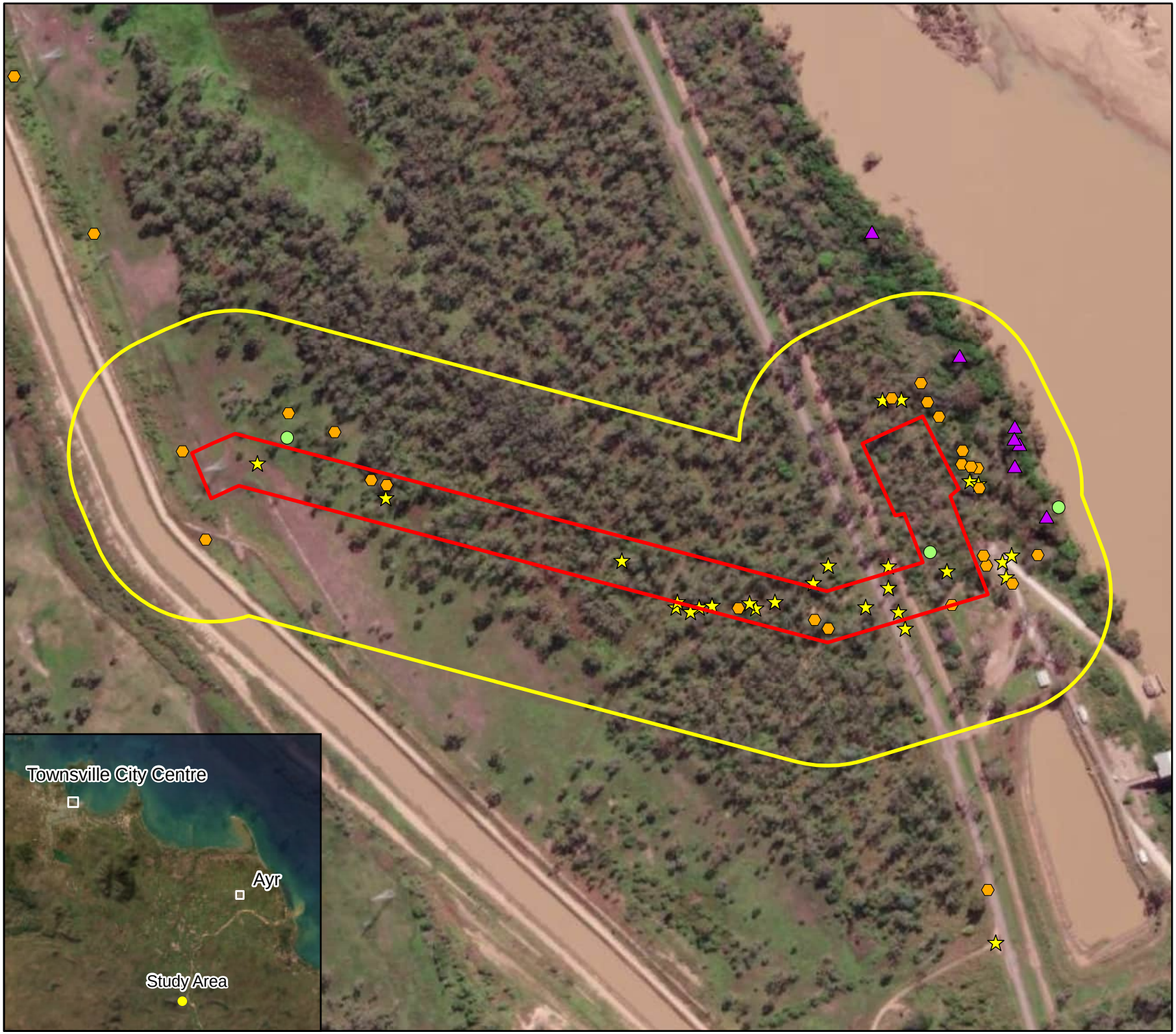
The following information was collected at each tertiary site:

- site location (GPS co-ordinate), site photos, date and observer
- vegetation structure, which included identifying the different strata (i.e., emergent, tree, shrub and ground layers and the height and cover values of each stratum)
- RE verification and condition.

The flora survey sites including flora observations and tertiary assessments are displayed in Figure 2.

3.3.1.2 Specimen Identification and Nomenclature

Specimens of plant taxa that could not be identified in the field were collected and preserved in accordance with the requirements of the Queensland Herbarium (Bean, 2016). Specimens were then identified using herbaria keys and other identification reference books as well as through comparison with the herbarium reference collection. Nomenclature used in this report follows the Queensland Herbarium flora census (Laidlaw, 2022). Exotic flora species are signified in text by an asterisk (*) and comprise species classified as naturalised from the flora census.



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- Project Area
- Study Area
- Observation Point
- Flora Observation Point
- Tertiary Assessment
- *Eucalyptus raveretiana* locations (GHD, 2021)

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Figure 2
Flora survey sites

3.3.2 Fauna

Methods employed during the field program included habitat assessments and incidental observations. Further information regarding each method is detailed below. The fauna survey sites are displayed in Figure 3.

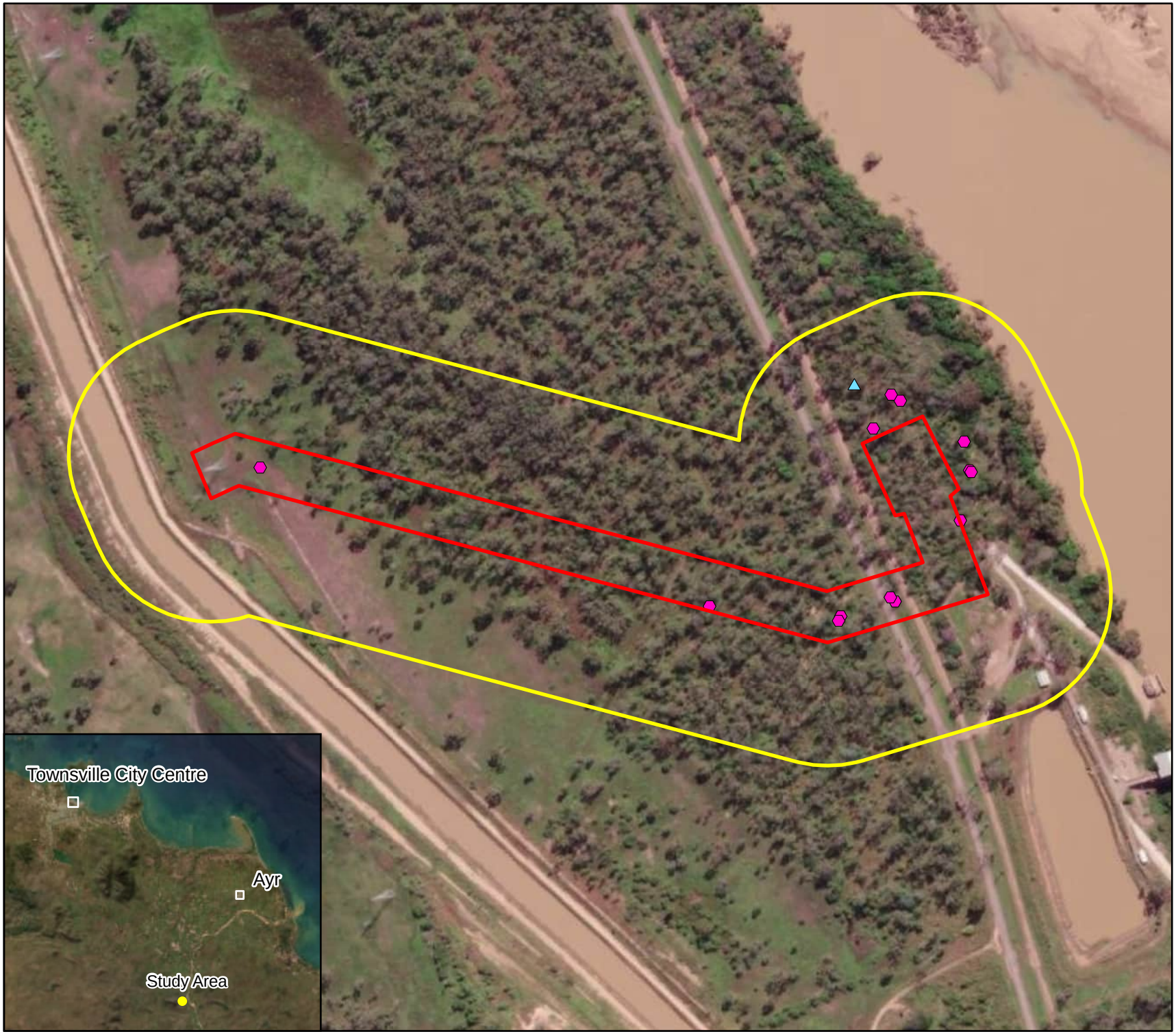
3.3.2.1 Habitat Assessments

Habitat assessments were undertaken to characterise the fauna habitat values within the Study Area. These assessments provide an indication of habitat suitability and likely utilisation for fauna species, particularly listed conservation significant fauna. Habitat attributes recorded during the assessment included:

- vegetation structure and dominant species, including a description of canopy, shrub and ground layer structure and composition
- presence and abundance of tree hollows and stags
- presence and abundance of woody debris such as habitat logs and ground timber
- presence, abundance and depth of leaf litter
- rocky habitat such as surface rocks, boulders, crevices, overhangs and caves
- proximity to water (both permanent and ephemeral)
- disturbance from invasive weeds/pests
- other disturbances such as grazing pressure, clearing, thinning or fire
- any other significant habitat features or values present.

3.3.2.2 Incidental Observations

Direct observations of fauna species were recorded throughout the survey. Searches for signs of animal activity, including tracks, scats, scratches, bones, fur, feathers, nests, foraging holes and diggings were also undertaken. Signs were attributed to the appropriate species where possible.



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- Project Area
- Study Area
- Fauna observation
- General habitat observation

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Figure 3
Fauna survey sites

3.4 Impact Assessment for Matters of State Environmental Significance

A significant residual impact assessment was undertaken for MSES identified within the Study Area, in accordance with the criteria provided in the Significant Residual Impact Guidelines (Department of State Development Infrastructure and Planning, 2014a).

Significant residual impact assessments for the relevant MSES values were completed using ground-truthed data, such as habitat mapping per species for protected wildlife habitat. The exception to this is the Landscape Fragmentation and Connectivity (LFC) Tool (version 1.4), which uses State RE mapping by default.

MSES present within the Study Area are identified in Section 6.0, while specific significant residual impact assessments for each MSES values present are outlined in Section 9.0.

3.5 Limitations

All field assessments are subject to limitations in the detection success of targeted species, particularly when conducted as a single event rather than ongoing over a long period of time. These limitations may result in ‘false-absence’ records where a species is not recorded but is present. However, to account for this a likelihood of occurrence assessment was undertaken in which the information from the survey was considered along with other information sources to determine the likelihood of occurrence.

Limitations associated with the flora field survey relate to the variability of vegetation communities across the survey location, as well as the detectability and presence of species at different times (e.g. flowering periods and emergence of annual species). A single field study cannot confirm that every species was detected. However, the survey was sufficient in characterising vegetation communities and habitat values within the Study Area.

This report has assessed the substation and transmission line locations and associated clearing areas, alongside potential construction areas. The Project Area is assessed as the maximum clearing area required for the Project and all associated activities, including laydown areas and access tracks.

A significant impact assessment on MNES protected by the Commonwealth EPBC Act was not undertaken as part of this assessment.

The limitations discussed above are not considered to fundamentally alter the outcomes of this assessment.

4.0 Ecological Values

4.1 Regional Context

4.1.1 Bioregion and Subregion

The Study Area is located within the Brigalow Belt bioregion. The bioregion is characterised by brigalow (*Acacia harpophylla*) forests and woodlands on clay soils (Sattler & Williams, 1999). Other ecosystems that are widespread throughout the bioregion include eucalypt forest and woodland, grassland, dry rainforest, cypress pine woodland and riparian communities.

The Study Area is situated within the Townsville Plains subregion, which is the most northerly subregion within the Brigalow Belt bioregion.

4.1.2 Surface Geology and Land Zone

The Queensland DoR detailed 1:100,000 regional surface geological mapping identified that the Study Area contains one geological unit (Department of Resources, 2023a) described in Table 1.

Table 1 Major surface geology units

Geological unit code	Age	Lithological summary	Dominant Soil	General Location within Study Area
Qha\e	Holocene	Sand, gravelly sand, gravel, silt, and clay; mainly undifferentiated flood plain, paleochannel, and minor terrace alluvium; delta and estuarine deposits	Alluvium	Entire Study Area

Land zones are categories that describe the major geologies, the associated landforms and geomorphic processes, and are an important component of the RE classification scheme (Wilson & Taylor, 2012). One land zone (Table 2) has been identified and is broadly consistent with the surface geology mapping.

Table 2 Land zones present within the Study Area

Land zone	Definition
3	**Recent Quaternary alluvial systems**, including closed depressions, paleo-estuarine deposits currently under freshwater influence, inland lakes and associated wave built lunettes. Excludes colluvial deposits such as talus slopes and pediments. Includes a diverse range of soils, predominantly Vertosols and Sodosols; also with Dermosols, Kurosols, Chromosols, Kandosols, Tenosols, Rudosols and Hydrosols; and Organosols in high rainfall areas.

4.1.3 Survey Timing and Climatic Conditions

The field survey was undertaken on the 4th and 5th of September 2023. The survey was undertaken during the daytime only. Weather observations during the survey period recorded the minimum and maximum temperature as 14.1 ºC and 28.8 ºC respectively (Ayr DPI Research Station 033002, located approximately 40 km north-east of the Study Area). No rainfall occurred immediately prior to the survey period (Bureau of Meteorology, 2023).

4.2 Flora

4.2.1 Vegetation Communities

The DES Queensland Herbarium regional ecosystem (RE) mapping (Version 13) identified five REs with least concern status under the VM Act as present within the Study Area (RE 11.3.7, RE 11.3.9, RE 11.3.25, RE 11.3.30, RE 11.3.35), as well as areas of non-remnant vegetation.

The field survey found that the desktop mapping of REs did not accurately reflect the vegetation on ground. Results of the field survey confirmed the presence of remnant RE 11.3.35 and RE 11.3.25a, plus non-remnant vegetation and water within the Study Area. The Study Area was found to contain

mostly remnant vegetation, with non-remnant areas in the south-eastern and westernmost edges. Within the Project Area the vegetation was predominantly remnant RE11.3.35.

Remnant RE 11.3.35 comprises of dominant *Eucalyptus platyphylla* (poplar gum) along with *Corymbia clarksoniana*, *Corymbia tessellaris*, *Corymbia erythrophloia* and *Corymbia dallachiana*. Some areas contained occasional hollow-bearing trees. The subcanopy layer contained *Planchonia careya* and *Ziziphus mauritiana** (chinee apple), with ground species including *Heteropogon triticeus* (giant spear grass), *Heteropogon contortus* (black spear grass) and *Megathyrsus maximus** (guinea grass). Some areas had dense infestations of chinee apple and *Cryptostegia grandiflora** (rubber vine).

Remnant riparian RE 11.3.25a occurs along the bank of the Burdekin River in the east of the Study Area, characterised by the presence of *Eucalyptus raveretiana,* (black ironbox) listed as Vulnerable under the EPBC Act and Least Concern under the NC Act. This vegetation community also had dense weed infestations, particularly *Ricinus communis** (castor oil plant).

The ground-truthed vegetation communities and REs within the Study Area and Project Area are presented in Figure 4 and summarised in Table 3.

Table 3 Vegetation communities present in the Study Area

Vegetation community (RE short description[1])	RE	VM Act Class[2]	BD Status[3]	Condition	Project Area (ha)	Study Area (ha)
1) *Eucalyptus platyphylla*, *Corymbia clarksoniana* woodland on alluvial plains	11.3.35	Least concern	No concern at present	Remnant	2.7	13.5
2) *Eucalyptus raveretiana* (sometimes emergent), *Eucalyptus tereticornis* and *Melaleuca fluviatilis* woodland	11.3.25a	Least concern	Of concern	Remnant	-	1.6
3) Water					-	1.4
4) Non-remnant vegetation					0.5	5.5
Total					**3.2**	**22.0**

[1] Vegetation community description adapted from the REDD Version 13 (Queensland Herbarium, 2023)

[2] Conservation class of REs under the VM Act.

[3] Biodiversity (BD) status of the RE, under the EP Act, based on an assessment of the condition of remnant vegetation in addition to the pre-clearing and remnant extent of a regional ecosystem.

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Legend

- Project Area
- Study Area

Vegetation communities

- *Eucalyptus raveretiana* (sometimes emergent), *Eucalyptus tereticornis* and *Melaleuca fluviatilis* woodland on river channels
- *Eucalyptus platyphylla, Corymbia clarksoniana* woodland on alluvial plains
- Water
- Non-remnant

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Figure 4
Vegetation Communities

4.2.2 Regulated Vegetation

The DoR Vegetation Management Report identified Category B (remnant) and Category X (non-remnant) vegetation occurring within the Study Area, (Department of Resources, 2023b). The field survey results largely confirmed the state mapping with some variation (Table 4). The following ground-truthed vegetation management categories were mapped within the Study Area:

- Category B (remnant vegetation), throughout the Study Area in the centre and east
- Category X (non-remnant vegetation) towards the west of the footprint within the grassy paddock, the canal and west of the canal, as well as a cleared area in the south-eastern corner of the Study Area.

This proportion of Category B and Category X was also reflected within the Project Area, with Category X associated with access tracks, roads and clearing for the adjacent pump intake site.

Table 4 Regulated vegetation categories within the Project Area

RVM Category	Area (ha)	
	Project Area	**Study Area**
Category B	2.71	16.44
Category X	0.45	5.67
Total	**3.16**	**22.11**

4.2.3 Regulated Vegetation Within a Defined Distance to a Watercourse

The Burdekin River is mapped within the eastern part of the Study Area as a Stream Order 9 under the VM Act. Vegetation within the Study Area occurs within 50 metres from the defining bank, and therefore the Study Area contains regulated vegetation within a defined distance to a watercourse. The high bank for the Burdekin River is broadly located west of RE 11.3.25a.

4.2.4 Regulated Vegetation Within 100 m of a Wetland

The desktop assessment identified no regulated vegetation occurring within 100 m of a wetland, since no wetlands under the VM Act are mapped near the Study Area. Field surveys confirmed Queensland Government mapping. Wetlands are not discussed further in this report.

4.2.5 Threatened Ecological Communities

The desktop assessment identified two TECs as potentially occurring within 20 km from the Study Area, namely *Poplar Box Grassy Woodland on Alluvial Plains* TEC and *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* TEC. No TECs or analogous REs were identified during field surveys within the Study Area.

4.2.6 Flora Species Diversity

A total of 64 species were recorded during the flora survey from 25 Families. The dominant families were Leguminosae (11 taxa), Poaceae (10 taxa) and Myrtaceae (9 taxa). Refer to Appendix B for the flora species list.

No essential habitat for flora species intersects the Project Area.

4.2.7 Conservation Significant Flora Species

Ten conservation significant flora species were identified by the PMST and WildNet searches (Appendix A). The desktop assessment identified one conservation significant flora species being black ironbox as being likely to occur within the Study Area. Black ironbox was confirmed present within the Study Area during field surveys, located outside of the Project Area associated with RE 11.3.25a along the Burdekin River (Table 5). The full likelihood of occurrence assessment is presented in Appendix C.

Table 5 Conservation significant flora species potentially occurring in the Study Area

Common Name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Likelihood of Occurrence in the Study Area
Black ironbox	*Eucalyptus raveretiana*	V	LC	Known

[1] Conservation status under the EPBC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, Mi = Migratory.

[2] Conservation status under the NC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, SLC=Special Least Concern, LC=Least Concern.

4.2.8 Protected Plants

The Study Area is not mapped as a 'high risk area' on the Protected Plants Flora Survey Trigger Map (Appendix A). No NC Act listed threated flora species were found during the field survey. A full species list is provided in Appendix B.

4.2.9 Marine Plants

The Study Area is sufficiently distant from the nearest highest astronomical tide (HAT) line and no marine plants were found to occur.

4.2.10 Introduced Flora Species

A total of 34 introduced species including two WoNS were identified as potentially occurring within 20 km by the desktop assessment. 32 introduced flora species were confirmed to occur in the Study Area during field surveys, with two WoNS and five species listed as Category 3 restricted matter under the Biosecurity Act (Table 6). A stand-alone Weed Survey Report has been produced to discuss the introduced flora species occurring within the Study Area in further detail.

Table 6 Introduced weed species including WoNS or restricted matter under the *Biosecurity Act 2014*

Scientific name	Common name	WoNS list	Biosecurity Act status
*Albizia lebbeck**	Indian siris	No	-
*Alternanthera sp.**	Joyweed	No	-
*Argemone ochroleuca**	Mexican poppy	No	-
*Argyreia nervosa**	Elephant ear vine	No	Category 3 restricted matter
*Basilicum polystachyon**	Basilicum	No	-
Bidens pilosa*	Cobblers pegs	No	-
Bothriochloa pertusa*	Indian bluegrass	No	-
*Cascabela thevetia**	Yellow oleander	No	Category 3 restricted matter
*Chamaecrista rotundifolia**	Wynn cassia	No	-
*Chloris virgata**	Feathertop Rhodes grass	No	-
*Cryptostegia grandiflora**	Rubber vine	Yes	Category 3 restricted matter
*Cucumis melo**	Muskmelon	No	-
*Erigeron bonariensis**	Fleabane	No	-
*Erigeron bonariensis**	Fleabane	No	-
*Gomphrena celosioides**	Gomphrena	No	-
*Jatropha gossypiifolia**	Bellyache bush	Yes	Category 3 restricted matter

Scientific name	Common name	WoNS list	Biosecurity Act status
*Macroptilium atropurpureum**	Siratro	No	-
*Megathyrsus maximus**	Guinea grass	No	-
*Melinis repens**	Red natal	No	-
*Mesosphaerum suaveolens**	Hyptis	No	-
*Passiflora foetida**	Stinking passionflower	No	-
*Praxelis clematidea**	Praxelis	No	-
*Psidium guajava**	Guava	No	-
*Ricinus communis**	Castor oil plant	No	-
*Sesbania cannabina**	Sesbania pea	No	-
*Sida cordifolia**	Flannel weed	No	-
*Sporobolus sp.**	Giant rats tail grass	No	-
*Stachytarpheta jamaicensis**	Blue snakeweed	No	-
*Stylosanthes scabra**	Stylo	No	-
*Themeda quadrivalvis**	Thatch grass	No	-
Xanthium occidentale*	Noogoora burr	No	-
*Ziziphus mauritiana**	Chinee apple	No	Category 3 restricted matter

4.3 Fauna

4.3.1 Habitat Types

Four fauna habitat types were found to occur within the Study Area based on field validated data, with two occurring within the Project Area (Table 7). A description of each habitat type is detailed in the subsequent sections below. The fauna habitat types are consistent with the vegetation communities as mapped on Figure 4.

Table 7 Fauna habitat types and descriptions

Habitat No.	Habitat Type	Associated RE	Area (ha)	
			Project Area	Study Area
1	*Eucalyptus platyphylla*, *Corymbia clarksoniana* woodland on alluvial plains	11.3.35	2.72	13.53
2	*Eucalyptus raveretiana* (sometimes emergent), *Eucalyptus tereticornis* and *Melaleuca fluviatilis* woodland on river channels	11.3.25a	0	1.64
3	Water	Non-remnant	0	1.27
4	Non-remnant vegetation	Non-remnant	0.45	5.66

4.3.1.1 Eucalyptus platyphylla, Corymbia clarksoniana woodland on alluvial plains

This habitat type occurs on gently undulating plains on silty loamy soil adjacent to the Burdekin River (Plate 1). Overall, the vegetation is predominantly native with exotic species occurring in the ground and shrub layers.

Mature koala food trees (*Eucalyptus* spp. and *Corymbia* spp.) dominate the canopy layer. Hollow-bearing mature trees and stags were found occasionally scattered throughout the Study Area. Although large hollows were rare in the Study Area, medium-sized hollows were present. These hollows may provide breeding habitat for the *Petauroides volans* (greater glider), and denning habitat for microbat species such as the *Saccolaimus saccolaimus nudicluniatus* (bare-rumped sheathtail bat). The bare-rumped sheathtail bat also shows a roosting preference for poplar gum which is present in the Study Area. The hollows may provide habitat for common birds such as *Platycercus adscitus* (pale-headed rosella) and *Calyptorhynchus banksii* (red-tailed black cockatoo) which were recorded in the Study Area. Suitable foraging opportunities occur for a range of nectar-feeding and foliage-gleaning birds with flowering Eucalypt species, and occasional records of mistletoe.

The shrub layer was found to be dense in parts of the Study Area and was dominated by exotic species particularly chinee apple and rubber vine with native species *Planchonia careya* (cocky apple), juvenile *E. platyphylla* and *Atalaya hemiglauca* also scattered throughout. The ground layer cover was dominated by mainly black spear grass, giant spear grass and the exotic Guinea grass. Exotic grasses that may provide suitable foraging habitat for the *Poephila cincta cincta* (black-throated finch (southern)) also occur in the ground layer at the edge of the remnant area, such as *Bothriochloa pertusa* (Indian bluegrass *), *Chloris virgata** (Rhodes grass) and *Melinis repens** (red natal grass). The grassy ground layer may also provide dispersal opportunities for small ground-dwelling mammals and foraging opportunities for macropods. The ground layer is unlikely to be suitable habitat for *Geophaps scripta scripta* (squatter pigeon (southern)) as the density of vegetated ground cover is not preferred by the species. Due to the potential for regular inundation and very soft sandy substrates, habitat is unlikely to be suitable for the *Egernia rugosa* (yakka skink).

Decorticating bark is occasional, providing some opportunities for arboreal reptiles such as geckos. Other opportunities for reptiles in this habitat are limited to occasional woody debris, medium sized hollow logs and some areas of thin leaf litter.

Disturbance is moderate and was primarily attributed to weeds, historical selective clearing and some feral pig disturbance. Cattle were also recorded in some locations.

Plate 1 ***Eucalyptus platyphylla, Corymbia clarksoniana*** **woodland on alluvial plains (RE 11.3.35)**

4.3.1.2 *Eucalyptus raveretiana* (sometimes emergent), *Eucalyptus tereticornis* and *Melaleuca fluviatilis* woodland on river channels

This habitat occurs in the Study Area along the Burdekin River, which is a higher-order watercourse (Plate 2). The Burdekin River is a slow flowing, wide watercourse, suggesting that water availability is moderate and likely to be greater during the wet season. Such conditions create suitable habitat for common amphibian species and provide a source of drinking water for a variety of fauna throughout the year including the conservation significant black-throated finch (southern). The watercourses have a sandy substrate providing suitable conditions for reptile species such as turtles, but the bank has a steep slope and is densely populated with weed species in the ground layer, posing potential access difficulties for terrestrial ground-dwelling fauna. Due to the potential for regular inundation and very soft sandy substrates, habitat is not suitable for the yakka skink.

The dominant canopy species present in this area is the black ironbox occurring all along the Burdekin River. Other *Eucalyptus* and *Melaleuca* species occur in the canopy layer, providing roosting and foraging habitat for the koala as well as bat and bird species such as those mentioned in Section 4.3.1.1. This canopy may also be suitable habitat for the greater glider and *Phascolarctos cinereus* (koala). The shrub and ground layers are predominantly made up of common exotic species including chinee apple, *Argyreia nervosa** (elephant ear vine), castor oil plant, *Alternanthera* sp.* (joyweed), and Guinea grass. Despite the exotic species, the understorey may still provide dispersal habitat for macropods and shelter for other reptiles and amphibian species including common snakes.

Plate 2 ***Eucalyptus raveretiana*** **(sometimes emergent),** ***Eucalyptus tereticornis*** **and** ***Melaleuca fluviatilis*** **woodland on river channels (11.3.25a)**

4.3.1.3 Water

This habitat type consists of two waterways within the Study Area, the perennial major Burdekin River to the east and a minor man-made canal to the west. The primary habitat value is access to fresh water, as well as sandy substrate.

4.3.1.4 Non-remnant vegetation

The non-remnant vegetation is associated with cleared land, access tracks, roads and existing infrastructure adjacent to the Study Area. Habitat values are reduced due to lack of vegetation structure and complexity, however it may still be important to some bird, mammal and reptile species (Plate 3). A few mature *Eucalyptus* and *Corymbia* species occur with a mown grassy understory beside access tracks in the east of the Study Area. Mistletoe in a poplar gum was observed in this area which can provide foraging and dispersal habitat for bird species such as parrots and honeyeaters, some of which were recorded in the neighbouring remnant habitat. Sparse grassy habitat occurs along the road corridors which could provide habitat for some reptile, ground-dwelling birds and mammals. Fauna species may utilise these habitat values to disperse between areas of remnant habitat.

Plate 3 Non-remnant vegetation

4.3.2 Conservation Significant Fauna Species

The desktop searches identified 44 conservation significant fauna species to consider in the likelihood of occurrence assessment. Following the field validation of habitat values within the Study Area, the likelihood of occurrence assessment was updated. The results of this assessment identified 15 conservation significant fauna species considered as likely or having the potential to occur within the Study Area (Table 8), including four threatened birds, five mammals and six migratory birds (one of which is also threatened). The full likelihood of occurrence assessment is presented in Appendix C.

Table 8 Conservation significant fauna species potentially occurring in the Study Area

Common Name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Likelihood of Occurrence in the Study Area
Birds				
Red goshawk	*Erythrotriorchis radiatus*	V	E	Potential
Squatter pigeon (southern)	*Geophaps scripta scripta*	V	V	Likely
White-throated needletail	*Hirundapus caudacutus*	V, Mi	V	Potential (flyover only)
Black-throated finch (southern)	*Poephila cincta cincta*	E	E	Likely
Migratory Birds				
Fork-tailed swift	*Apus pacificus*	Mi	SLC	Potential (flyover only)
Sharp-tailed sandpiper	*Calidris acuminata*	Mi	SLC	Potential
Satin flycatcher	*Myiagra cyanoleuca*	Mi	SLC	Potential
Osprey	*Pandion haliaetus*	Mi	SLC	Potential
Rufous fantail	*Rhipidura rufifrons*	Mi	SLC	Potential
Mammals				
Northern quoll	*Dasyurus hallucatus*	E	LC	Potential
Greater glider (northern)	*Petauroides minor* (syn. *P. volans minor*)	V	V	Potential
Greater glider (southern and central)	*Petauroides volans* (syn. *P. v. volans, P. armillatus*)	E	E	Potential
Koala	*Phascolarctos cinereus*	E	E	Potential
Bare-rumped sheathtail bat	*Saccolaimus saccolaimus nudicluniatus*	V	E	Potential
Short-beaked echidna	*Tachyglossus aculeatus*	-	SLC	Likely

[1] Conservation status under the EPBC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, Mi = Migratory.

[2] Conservation status under the NC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, SLC=Special Least Concern, LC=Least Concern.

4.3.3 Essential Habitat

Essential habitat is produced by the Queensland Government using a combination of species habitat models and buffered species records (Department of Natural Resources Mines and Energy, 2023). Essential habitat for protected wildlife is an area of vegetation identified as assessable vegetation on the Regulated Vegetation Management Map:

- that has at least three essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database. Essential habitat factors are comprised of – regional ecosystem (mandatory for most species), vegetation community, altitude, soils, position in landscape; or

- in which the protected wildlife, at any stage of its life cycle, is located.

There is no essential habitat mapped within the Project Area. Essential habitat for the Koala (*Phascolarctos cinereus*) is mapped approximately 2 km to the west of the Study Area on Lot 22 GS1042.

4.3.4 Introduced Fauna Species

Evidence of one introduced fauna species was recorded during the field surveys which is listed as restricted matter under the Biosecurity Act (Table 9). Other introduced fauna species that may occur within the Study Area include the fox, hare, black rat and house mouse.

Table 9 Introduced fauna species

Common name	Scientific name	Biosecurity Act status
Feral pig	*Sus scrofa*	Category 3,4,6

4.3.5 Fish Passage

Constructing or raising barrier works in a waterway will trigger development applications if they are not considered accepted development under the DAF Accepted Development Requirements for operational works that is constructing or raising waterway barrier works (ADR) (Department of Agriculture and Fisheries, 2020). A key consideration in a waterway barrier application is providing for appropriate fish passage. Waterway determinations under the Fisheries Act use several colours to identify their level of risk of impact on fisheries. These are as follows (Department of Agriculture, Fisheries and Forestry, 2013):

- low impact (green)
- moderate impact (amber)
- high impact (red)
- major impact (purple)
- tidal (grey).

One major impact (purple) waterway is mapped adjacent to the Study Area, associated with the Burdekin River to the east (Figure 5). One low impact (green) waterway occurs approximately 100 m to the west of the Study Area.

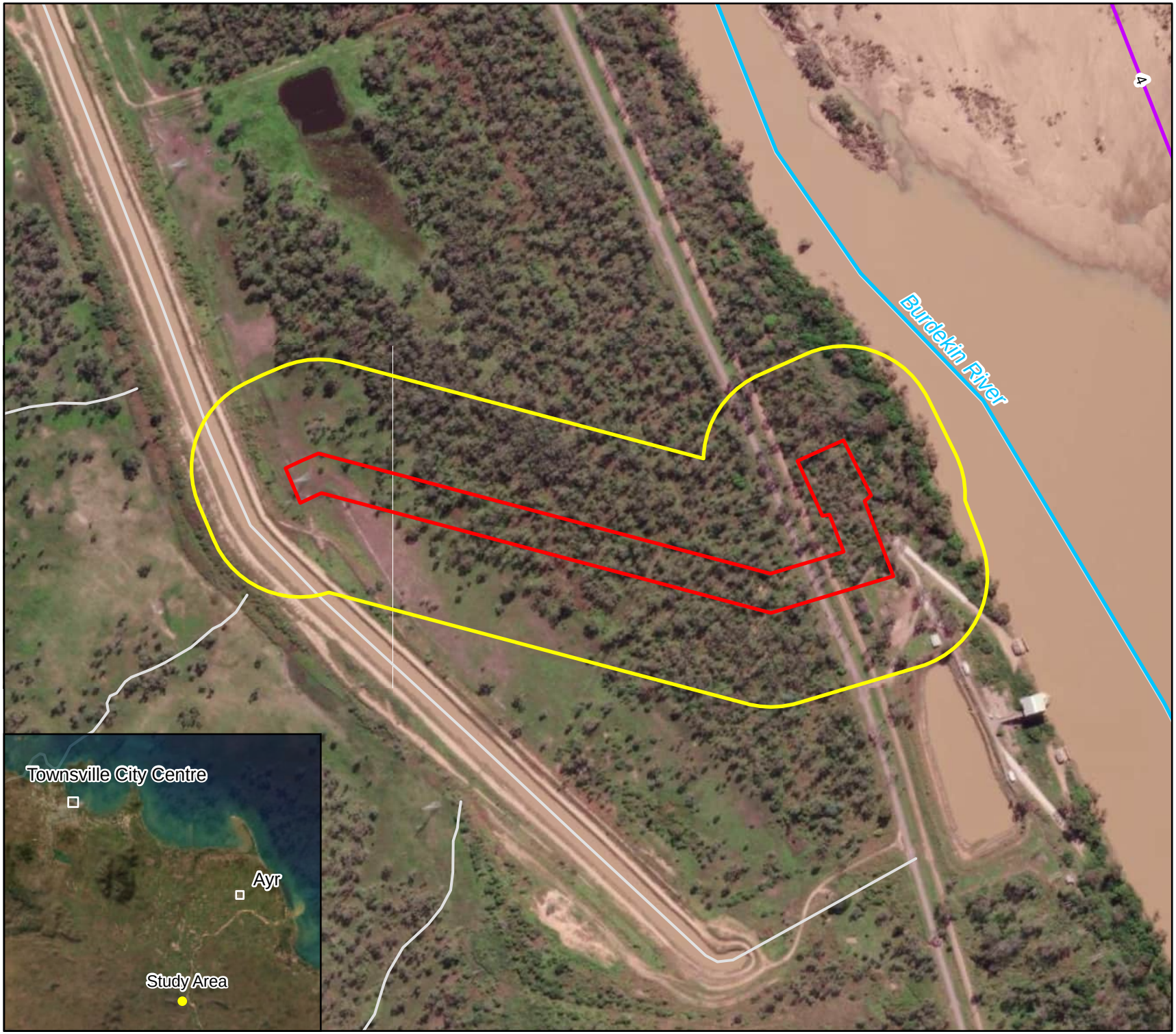
4.4 Wetlands and Watercourses

Wetland mapping reviewed as part of the desktop assessment included the DES Queensland Wetland mapping, MSES High Ecological Significance (HES) wetland mapping and Vegetation management wetland mapping. VM Act watercourse mapping was also reviewed (Figure 5).

The Watercourse Identification Map (WIM) identifies features that are protected and managed under the *Water Act 2000* (Water Act). The WIM primarily identifies surface water features (i.e., watercourses) and overland flow features (i.e., drainage features). The Burdekin River occurs within the Study Area to the east, which is considered a watercourse under the Water Act. No Water Act watercourses intersect the Project Area. There are unmapped watercourses associated with creek lines to the west of the Study Area, and the canal within the Study Area.

The Burdekin River is a stream order 9 VM Act watercourse that occurs in the Study Area to the east. No other VM Act watercourses intersect the Study Area, but two drainage features with stream order 1 are mapped to the west and south of the Study Area.

There are no DES, HES or VM Act wetlands mapped within or adjacent to the Study Area.



AECOM

N

0 75 150
Meters

Legend

- Project Area
- Study Area

***Water Act 2000* Watercourse Identification Map**

- Watercourse
- Unmapped

***Fisheries Act 1994* waterways**

- 4 - Major impact

Powerlink Burdekin Haughton Pump Load Ecology Technical Report

Figure 5
Wetlands & Watercourses

5.0 Matters of National Environmental Significance

A summary of Matters of National Environmental Significance (MNES) values listed under the EPBC Act that may occur within the Study Area are presented in Table 10.

Table 10 MNES present within the Study Area

MNES Value	Value Present?	Comments
World Heritage properties	**No**	There are no World Heritage properties within or adjacent to the Study Area. However, the Great Barrier Reef World Heritage Area is located at the mouth of the Burdekin River.
National heritage places	**No**	There are no National heritage places within or adjacent to the Study Area.
Wetlands of international importance (listed under the Ramsar convention)	**No**	The Study Area is sufficiently distant from any Wetlands of international importance.
Listed threatened species and ecological communities	**Yes**	The likelihood of occurrence assessment identified no EPBC Act listed TECs as potential to occur within the Study Area. The likelihood of occurrence assessment identified the following EPBC Act listed threatened species as known, likely or with potential to occur within the Study Area: **Fauna** • Red goshawk • Squatter pigeon (southern) • White-throated needletail • Black-throated finch (southern) • Northern quoll • Greater glider (northern) • Greater glider (southern and central) • Koala • Bare-rumped sheathtail bat. **Flora** • Black ironbox.
Migratory species	**Yes**	The likelihood of occurrence assessment identified the following EPBC Act listed migratory species as likely or with potential to occur within the Study Area: • White-throated needletail • Fork-tailed swift • Sharp-tailed sandpiper • Satin flycatcher • Osprey • Rufous fantail
Commonwealth Marine Areas	**No**	The Study Area is sufficiently distant from any Commonwealth Marine Area.
Great Barrier Reef Marine Park	**No**	Great Barrier Reef Marine Park is not present within or adjacent to the Study Area. However, the Great Barrier Reef Marine Park is located at the mouth of the Burdekin River (general use zone).
Commonwealth Land	**No**	Commonwealth land is not located within or adjacent to the Study Area.
Nuclear Actions	**No**	The Project is not and does not involve a nuclear action.

MNES Value	Value Present?	Comments
Protection of water resources from coal seam gas development and large coal mining development	**No**	The Project does not involve coal seam gas or coal mining development and as such impacts to ‘a water resource’ are not anticipated.

6.0 Matters of State Environmental Significance

A summary of Matters of State Environmental Significance (MSES) values that may occur within the Study Area are presented in Table 11.

Table 11 MSES within the Study Area

Ecological Value	Value Present?	Comments
Regulated vegetation (endangered or of concern REs)	**No**	All regulated vegetation within the Study Area is Least Concern.
Regulated vegetation (intersecting a wetland)	**No**	Regulated vegetation within a mapped wetland is not present within or adjacent to the Study Area.
Regulated vegetation (within the defined distance of a watercourse)	**Yes**	Remnant vegetation is mapped within the Study Area (Section 4.2.3).
Regulated vegetation (essential habitat)	**No**	Essential habitat is not present within or adjacent to the Study Area.
Connectivity areas	**Yes**	Connectivity occurs within the Study Area as per the MSES description, with linear connectivity along the Burdekin River, and remnant vegetation present. The Landscape Function Connectivity (LFC) tool has been used to determine if the impact on connectivity areas is significant in Appendix D.
Wetlands and watercourses (wetlands in a wetland protection area (WPA), wetlands of high ecological significance (HES); or wetlands or watercourses in high ecological value (HEV) waters)	**No**	Wetlands and watercourses within WPA, HES wetlands, or wetlands and watercourses in HEV waters are not present within or adjacent to the Study Area.
Designated precinct in a Strategic Environmental Area	**No**	The Study Area does not occur within a designated precinct in Strategic Environmental Area.
Protected wildlife habitat	**Yes**	The likelihood of occurrence assessment identified the following NC Act listed species as likely or with potential to occur within the Study Area: • Red goshawk • Squatter pigeon (southern) • White-throated needletail • Black-throated finch (southern) • Greater glider (northern) • Greater glider (southern and central) • Koala • Bare-rumped sheathtail bat • Short-beaked echidna.
Protected areas (national parks, regional parks and nature refuges)	**No**	Protected areas are not present within or adjacent to the Study Area.
Fish habitat areas and highly protected zones of State Marine Parks	**No**	Fish habitat areas and highly protected zones of State Marine Parks are not present within or adjacent to the Study Area.

Ecological Value	Value Present?	Comments
Waterways providing for fish passage	**No**	The Study Area is adjacent but will not impact one major impact (purple) waterway providing for fish passage.
Marine plants	**No**	Marine plants are not present within or adjacent to the Study Area.
Legally secured offset areas	**No**	Legally secured offset areas under State legislation are not present within or adjacent to the Study Area, based on publicly available information.

7.0 Potential Environmental Impacts

Information on the potential impacts associated with the Project are outlined below. Proposed mitigation measures to minimise the potential impacts on the relevant ecological values are outlined in Section 8.0. Given the scale of the Project, potential direct and indirect impacts may affect individuals and are unlikely to have a population level impact on species.

7.1 Construction Phase

The greatest risk of potential impact on ecological values from the Project will occur during the construction phase. The construction activities to support the installation of the substation, transmission towers, associated lines and access tracks will involve vegetation clearing, excavation and ground reinstatement. Direct and indirect impacts potentially associated with this phase are described below.

7.1.1 Direct Impacts

Vegetation clearing is a direct impact that can result in the loss of vegetation values and habitat, with the severity of impacts more pronounced in habitats that provide values for conservation significant species. Potential impacts resulting from clearing native vegetation can include:

- Reduced patch size of vegetation communities potentially compromising the viability of the community and associated habitat.
- Loss of habitat causing a reduction of biological diversity or loss of local populations and genotypes.
- Loss of or disturbance to microhabitat features such as tree hollows, leaf litter, ground timber, dense shrubs and hollows.
- Loss of floristic diversity and the food resources this provides such as foliage, flowers, nectar, fruit and seeds.
- Fragmentation of habitats resulting in reduced dispersal opportunities for fauna.
- Destruction of abiotic features necessary to support vegetation communities and habitat types.

Clearing will only be completed strictly as needed and will be minimised as low as reasonably practicable. The maximum clearing extents within the Project Area per regional ecosystem presented in Table 12. As per the State regulated vegetation mapping, Category B and X occur within the Project Area. The significance of impacts to MSES regulated vegetation and connectivity values are detailed in Appendix D.

Table 12 REs within Project Area

RE ID	Short Description[1]	VM Act Class[2]	BDStatus[3]	Extent within Project Area (ha)
11.3.35	Eucalyptus platyphylla, Corymbia clarksoniana woodland on alluvial plains	Least concern	No concern at present	2.7
Non-remnant				0.5
Total Project Area				**3.2**

[1] Short description as per the Regional Ecosystem Description Database (REDD) Version 13 (Queensland Herbarium, 2023)

[2] Conservation status of the RE under the VM Act.

[3] Biodiversity (BD) status under the EP Act of the RE based on an assessment of the condition of remnant vegetation in addition to the pre-clearing and remnant extent of a regional ecosystem.

The worst-case scenario extent of clearing impacts to each potential, likely or known conservation significant species are detailed in Table 13. Remnant RE 11.3.35 is the only vegetation occurring within the Project Area, with a total of 2.7 ha within the Project Area. Therefore the maximum direct impact area values presented in Table 13 are generally the same for all species assessed, with the exception of black ironbox which only occurs within the Study Area along the Burdekin River associated with RE 11.3.25a, and does not occur within the Project Area. For ecological values identified as unlikely, no

direct impacts are anticipated to occur due to the unlikely presence of these values within the Project Area and associated habitat.

Table 13 Direct impacts on ecological values

Ecological Value	EPBC Act Listing[1]	NC Act Listing[2]	Likelihood of Occurrence	Maximum direct impact area (ha) within the Project Area
Flora species				
Black ironbox	V	LC	Known	0
Fauna species				
Red goshawk	E	E	Potential	2.7
Squatter pigeon (southern)	V	V	Likely	2.7
White-throated needletail	V, Mi	V	Potential (flyover only)	2.7
Black-throated finch (southern)	E	E	Likely	2.7
Northern quoll	E	LC	Potential	2.7
Greater glider (northern)	V	V	Potential	2.7
Greater glider (southern and central)	E	E	Potential	2.7
Koala	E	E	Potential	2.7
Bare-rumped sheathtail bat	V	E	Potential	2.7
Migratory species				
Fork-tailed swift	Mi	SLC	Potential (flyover only)	2.7
Sharp-tailed sandpiper	Mi	SLC	Potential	2.7
Satin flycatcher	Mi	SLC	Potential	2.7
Osprey	Mi	SLC	Potential	2.7
Rufous fantail	Mi	SLC	Potential	2.7

[1] Conservation status under the EPBC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, Mi = Migratory.

[2] Conservation status under the NC Act where CE=Critically Endangered, E=Endangered, V=Vulnerable, SLC=Special Least Concern, LC=Least Concern.

Due to the size and width of the Project Area, direct impacts will be limited to a relatively small area within the vegetation patch. This ultimately will reduce the duration of the impact, and direct impacts are therefore considered to be predictable and known.

The Project Area connects with an existing OHTL and is adjacent to an approved pump station, with a road and canal also located within the Study Area. Hence, habitat within parts of the Project Area and surrounding have already been subjected to low-level fragmentation and clearing.

Vegetation clearing will be required for the construction of the Project. Clearing has the potential to dissect and disconnect vegetation communities, reducing the size of the vegetation patches, which can impact on the success of seed dispersal, species recruitment and ultimately the long-term viability and persistence of a vegetation community within the landscape. Fragmentation impacts may also result in reduced fauna movement opportunities, leading to reduced species recruitment, genetic flow and ultimately affect the long-term viability and persistence of fauna populations within the landscape.

The maximum clearing width is predominantly 40 m and as such fragmentation impacts to conservation significant species that are either highly mobile, adapted to fragmented landscapes or are known to still traverse cleared or modified areas without significant risk. Furthermore, this maximum clearing width may not be required across the entirety of the Project Area during construction, with clearing to be limited to as low as reasonably practicable.

Fauna mortality is another direct impact that may occur to conservation significant species during the construction phase. Fauna may be injured or killed during construction principally through:

- Strike from moving vehicles/machinery – key issue for ground dwelling species, particularly those with poor mobility
- Entrapment in habitat during removal – key issue during tree felling for species that use tree hollows or hollow logs for roosting and denning
- Entrapment in trenches/holes – key issue for ground dwelling species (reptiles and small mammals), particularly those that are active at night and cannot detect trenches to avoid.

7.1.2 Indirect Impacts

The loss of vegetation and habitat as well as the construction activities required to be undertaken to clear vegetation or complete construction, can potentially result in indirect or secondary impacts to the associated fauna and floristic values in the form of habitat degradation. This includes:

- Increased edge effects reducing the condition of quality of remaining vegetation communities and habitat types.
- Although exotic weeds were found to be relatively common across the Project Area, Project activities such as vegetation or ground disturbance, importation of construction materials and vehicle access can permit the establishment and spread of exotic species. Weed infestations can degrade vegetation communities by increasing competition with native species, increasing fuel loads, reducing floristic diversity, altering the vegetation structure and habitat for native fauna species that may displace native species, native habitat resources and alter fire regimes.
- Soil exposure resulting in an increased risk of erosion and sedimentation of water bodies, reducing water quality and degrading aquatic habitats.
- Increased risk of contamination associated with activities such as refuelling or storage of chemicals.
- Generation of dust emissions leading to excessive deposition of dust on plants may have potential impacts on vegetation if excessive levels are sustained over extended periods. When dust settles on plant foliage, it can reduce the amount of light penetration on the leaf surface, block and damage stomata, and slow rates of gas exchange and water loss. Diminished ability to photosynthesise due to physical effects may result in reduced growth rates of vegetation and decreases in floral vigour and overall community health. The potential effects of dust deposition on vegetation are determined by a number of factors including:
    - the characteristics of leaf surfaces, such as surface roughness, influencing the rate of dust deposition on vegetation
    - concentration and size of dust particles in the ambient air and its associated deposition rates
    - local meteorological conditions and the degree of penetration of dust into vegetation.
- Increased noise and light levels affecting foraging and breeding behaviour for some fauna species or resulting in complete avoidance and displacement from habitats. Fauna will generally move away from noise and light sources as these may be perceived as a threat. Acclimatisation by some species is likely to occur over the medium to long term and many of the species identified in the Project Area are known to occur in areas subject to noise, light and general activity.
- Periodic burst of elevated noise levels may startle and disorientate fauna species within proximity.
- Although the Project will not increase food resources or facilitate the movement of pests via the creation of new pathways, increased anthropogenic activity may lead to temporary increased pest levels.

Conservation significant flora and fauna species are each susceptible to these indirect impacts with varying degrees.

7.2 Operation and Maintenance Phase

Potential impacts on ecological values during the operation and maintenance phase of the Project are likely to be low. Activity within the Project Area will be very low and limited to periodic maintenance.

Maintenance will involve vegetation clearing (predominantly ground slashing of regrowth vegetation as needed) in areas that were cleared during the construction phase and along tracks.

Traversing maintenance vehicles may inadvertently introduce weeds and potentially collide with ground dwelling conservation significant fauna species resulting in injury or mortality. These potential impacts will be mitigated through the implementation of the Project's EMP which will include specific controls such as weed hygiene procedures, designated tracks and site speed limits and triggers for erosion and sediment control management.

Operation of the Project may also lead to an increased risk of fauna mortality at an individual level as a result of electrocution. Collision with OHTL is not a known risk to conservation significant fauna values identified as potentially occurring.

7.3 Decommissioning and Rehabilitation Phase

Similar to the operation and maintenance phase of the Project, rehabilitation activities are also considered to have only low and temporary impacts on ecological values. All works in this phase will be conducted in consultation with landholders. Other than for surface rehabilitation, no ground disturbance will occur as subsurface components of the Project infrastructure will likely remain in-situ.

Temporary and localised increases in noise and potentially dust may occur, but will be managed using the same methods used during construction. Traversing vehicles required to complete decommissioning or rehabilitation activities may inadvertently introduce weeds and potentially collide with ground dwelling conservation significant fauna species resulting in injury or mortality. Any impacts would be mitigated through implementation of the Project EMP as per the other phases of the Project.

8.0 Avoidance, Minimisation, Mitigation and Management

Powerlink has implemented the hierarchy of management principles in the planning for and development of the Project. These principles and the order in which they have been applied is as follows.

1. **Avoid**: locating activities to avoid direct and indirect impacts on ecological values.
2. **Minimise**: minimising direct and indirect impacts where they cannot be completely avoided.
3. **Mitigate**: implementing mitigation and management measures to reduce direct, indirect and cumulative impacts.
4. **Remediate and rehabilitate**: actively remediate and rehabilitate impacted areas to promote long-term recovery.
5. **Offset (where necessary)**: provide suitable offsets for activities that result in significant residual impacts to ecological values even with the implementation of the above principles.

Section 8.1 describes how impacts on ecological values will be avoided and minimised for the Project and Section 8.2 describes the mitigation measures.

An Environmental Management Plan (EMP) will be prepared for the Project. This plan will identify the performance criteria and general requirements / standard operational controls that will be implemented to meet Powerlink's environmental management requirements. Key themes relevant to the management of potential impacts on ecological values will include biosecurity, agricultural chemicals, soils and water, acid sulfate soils, native fauna, vegetation management, contaminated land, waste, hazardous materials, air quality, noise and vibration, visual amenity, bushfire and transport and traffic.

Any future EPBC approval conditions outside of this report should be considered during construction and operation phase of the Project.

8.1 Avoid and Minimise

The avoidance of ecological values and minimisation of impacts to these values has been demonstrated as follows:

- Project Area siting to avoid direct and indirect impacts to riparian vegetation
- Optimising the Project Area through design with consideration to clearing extent.

The location of the Project Area is constrained by the location of existing and approved infrastructure, as the Project will connect the approved pump station to the existing powerline network. However, the Project Area is relatively small and all Project activities will occur within the Project Area, including laydown areas and stockpiling. Indirect impacts resulting from the construction of the Project will be localised and temporary, and actively managed as detailed below. Furthermore, clearing extents detailed in Section 7.1.1 represent a maximum area, and direct impacts to conservation significant species will be minimised to as low as reasonably practicable.

8.2 Mitigate and Manage

To mitigate potential impacts to ecological values, an EMP will be developed for the Project. This should include both general and species-specific mitigation and management measures for conservation significant species, including the measures provided in the subsequent sections.

8.2.1 General Mitigation Measures

The key general mitigation measures are detailed below:

- Delineate exclusion areas to avoid unauthorised disturbance and access of areas of threatened species habitat.
- Movement within the Project Area will be via approved access tracks only with speed limits enforced. The requirement to enter and traverse the Project Area will be minimised where possible and limited to those required for essential Project activities.

- All clearing will be conducted with a suitably qualified suitably qualified fauna spotter-catcher present.
- Spotter-catchers will scout the area to be disturbed for the presence of conservation significant fauna species immediately prior to the commencement of disturbance and relocate the fauna to an undisturbed location.
- Exclusion zones will be established around any active breeding places identified during pre-clearance surveys and any fauna habitat features to be retained (e.g., mature trees, inactive breeding places) and appropriately marked out, where practicable. Where there is the potential an active breeding place will be tampered with, this will only be done in accordance with an approved low-risk and/or high-risk DES Species Management Plan (SMP) (depending on the species to be impacted).
- Night works within or adjacent to areas of conservation significant species' habitat will be avoided where possible. Where night works are required, lights will be directed to minimise light spill into adjacent habitats.
- Microhabitat features such as large fallen logs will be relocated to adjacent areas of undisturbed vegetation prior to vegetation clearing where practicable.
- Dust suppression measures will be implemented as required i.e., on high wind days and/or during extended dry periods.
- Undertake refuelling and chemical storage in designated areas and follow emergency response procedures in the event of a spill. Any containment areas will be designed and managed in accordance with relevant regulatory requirements and standards.
- Threat of wildfire caused by Powerlink activities will be minimised through maintenance of firebreaks around ignition sources as appropriate.
- Weed and pest management strategies to be implemented for controlling the spread of weeds and pests, particularly vehicles traversing the Project Area. This includes:
    - Pre-construction and post-construction weed surveys will be undertaken within the Project Area.
    - Wash down protocols are required for any vehicles or machinery entering and leaving the Project Area. Any material brought into the Project Area will be inspected and cleaned.
    - Ongoing monitoring of the Project Area to identify any new incidence of weed and pest infestation.
- Disturbed areas will be rehabilitated in accordance with a Rehabilitation Monitoring Plan to be developed prior to construction.

8.2.2 Species-specific Mitigation Measures

Mitigation measures specific to the potentially occurring conservation significant species are detailed in Table 14 below.

Table 14 Species-specific mitigation measures

MNES	Mitigation measure
Ground-dwelling MNES fauna	• Any open trenches, pits or excavations will be checked for trapped fauna in the morning and at the end of the day by a spotter catcher • Trench ladders, ramps, sticks, ropes and moist hessian sacks at regular intervals (or similar) will be utilised where trenches or excavations are anticipated to remain open for extended periods. This will help trapped fauna escape and/or survive until removed by a fauna spotter-catcher. • Covers for tower/pole excavations suitable for preventing small animals entering the excavation are to be utilized when the excavation is unattended (e.g. overnight). Covers or other suitable fauna barriers are to be utilized when steel reinforcement is

MNES	Mitigation measure
	placed within tower/pole foundation excavation and the excavation unattended (e.g. overnight).
Black ironbox	• Population mapping undertaken by GHD will be reviewed, and checked during pre-clearance surveys which will include the development of any no-go areas. Confirmation of potential population avoidance will be completed during final scouting. Where possible, the siting of infrastructure will avoid areas of known occurrence as a priority. • Clearing will be restricted to the minimal amount necessary for construction and will not extend outside the Project Area.
Red goshawk and osprey	• Retain tall trees that contain potential raptor nests (even if abandoned), especially where located along watercourses where possible.
Squatter pigeon (southern)	• Speed limits will be enforced within the site to reduce risk of collision with wildlife. • No unauthorised off-track driving.
Black-throated finch (southern)	• Pre-clearance surveys by a spotter-catcher will be undertaken in mapped habitat areas and near water sources to ensure any potential nests are located and their location demarcated. A sufficient buffer distance will be implemented to avoid potential disturbance and displacement until the nests have been vacated.
Northern quoll	• Large hollow logs that must be removed from areas of potential northern quoll habitat will be retained and relocated to adjacent or nearby areas of suitable northern quoll habitat. • Where pits, voids or trenches are required, include appropriate cover to prevent extended water retention from rainfall and surface water flows in these spaces to reduce breeding opportunities for cane toads .
Greater glider	• All hollow-bearing trees will be inspected by a fauna spotter-catcher prior to clearing to identify any denning or nesting individuals. • All hollow-bearing trees will be soft-felled during clearing activities.
Koala	• Clearing must be carried out in a way that ensures any koala present have time to move out of the clearing site without human intervention. • If a koala is located during pre-clearance surveys or during clearing activities: - The individual must not be forcibly relocated - Any tree which houses a koala as well as any tree with a crown that overlaps that tree will not be cleared until the koala vacates the tree on its own volition - Allow a clearing buffer surrounding the tree, equal to the height of the tree or deemed suitable by the fauna spotter catcher - Any injured koala (and fauna in general) should be transported to a vet or recognised wildlife carer. • Where deemed necessary by the fauna spotter-catcher, temporary exclusion fencing may be required to prevent wildlife from returning to work areas.
Bare-rumped sheathtail bat	• A spotter-catcher must be on-site during clearing activities to identify any potential roost trees (i.e. hollow bearing trees). Any bats found to be potentially affected by the project construction will be relocated to an alternative nearby empty hollow. • Any identified active roosting maternity colonies within or adjacent to the project alignment will be considered during vegetation clearing with a sufficient buffer distance implemented to avoid potential disturbance and displacement until these roosting maternity colonies have moved on. • Clearing works should be staged to allow bats to leave roosting sites. • No vegetation clearing should occur at night (bright lights can interfere with bat behaviour).

MNES	Mitigation measure
	• Clearing of hollow-bearing trees will only occur where necessary and cleared logs/stags will be relocated to adjoining habitat that is to be retained.
Sharp-tailed sandpiper	• Prior to construction works commencing, the spotter catcher will confirm the presence of any migratory birds that may be disturbed by the activity. If found to be present at the time of works, appropriate mitigation measures should be developed to minimise disturbance.

9.0 MSES Significant Residual Impact Assessment

As discussed in Section 6.0, the following MSES are found to be potentially occurring within the Study Area:

- regulated vegetation (within the defined distance of a watercourse)
- connectivity
- protected wildlife habitat

A significant residual impact assessment has been undertaken for the Project (Appendix D) in accordance with the criteria provided in the Significant Residual Impact Guidelines (Department of State Development Infrastructure and Planning, 2014a).

Significant residual impact assessments were completed using the Project Area, which is considered to represent the maximum impact area. The outcomes of these assessments and the associated justification is summarised in Table 15 below. After considering potential impacts, mitigation measures and the state significant residual impact criteria (Appendix D), the Project is considered unlikely to have a significant residual impact on MSES values.

Table 15 Summary of significant residual impact assessment for MSES within the Project Area

MSES value	Significant residual impact expected?	Primary justification
Regulated vegetation (within the defined distance of a watercourse)	**No**	The Project meets the criteria under the Significant Residual Impact Guidelines to be considered unlikely to have a significant residual impact, as the total clearing of regulated vegetation within a defined distance of a watercourse is less than 1 ha, works do not intersect Essential Habitat and the Project is considered linear infrastructure.
Protected wildlife habitat	**No**	The Project meets the criteria under the Significant Residual Impact Guidelines to be considered unlikely to have a significant residual impact on protected wildlife habitat as the Project does not meet Significant Residual Impact criteria for endangered, vulnerable or special least concern species.

10.0 Conclusions and Recommendations

AECOM was engaged by Powerlink to undertake an ecology field survey to identify the existing ecological values, potential project impacts, mitigation measures and associated legislative requirements for the Burdekin River Pump Station connection into Powerlink's transmission network. The assessment will support relevant approval applications at a State level.

Ecological values within the Study Area include remnant vegetation communities that support a range of habitat values and resources for a diversity of flora and fauna species, including potential and likely conservation significant fauna species, and known conservation significant flora species. Cleared areas associated with existing roads and infrastructure also occur and present existing connectivity barriers.

Potential direct and indirect impacts to ecological values may occur as a result of the Project. However, the Project design has applied the principle of avoidance, mitigation and management to minimise environmental impacts to an acceptable level, and as a result the clearing of vegetation communities and habitats is expected to be limited to approximately 2.7 ha, plus 0.5 ha non-remnant vegetation clearing, amounting to a total clearing area of approximately 3.2 ha.

Several MSES values were identified within the study area, namely regulated vegetation (within the defined distance of a watercourse), connectivity and protected wildlife habitat. These MSES values were subject to an impact assessment as per the MSES Significant Residual Impact Guidelines (Department of State Development Infrastructure and Planning, 2014a). After considering potential impacts, mitigation measures and the state significant residual impact criteria (Appendix D), the Project is considered unlikely to have a significant residual impact on MSES values.

Whilst it is considered that the project has a relatively low risk of triggering approval requirements under the EPBC Act, a significant impact assessment was not completed to confirm this as part of the Ecology Technical Report. It is recommended that due diligence be undertaken to confirm that an EPBC referral is not required.

11.0 References

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Appendix A

Desktop Assessment Reports

Appendix A Desktop Assessment Reports

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 14-Nov-2023

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	31
Listed Migratory Species:	18

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	23
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	2
EPBC Act Referrals:	9
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Bowling green bay	20 - 30km upstream from Ramsar site	In feature area

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community may occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Geophaps scripta scripta](#) Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area	In feature area
[Neochmia ruficauda ruficauda](#) Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Poephila cincta cincta](#) Southern Black-throated Finch [64447]	Endangered	Species or species habitat likely to occur within area	In feature area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
[Tyto novaehollandiae kimberli](#) Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area	In feature area
[Macroderma gigas](#) Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Petauroides minor](#) Greater Glider (northern), Greater Glider (north-eastern Queensland) [92008]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Petauroides volans](#) Greater Glider (southern and central) [254]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat likely to occur within area	In feature area
Rhinolophus robertsi			
Large-eared Horseshoe Bat, Greater Large-eared Horseshoe Bat [87639]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Saccolaimus saccolaimus nudicluniatus			
Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Xeromys myoides			
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
PLANT			
Bulbophyllum globuliforme			
Miniature Moss-orchid, Hoop Pine Orchid [6649]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Dichanthium setosum			
bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eucalyptus raveretiana			
Black Ironbox [16344]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Leichhardtia brevifolia listed as Marsdenia brevifolia			
[91893]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Omphalea celata			
[64586]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Phaius australis			
Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area	In buffer area only
Phlegmariurus tetrastichoides			
Square Tassel Fern [86555]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Solanum graniticum Granite Nightshade [84819]	Endangered	Species or species habitat may occur within area	In feature area
Tephrosia leveillei [16946]	Vulnerable	Species or species habitat may occur within area	In buffer area only
REPTILE			
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Lerista vittata Mount Cooper Striped Skink, Mount Cooper Striped Lerista [1308]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat likely to occur within area	In feature area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat likely to occur within area	In feature area
[Symposiachrus trivirgatus as Monarcha trivirgatus](#) Spectacled Monarch [83946]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pandion haliaetus			
Osprey [952]		Species or species habitat known to occur within area	In feature area
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anseranas semipalmata			
Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis			
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
[Chalcites osculans as Chrysococcyx osculans](#) Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area overfly marine area	In feature area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat may occur within area overfly marine area	In feature area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus			
Osprey [952]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons			
Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus			
Spectacled Monarch [83946]		Species or species habitat may occur within area overfly marine area	In feature area
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area overfly marine area	In buffer area only
Reptile			
Crocodylus porosus			
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area

Extra Information

Nationally Important Wetlands		[Resource Information]
Wetland Name	State	Buffer Status
Barrattas Channels Aggregation	QLD	In buffer area only
Junction of the Bogie River and Kirknie Creek Aggregation	QLD	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Haughton Pipeline Stage 2 Project	2021/9133		Post-Approval	In feature area
Controlled action				
Cleangen Burdekin Solar Farm	2017/7998	Controlled Action	Further Information Request	In buffer area only
Clearing of Vegetation for High Value Agriculture, Byrne Valley Station, Kirknie, Queensland	2017/8108	Controlled Action	Post-Approval	In buffer area only
Gas pipeline	2002/728	Controlled Action	Post-Approval	In buffer area only
Mio College Vegetation Clearing for High Value Agriculture, Barratta Road, Clare QLD	2017/7876	Controlled Action	Post-Approval	In buffer area only
The Burdekin Cassava Project	2010/5514	Controlled Action	Post-Approval	In buffer area only
Water for Bowen project	2006/2527	Controlled Action	Completed	In buffer area only
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Not controlled action (particular manner)				
275kV Transmission Line from Ross substation to Strathmore Substation (approx 180km)	2008/4390	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: Animals
Type: All
Queensland status: Rare and threatened species
Records: All
Date: All
Latitude: -19.9263
Longitude: 147.2162
Distance: 20
Email: taruna.venkatachalam@aecom.com
Date submitted: Tuesday 14 Nov 2023 13:02:10
Date extracted: Tuesday 14 Nov 2023 13:10:08

The number of records retrieved = 1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		E	E	1

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.*
The codes are Extinct (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.*
The values of EPBC are Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) and Conservation Dependent (CD).

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: Plants (including other non-animals such as fungi and protists)
Type: All
Queensland status: Rare and threatened species
Records: All
Date: All
Latitude: -19.9263
Longitude: 147.2162
Distance: 20
Email: taruna.venkatachalam@aecom.com
Date submitted: Tuesday 14 Nov 2023 13:03:01
Date extracted: Tuesday 14 Nov 2023 13:10:05

The number of records retrieved = 1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Solanaceae	*Solanum sporadotrichum*			NT		1/1

CODES

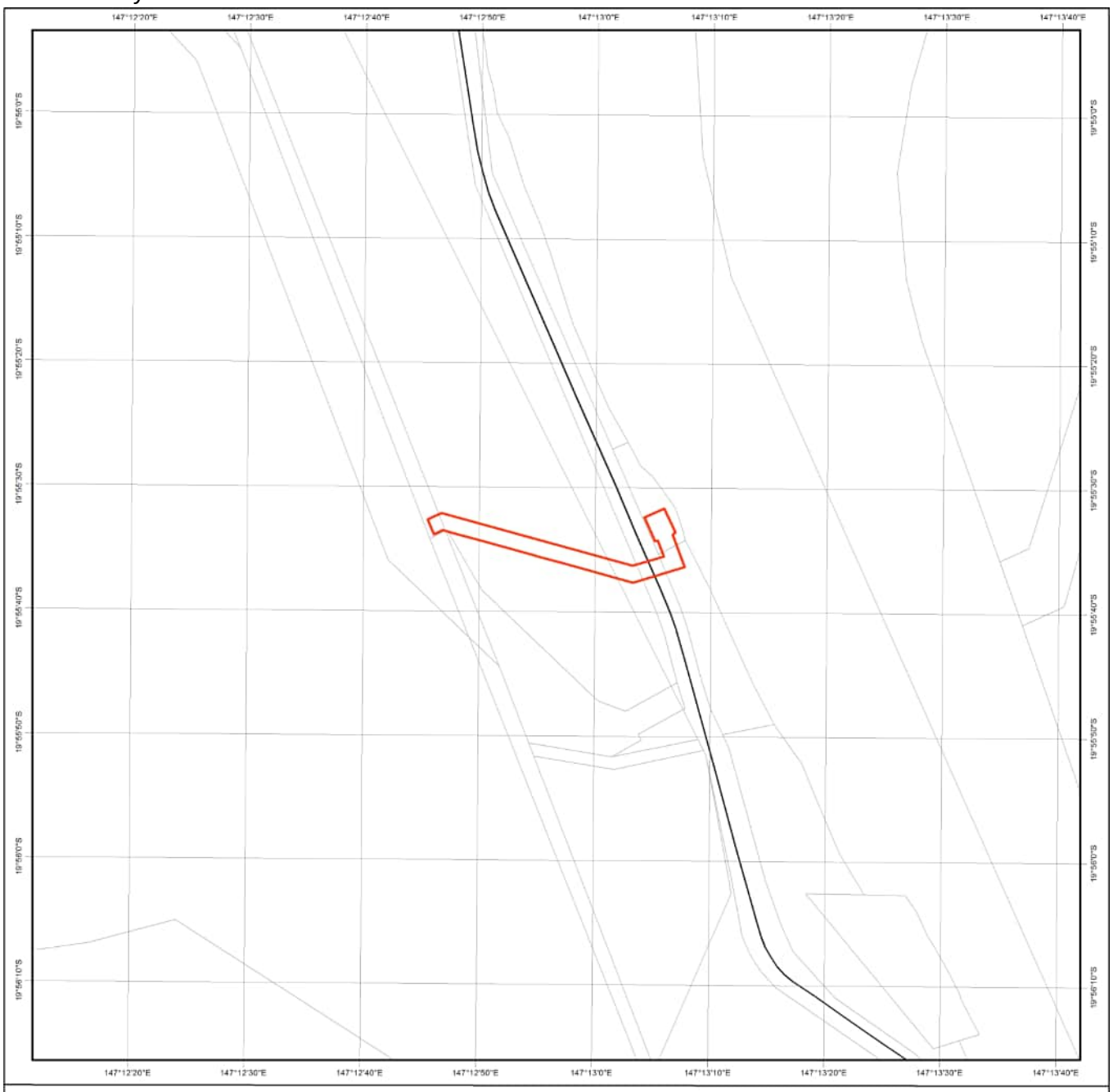
I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.*
The codes are Extinct (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.*
The values of EPBC are Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) and Conservation Dependent (CD).

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

14/11/2023 14:04:54
Custom Geometry



Protected Plants Flora Survey Trigger Map

Legend

- polygon
- High risk area
- Other land parcel boundaries
- Freeways / motorways / highways
- Secondary roads / streets

N

0 100 200 300 400 500 m

This product is projected into:
GDA 1994 Queensland Albers

This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

Land parcel boundaries are provided as locational aid only.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Science at palm@des.qld.gov.au

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

Protected plants flora survey trigger map

The protected plants flora survey trigger map identifies 'high risk areas' where threatened and near threatened plants are known to exist or are likely to exist. Under the *Nature Conservation Act 1992* (the Act) it is an offence to clear protected plants that are 'in the wild' unless you are authorised or the clearing is exempt, for more information see section 89 of the Act.

Please see the Department of Environment and Science webpage on the clearing of protected plants for information on what exemptions may apply in your circumstances, whether you may need to undertake a flora survey, and whether you may need a protected plants clearing permit.

Updates to the data informing the flora survey trigger map

The flora survey trigger map will be reviewed, and updated if necessary, at least every 12 months to ensure the map reflects the most up-to-date and accurate data available.

Species information

Please note that flora survey trigger maps do not identify species associated with 'high risk areas'. While some species information may be publicly available, for example via the Queensland Spatial Catalogue, the Department of Environment and Science does not provide species information on request. Regardless of whether species information is available for a particular high risk area, clearing plants in a high risk area may require a flora survey and/or clearing permit. Please see the Department of Environment and Science webpage on the clearing of protected plants for more information.

Appendix B

Flora and Fauna Species Lists

Appendix B Flora and Fauna Species Lists

Table 16 Flora species list

Family	Scientific name	Common name	EPBC Act listing	NC Act listing
Amaranthaceae	*Achyranthes aspera*	Chaff flower	-	Least concern
Amaranthaceae	*Alternanthera* sp.*	Joyweed	-	-
Amaranthaceae	*Gomphrena celosioides**	Gomphrena	-	-
Apocynaceae	*Cascabela thevetia**	Yellow oleander	-	-
Apocynaceae	*Cryptostegia grandiflora**	Rubber vine	-	-
Asteraceae	*Bidens pilosa**	Cobblers pegs	-	-
Asteraceae	*Erigeron bonariensis**	Fleabane	-	-
Asteraceae	*Praxelis clematidea**	Praxelis	-	-
Asteraceae	*Pterocaulon redolens*		-	Least concern
Asteraceae	*Xanthium occidentale**	Noogoora burr	-	-
Convolvulaceae	*Argyreia nervosa**	Elephant ear vine	-	-
Cucurbitaceae	*Cucumis melo**	Muskmelon	-	-
Euphorbiaceae	*Jatropha gossypiifolia**	Bellyache bush	-	-
Euphorbiaceae	*Macaranga sp.*	Macaranga	-	Least concern
Euphorbiaceae	*Ricinus communis**	Castor oil plant	-	-
Lamiaceae	*Basilicum polystachyon**	Basilicum	-	-
Lamiaceae	*Mesosphaerum suaveolens**	Hyptis	-	-
Lauraceae	*Cassytha filiformis*	Dodder laurel	-	Least concern
Laxmanniaceae	*Eustrephus latifolius*	Wombat berry	-	Least concern
Leguminosae	*Acacia holosericea*	Strap wattle	-	Least concern
Leguminosae	*Acacia leiocalyx*	Early flowering wattle	-	Least concern
Leguminosae	*Albizia lebbeck**	Indian siris	-	-
Leguminosae	*Chamaecrista rotundifolia**	Wynn cassia	-	-
Leguminosae	*Erythrina vespertilio*	Batwing coral tree	-	Least concern
Leguminosae	*Lysiphyllum carronii*	Bauhinia	-	Least concern
Leguminosae	*Macroptilium atropurpureum**	Siratro	-	-
Leguminosae	*Senna* sp.	Rattlepod	-	-
Leguminosae	*Sesbania cannabina**	Sesbania pea	-	-

Family	Scientific name	Common name	EPBC Act listing	NC Act listing
Leguminosae	*Stylosanthes scabra**	Stylo	-	-
Leguminosae	*Vachellia bidwillii*	Corkwood wattle	-	Least concern
Loranthaceae	*Amyema* sp.	Mistletoe in Eucalyptus platyphylla	-	Least concern
Malvaceae	*Sida cordifolia**	Flannel weed	-	-
Malvaceae	*Sida* sp.		-	-
Moraceae	*Ficus opposita*	Sandpaper fig	-	Least concern
Myrtaceae	*Corymbia clarksoniana*	Grey bloodwood	-	Least concern
Myrtaceae	*Corymbia dallachiana*	Dallachy's gum	-	Least concern
Myrtaceae	*Corymbia erythrophloia*	Red bloodwood	-	Least concern
Myrtaceae	*Corymbia tessellaris*	Moreton Bay ash	-	Least concern
Myrtaceae	*Eucalyptus platyphylla*	Poplar gum	-	Least concern
Myrtaceae	*Eucalyptus raveretiana*	Black ironbox	Vulnerable	Least concern
Myrtaceae	*Eucalyptus tereticornis*	Forest red gum	-	Least concern
Myrtaceae	*Melaleuca leucadendra*	Weeping paperbark	-	Least concern
Myrtaceae	*Psidium guajava**	Guava	-	-
Papaveraceae	*Argemone ochroleuca**	Mexican poppy	-	-
Passifloraceae	*Passiflora foetida**	Stinking passionflower	-	-
Phyllanthaceae	*Breynia oblongifolia*	Coffee bush	-	Least concern
Poaceae	*Bothriochloa pertusa**	Indian bluegrass	-	-
Poaceae	*Chloris virgata**	Feathertop Rhodes grass	-	-
Poaceae	*Chrysopogon fallax*	Golden beard grass	-	Least concern
Poaceae	*Heteropogon contortus*	Black speargrass	-	Least concern
Poaceae	*Heteropogon triticeus*	Giant speargrass	-	Least concern
Poaceae	*Megathyrsus maximus**	Guinea grass	-	-
Poaceae	*Melinis repens**	Red natal	-	-
Poaceae	*Perotis rara*	Comet grass	-	Least concern
Poaceae	*Sporobolus* sp.*	Giant rats tail grass	-	-
Poaceae	*Themeda quadrivalvis**	Thatch grass	-	-

Family	Scientific name	Common name	EPBC Act listing	NC Act listing
Proteaceae	*Grevillea striata*	Beefwood	-	Least concern
Rhamnaceae	*Ziziphus mauritiana**	Chinee apple	-	-
Rubiaceae	*Nauclea orientalis*	Leichhardt Tree	-	Least concern
Rubiaceae	*Psydrax odorata*		-	Least concern
Sapindaceae	*Atalaya hemiglauca*	Whitewood	-	Least concern
Scrophulariaceae	*Eremophila debilis*	Winter apple	-	Least concern
Sparrmanniaceae	*Grewia sp.*	Dogs balls	-	Least concern
Verbenaceae	*Stachytarpheta jamaicensis**	Blue snakeweed	-	-

Table 17 Fauna species list

Scientific name	Common name	EPBC Act listing	NC Act listing
Cinnyris jugularis	Olive-backed sunbird	-	Least concern
Haliastur sphenurus	Whistling kite	-	Least concern
Corvus orru	Crow	-	Least concern
Calyptorhynchus banksii	Red-tailed black cockatoo	-	Least concern
Pteropus sp.	Flying fox	-	-
Chlamydera nuchalis	Great bowerbird	-	Least concern
Platycercus adscitus	Pale headed rosella	-	Least concern
Dacelo novaeguineae	Laughing kookaburra	-	Least concern
Coracina novaehollandiae	Black-faced cuckoo shrike	-	Least concern
*Sus scrofa**	Feral pig	-	-

Appendix C

Likelihood of Occurrence Assessment

Appendix C Likelihood of Occurrence Assessment

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
Birds						
Curlew sandpiper	*Calidris ferruginea*	CE, Mi	CR	The curlew sandpiper mainly occurs on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They occur in both fresh and brackish waters (Department of Climate Change Energy the Environment and Water, 2023b). In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers.	Species records are common along the coastline of Australia, with occasional records occurring further inland. There are no species records within 20 km of the Project Area. Records are mostly found within 10 km from the coast, > 40 km from the Project Area.	**Unlikely** Preferred intertidal habitat is not present, and the Study Area is located > 40 km from the coast. There are no species records within 20 km of the Project Area.
Greater sand plover	*Charadrius leschenaultii*	V, Mi	V	The Greater sand plover is a non-breeding migrant to Australia. It is almost entirely coastal, inhabiting littoral and estuarine habitats. They are reported to mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons, inshore reefs, small rocky islands or coral reefs (Department of Climate Change Energy the Environment and Water, 2023b). It has been recorded in the coastal areas of all states in Australia, however the greatest numbers occur in northern Australia. Internationally important sites in Australia include Eighty Mile Beach (Western Australia), Roebuck Bay (Western Australia), south-eastern corner of Gulf of Carpentaria (Queensland), Ashmore Reef (Western Australia) and the Darwin area (Northern Territory).	Species records are common along the coastline of Australia, with rare records occurring further inland. There are no species records within 20 km of the Project Area. Records are mostly found within 10 km from the coast, > 40 km from the Project Area.	**Unlikely** Preferred intertidal habitat is not present, and the Study Area is located > 40 km from the coast. There are no species records within 20 km of the Project Area.
Red goshawk	*Erythrotriorchis radiatus*	E	E	In northern and central Queensland, red goshawks are mainly associated with extensive, uncleared, mosaics of native vegetation, especially riparian vegetation, open forest and woodland that contain a mix of eucalypt, ironbark and bloodwood species. Permanent water (watercourses and wetlands) is usually present in close proximity, with tall emergent trees used for nesting. The red goshawk is thought to have a very large home range covering between 50 and 220 square kilometres (Department of Climate Change Energy the Environment and Water, 2023b). This species is sparsely distributed across coastal and sub-coastal Australia, from the western Kimberley to northern New South Wales. There appears to have been a contraction in range in recent years. Occasionally recorded from gorge country in central Australia and western Queensland.	Species records typically occur along the eastern and northern coastline of mainland Australia between Sydney and Broome, with occasional records further inland. There appears to have been a contraction in range to the north in recent years with new records to the southern extent of the range being rare. There is only one recent record (2013) within 200 km of the Project Area, at Glenden approximately 180 km to the south. Other records within 200 km are undated, older than 20 years or have high spatial uncertainty.	**Potential** Suitable habitat comprising of open eucalypt woodland with permanent water (Burdekin River) is likely to be present within the Study Area. One record of the species occurs within 200 km of the Study Area, which is within the species' home range travelling distance. The species has been considered potential based on its shrinking range within Northern Australia.
Grey falcon	*Falco hypoleucos*	V	V	The grey falcon occurs at low densities across inland Australia, though the ecology of the grey falcon is known almost entirely from anecdotal and opportunistic observations. This species frequents timbered lowland plains, particularly Acacia shrublands that are crossed by tree-lined water courses. It has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter. The grey falcon occurs in arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia. This species is mainly found where annual rainfall is less than 500 mm, except when wet years are followed by drought, when the species becomes more widespread (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur throughout northern, central and eastern Australia. The nearest recent record (2023) is present approximately 100 km to the west of the Project Area near Charters Towers.	**Unlikely** Marginal suitable vegetation crossed by tree-lined watercourses are likely to be present within and adjacent to the Study Area, but the nearest recent record is > 100 km from the Study Area.
Squatter pigeon (southern)	*Geophaps scripta scripta*	V	V	The squatter pigeon (southern) occurs in dry grassy woodland and open forest, mostly in sandy areas close to water (generally within 3 km). In Queensland, Squatter Pigeon (southern) foraging and breeding habitat is known to occur on well-draining, sandy or loamy soils on low, gently sloping, flat to undulating plains and foothills (i.e. Queensland	Species records typically occur along the coast and inland between the Gold Coast and Townsville.	**Likely** Suitable grassy open woodland habitat is present within the Study Area and is in close proximity to a permanent water source.

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
				Regional Ecosystem Land Zone 5), and lateritic (duplex) soils on low 'jump-ups' and escarpments (i.e. Queensland Regional Ecosystem Land Zone 7) (Department of Climate Change Energy the Environment and Water, 2023b). This sub-species is now largely (if not wholly) restricted to Queensland, from the New South Wales border, north to the Burdekin River, west to Charleville and Longreach, and east to the coast to Townsville and Proserpine. In southern Queensland, only small, isolated and sparsely distributed sub-populations of the sub-species occur in this part of its range.	A few recent records occur within 20 km of the Project Area. The nearest record (2007) is located approximately 2 km to the east of the Project Area. The most recent record within 20 km (2021) occurs approximately 8 km north-west of the Project Area.	Recent records are also present within 10 km of the Study Area (ALA).
White-throated needletail	*Hirundapus caudacutus*	V, Mi	V	In Australia, the white-throated needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Due to their aerial nature, it has been stated that conventional habitat descriptions are inapplicable (Cramp 1985), but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (Department of Climate Change Energy the Environment and Water, 2023b). This species is widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and New South Wales, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (Department of the Environment, 2015).	Species records typically occur along the coast and inland between Adelaide and Cape York. Records within 20 km of the Project Area are undated, older than 20 years or have high spatial uncertainty. The nearest recent (2019) record is located approximately 40 km north-west of the Project Area.	**Potential (flyover only)** The aerial space above the Study Area would likely provide suitable foraging and dispersal habitat, however there are no reliable records within 20 km. While the species was not observed during recent surveys within the Project Area (GHD, 2021), it has been marked as having potential to occur due to the historical records within 20 km.
Star finch (eastern, southern)	*Neochmia ruficauda ruficauda*	E	E	The star finch (eastern) occurs mainly in grasslands and grassy woodlands that are located close to bodies of fresh water. It also occurs in cleared or suburban areas such as along roadsides and in towns. Studies at nine former sites of the star finch (eastern) found that the habitat consisted mainly of woodland. These habitats are dominated by trees that are typically associated with permanent water or areas that are regularly inundated; the most common species are *Eucalyptus coolabah, Eucalyptus tereticornis, Eucalyptus tessellaris, Melaleuca leucadendra, Eucalyptus camaldulensis* and *Casuarina cunninghamiana*. Based on the small number of accepted records, the distribution of this subspecies formerly extended from Bowen in central Queensland, south to the Namoi River in northern New South Wales, and west to the Blackall Range. Recent records have been obtained only from scattered sites in central Queensland (i.e. between 21°S and 25°S, and 141°E and 150°E) and, consequently, the star finch (eastern) now appears to be extinct in both south-eastern Queensland and northern New South Wales (Department of Climate Change Energy the Environment and Water, 2023b).	Species records occur sporadically across inland and coastal Queensland. There are no spatially or temporally accurate records of the species present within 200 km. The species is considered functionally extinct.	**Unlikely** Suitable habitat may be present for the species to persist in the Study Area, but no records are present within 20 km of the Study Area.
Eastern curlew	*Numenius madagascariensis*	CE, Mi	E	During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae). Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets (Department of Climate Change Energy the Environment and Water, 2023b). Within Australia, the eastern curlew has a primarily coastal distribution, they are rarely recorded inland.	The species typically occurs along the coastline of mainland Australia and Tasmania, with the exception of the southern section of coastline between Esperance and Ceduna as well as the western coastline of Tasmania. The nearest recent species record (2011) is present approximately 40 km north of the Project Area near Shirbourne.	**Unlikely** Suitable coastal estuarine habitat is not present in the Study Area. There are no species records within 20 km.

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
Black-throated finch (Southern)	*Poephila cincta cincta*	E	E	The black-throated finch (southern) occurs mainly in grassy, open woodlands and forests, typically dominated by *Eucalyptus, Corymbia* and *Melaleuca*, and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water. Almost all recent records of the finch from south of the tropics have been in riparian habitat. The subspecies is thought to require a mosaic of different habitats in which it can find seed during the wet season (Department of Climate Change Energy the Environment and Water, 2023b). The black-throated finch (southern) occurs at two general locations: in the Townsville region, where it is considered to be locally common at a few sites around Townsville and Charters Towers; and at scattered sites in central-eastern Queensland (between Aramac and Great Basalt Wall National Park).	The species typically occurs to areas south of Townsville and north of Mackay. Some record locations are generalised to protect the species from exploitation. There are three recent, spatially accurate records (2021) at a single location approximately 6 km north-west of the Project Area. All other records within 20 km are spatially or temporally unreliable.	**Likely** Suitable habitat is present in the form of grassland and open woodland adjacent to a permanent water source, however presence of weed species in the ground layer may reduce the habitat quality for the species. The Study Area is within an important area for the species and multiple records are present nearby (ALA). The species was identified within 4 km of the Project Area during recent surveys (GHD, 2021).
Australian painted snipe	*Rostratula australis*	E	E	Preferred habitat for the Australian painted snipe includes shallow inland wetlands, brackish or freshwater, that are permanently or temporarily inundated. Breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby (Department of Climate Change Energy the Environment and Water, 2023b). The Australian painted snipe has been recorded from wetlands in all Australian states, however is most common in eastern Australia, especially the Murray-Darling Basin. Individuals are nomadic, and there is some evidence of partial migration from south-eastern wetlands to coastal central and northern Queensland in autumn and winter.	Species records typically occur throughout Australia, with the highest density of records present along the coast and inland between Adelaide and Townsville. Most records within at least 50 km are spatially and temporally inaccurate. The nearest recent record (2013) is located approximately 60 km north-west near Woodstock.	**Unlikely** Marginal inland wetland habitat may be present on the banks of the Burdekin River; however the nearest recent record is located approximately 60 km from the Study Area.
Masked owl (northern)	*Tyto novaehollandiae kimberli*	V	V	In northern Australia, the masked owl has been recorded from riparian forest, rainforest, open forest, Melaleuca swamps and the edges of mangroves, as well as along the margins of sugar cane fields. The distribution of the masked owl (northern) is very poorly known, and three subpopulations have been suggested: Kimberley, Northern Territory (NT) and Cape York. (Department of Climate Change Energy the Environment and Water, 2023b). In Queensland, there are historical records from the Normanton region, and from Pascoe, Archer, Chester and Watson Rivers on Cape York Peninsula. It occurs along the southern rim of the Gulf of Carpentaria, Cape York Peninsula and south to Atherton Tablelands and the Einasleigh-Burdekin divide. There is some confusion about where the Queensland southern limit of the subspecies is, with authorities suggesting Mackay or Coomooboolaroo Station (west of Rockhampton).	The species typically occurs along the north eastern and northern coastline of mainland Australia and areas immediately inland between Townsville and Darwin. The nearest recent species records are present approximately 150 km north of the Project Area. All records < 150 km from the Project Area are older than 2002.	**Unlikely** Marginal habitat along the margins of cane farms may be present in the Study Area, however the preferred habitat does not occur. The nearest recent record is located approximately 150 km from the Study Area.
Migratory birds						
Common sandpiper	*Actitis hypoleucos*	Mi	SLC	The common sandpiper is known to occur in a range of wetland environments, both coastal and inland, with varying levels of salinity. Their primary habitat is rocky shorelines and narrow muddy margins of billabongs, lakes, estuaries and mangroves. The species has also been recorded on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties (Department of Climate Change Energy the Environment and Water, 2023b). Found along all coastlines of Australia and in many areas inland, the common sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia.	Species records typically occur along the coastline of mainland Australia with occasional records occurring inland. The nearest recent record (2015) is present approximately 40 km northwest of the Project Area.	**Unlikely** Marginal habitat may be present for the species to persist in the Study Area, however the Burdekin River is freshwater, with its banks considered sandy and not muddy. There str no recent records within 20 km of the Study Area.
Fork-tailed swift	*Apus pacificus*	Mi	SLC	The fork-tailed swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. This species mostly occurs over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. They often occur over cliffs and beaches and over islands and sometimes well out to sea.	Species records typically occur throughout Australia with the highest density of records along the eastern coast between Adelaide and Cairns. There are no records within 20 km that are spatially or temporally accurate. The nearest	**Potential (flyover only)** While the nearest recent record is located > 30 km away and species sightings or other presence data were not observed during recent surveys within the Study Area (GHD, 2021), suitable open woodland and scrub

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
				This species is generally recorded east of the Great Dividing Range from Cooktown to the New South Wales border but extends further west in southern Queensland (Department of Climate Change Energy the Environment and Water, 2023b).	recent record (2018) is located approximately 35 km east of the Project Area.	habitat is present and the species may use the space above the Project Area.
Sharp-tailed sandpiper	*Calidris acuminata*	Mi	SLC	In Australasia, the sharp-tailed sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland. They also occur in saltworks and sewage farms. In Queensland, the sharp-tailed sandpiper is recorded in most regions, being widespread along much of the coast and are very sparsely scattered inland, particularly in the centre and south-west (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur throughout mainland Australia and Tasmania, with the highest density of records present in Victoria, New South Wales and along the eastern coastline. The nearest recent records (2021) are present approximately 7 km north of the Project Area. More records are present within 10 km of the coast, > 35 km east.	**Potential** Marginally suitable habitat may present in the Study Area, among low vegetation and banks along the Burdekin River, however these banks are considered sandy and not muddy. Recent records are present within 10 km of the Study Area.
Pectoral sandpiper	*Calidris melanotos*	Mi	SLC	In Australasia, the pectoral sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. This species is usually found in coastal or near coastal habitat but very occasionally found further inland. In Queensland, most records for the pectoral sandpiper occur around Cairns. There are scattered records elsewhere, mainly from east of the Great Divide between Townsville and Yeppoon. Records also exist in the south-east of the state as well as a few inland records at Mount Isa, Longreach and Oakley (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur throughout mainland Australia and Tasmania, with the highest density of records present in Victoria and along the eastern coastline. There are no records within 20 km of the Project Area. The nearest recent records (2018) are present at Townsville Town Common, approximately 100 km to the north.	**Unlikely** Suitable habitat is not present for the species to persist in the Study Area. Recent records of the species are located greater than 20 km away.
Oriental cuckoo	*Cuculus optatus*	Mi	SLC	The Oriental cuckoo uses a range of vegetated habitats such as monsoon rainforest, wet sclerophyll forest, open woodlands and appears quite often along edges of forests, or ecotones between forest types. It mainly inhabits coniferous, deciduous and mixed forests. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground. The species is a regular migrant to Australia, where it spends the non-breeding season (Sept- May) in coastal regions across northern and eastern Australia as well as offshore islands (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur along the eastern and northern coastline and immediately inland of mainland Australia from the Victorian and New South Wales border to Broome. Records within 20 km are outdated or spatially inaccurate. The nearest recent wild record is located approximately 50 km north near Cromarty.	**Unlikely** Suitable open woodland habitat is present within the Study Area, but there are no recent records within 20 km.
Latham's snipe	*Gallinago hardwickii*	Mi	SLC	In Australia, Latham's snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g., swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity. Latham's snipe is a non-breeding visitor to south-eastern Australia, and is a passage migrant through northern Australia. This species has been recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. In Queensland, the range extends inland over the eastern tablelands in south-eastern Queensland (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur throughout the eastern coast of Australia, with the highest density of records present along the coast and inland between Adelaide and Rockhampton. Records within 20 km are outdated or spatially inaccurate. The nearest recent records (2015-2019) are located approximately 40 north-west of the Project Area.	**Unlikely** Wetland habitat suitable for this species may be marginally present in the Study Area along the banks of the Burdekin, but there are no recent records within 20 km.
Black-faced monarch	*Monarcha melanopsis*	Mi	SLC	The black-faced monarch is a wet forest specialist, occurring mainly in rainforests and riparian vegetation. This species mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrub land, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate	Species records typically occurs throughout Australia with the highest density of records along the eastern coast between Melbourne and Cape York.	**Unlikely** Suitable wet forest habitat is not present in the Study Area. There are no recent records within 40 km of the Study Area.

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				rainforest. The species is occasionally found in eucalypt forest (mainly wet sclerophyll forest) nearby preferred rainforest habitat, particularly in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands often with a patchy understorey. The species is more likely to be found in these marginal habitats when on passage (Australian winter). In Queensland, the black-faced monarch is widespread from the islands of the Torres Strait and on Cape York Peninsula, south along the coasts (occasionally including offshore islands) and the eastern slopes of the Great Divide, to the New South Wales border (Department of Climate Change Energy the Environment and Water, 2023b).	There are no recent records within at least 40 km of the Project Area.	
Yellow wagtail	*Motacilla flava*	Mi	SLC	The yellow wagtail is considered one of five 'extremely uncommon migrants' to Australia. When in Australia it is a regular wet season visitor to northern Australia. In Queensland this species has been recorded from Mossman south to Townsville. Habitat requirements for the yellow wagtail are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves. The yellow wagtail is a regular wet season visitor to northern Australia. In Queensland this species is a regular visitor from Mossman south to Townsville. The species is a vagrant further south and on Heron Island (Department of Climate Change Energy the Environment and Water, 2023b).	Species records are rare throughout Australia, typically occurring along the coastline between Sydney and Broome. The nearest recent record (2016) is present approximately 600 km south of the Project Area near Gladstone.	**Unlikely** Suitable habitat may be present in the Study Area. However, the nearest recent record is located 600 km away.
Satin flycatcher	*Myiagra cyanoleuca*	Mi	SLC	Satin flycatchers are eucalypt forest and woodland inhabitants. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland. The diversity of occupied habitats expands during migration, with the species recorded in most wooded habitats. Wintering birds in northern Queensland will use rainforest – gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps. In Queensland, this species is widespread but scattered in the east, being recorded on passage on a few islands in the western Torres Strait. Satin flycatchers are also found extensively along the Great Dividing Range (Department of Climate Change Energy the Environment and Water, 2023b).	Species records occur along the coastline and inland of mainland Australia from Adelaide to Cape York. The nearest recent record (2021) is present approximately 6 km north-west of the Project Area. Other records within 20 km are outdated or spatially unreliable.	**Potential** Suitable habitat in the form of open eucalypt woodland habitat is likely present in the Study Area and a recent record occurs within 10 km. The species may use the habitat within the Study Area for foraging and dispersal.
Osprey	*Pandion haliaetus*	Mi	SLC	Eastern ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging. The breeding range of the osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in New South Wales; with a second isolated breeding population on the coast of South Australia, extending from Head of Bight east to Cape Spencer and Kangaroo Island (Department of Climate Change Energy the Environment and Water, 2023b).	Species records occur along the coastline of mainland Australia. Records within 20 km are outdated or spatially unreliable. The nearest recent record (2017) is located approximately 30 km north-east near Mount Kelly.	**Potential** Suitable coastal habitat is not present within the Study Area, but the species may travel along the major Burdekin River located within and adjacent to the Study Area. There are no recent records within 20 km (ALA). The species was not recorded during recent surveys in the Study Area, but potential nesting and foraging habitat has been mapped along the Burdekin River (GHD, 2021).
Rufous fantail	*Rhipidura rufifrons*	Mi	SLC	In east and south-east Australia, the rufous fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts, usually with a dense shrubby understorey often including ferns. The rufous fantail is found in northern and eastern coastal Australia, being more common in the north. This species migrates to south-east Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Department of Climate Change Energy the Environment and Water, 2023b).	Species records occur along the coastline and inland of mainland Australia from Adelaide to Darwin. The nearest recent record (2021) is present approximately 6 km north-west of the Project Area. Other records within 20 km are outdated or spatially unreliable.	**Potential** Marginal habitat may be present in the Study Area including eucalypts on alluvial plains with shrubby understory, but preferred wet sclerophyll and ferns are unlikely to be present. The nearest recent record is located within 10 km from the Study Area.

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
Spectacled monarch	*Symposiachrus trivirgatus* (syn. *Monarcha trivirgatus*)	Mi	SLC	The spectacled monarch occupies dense vegetation, mainly in rainforest but also in moist or wet sclerophyll forest and occasionally in other densely vegetated habitats such as mangroves, drier forest, woodlands, parks and gardens. This species is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales (Department of Climate Change Energy the Environment and Water, 2023b).	The species typically occurs along the coastline between Wollongong and Cape York. The nearest recent species record (2014) is present approximately 40 km to the west of the Project Area near Inkerman. The only record within 20 km (1993) is outdated.	**Unlikely** Primary habitat for the species (dense wet rainforest vegetation) is not present within the Study Area, but marginal habitat such as dry woodland does occur. There are no recent records within 20 km of the Study Area.
Common greenshank	*Tringa nebularia*	Mi	SLC	The common greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. In Queensland, this species is widespread in the Gulf country and eastern Gulf of Carpentaria. It has been recorded in most coastal regions, possibly with a gap between north Cape York Peninsula and Cooktown. Inland, there have been a few records south of a line from near Dalby to Mount Guide, and sparsely scattered records elsewhere (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur throughout mainland Australia and Tasmania. The nearest recent record (2023) occurs approximately 35 km east of the Project Area. There are no records within 20 km.	**Unlikely** Suitable habitat is unlikely to be present in the Study Area. There are no recent records within 20 km of the Study Area.
Mammals						
Northern quoll	*Dasyurus hallucatus*	E	LC	The northern quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. The northern quoll is also known to occupy non rocky lowland habitats such as beach scrub communities in central Queensland northern quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal. In Queensland, the northern quoll is known to occur as far south as Gracemere and Mount Morgan, south of Rockhampton, as far north as Weipa in Queensland and extends as far west into central Queensland to the vicinity of Carnarvon Range National Park (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur along the northern coast of Australia and areas inland between Brisbane and Karratha. The nearest species record (2019) is present approximately 44 km to the north-east of the Project Area in Ayr. Other records within 40 km are older than 1972.	**Potential** Habitat suitable for this generalist species may occur within the Study Area, including eucalypt woodland and shrubland. Although the nearest recent record is > 40 km away, the species may utilise the Study Area during breeding season when the species expands its home range.
Ghost bat	*Macroderma gigas*	V	E	Regional populations of ghost bat are centred on permanent maternity roosts that are genetically isolated from each other. Roost sites are deep natural caves or disused mines with a specific microclimate, which is a relatively stable temperature (23ºC to 28ºC) with moderate to high (50-90 %) relative humidity, and the ceiling at least 2 m above the floor. Individuals aggregate in these maternity roosts during spring and summer (Department of Climate Change Energy the Environment and Water, 2023b). Ghost bat is endemic to Australia. In Queensland this species is currently distributed in only 4-5 highly disjunct populations along the coast and inland from the McIlwraith Range in Cape York to Rockhampton. The major colony of *M. gigas* occurs at Mount Etna. *Macroderma gigas* also occurs in the northern Pilbara and Kimberley in Western Australia, and the top end of the Northern Territory.	Species records typically occur sporadically along the northern coastline of Australia and in central Australia. There are no living records of the species within at least 50 km of the Project Area. The nearest recent record (2016) is located approximately 100 km north-west at Hervey Range.	**Unlikely** Suitable roost habitat within the Study Area is unlikely. The nearest record is approximately 50 km to the north-west of the Project Area (ALA). Suitable foraging habitat was found to occur around the Study Area during recent surveys (GHD, 2021).
Greater glider (northern)	*Petauroides minor* (**syn.** *P. volans minor*)	V	V	The greater glider (northern) is found in highest abundance in open woodland to open forests with relatively old trees and abundant hollows. The main tree species for the greater glider (northern) for feeding are white mahogany, narrow -leaved ironbark, forest fed gum, pink bloodwood, grey box, lemon-scented gum, and for denning are white mahogany, lemon-scented gum and forest red gum (Department of Climate Change Energy the Environment and Water, 2023b). The greater glider (northern) occurs in the wet-dry tropical region of north eastern Australia, with a distribution from slightly south of Townsville northwards to the Windsor Tableland. This distribution is very patchy, with some isolated subpopulations, for	Species records for the northern subspecies occur between Cairns and Townsville, while the southern subspecies occurs between Townsville and Melbourne. The two subspecies diverge in north-central Queensland around the Townsville region which is where the Project Area occurs, so records are considered together. There are no records for either species within 50 km of	**Potential** Suitable breeding habitat in the form of large trees with hollows occur within the Study Area within eucalypt woodland. Therefore, this species has been assessed as having a potential to occur despite the significant distance to a recent record.

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
				example in the Gregory Range/Gilbert Plateau west of Townsville, and Blackbraes National Park.	the Study Area. The nearest recent records are located approximately 60 km north and 80 km south-east of the Study Area.	
Greater glider (southern and central)	*Petauroides volans* (**syn.** *P. v. volans, P. armillatus*)	E	E	During the day, the greater glider (southern) spends most of its time denning in hollowed trees, with each animal inhabiting up to twenty different dens within its home range. It is primarily folivorous, with a diet mostly comprising the leaves and flowers of Myrtaceae (e.g., eucalypt) trees. The Greater Glider is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria, with an elevational range from sea level to 1200 m above sea level. An isolated inland subpopulation occurs in the Gregory Range west of Townsville, and another in the Einasleigh (Department of Climate Change Energy the Environment and Water, 2023b).		**Potential** Suitable breeding habitat in the form of large trees with hollows occur within the Study Area within eucalypt woodland. Therefore, this species has been assessed as having a potential to occur despite the significant distance to a recent record.
Koala	*Phascolarctos cinereus*	E	E	Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities. Koalas eat a variety of eucalypt leaves and a few other related tree species, including *Lophostemon, Melaleuca* and *Corymbia* species. Koalas are found in higher densities where food trees are growing on more fertile soils and along watercourses. They do, however, remain in areas where their habitat has been partially cleared and in urban areas (Department of Climate Change Energy the Environment and Water, 2023b). In Queensland, the Koala's distribution extends inland from the east coast: from the Wet Tropics bioregion, into the Einasleigh Uplands bioregion in the north of the state; from the Central Mackay Coast bioregion, through the Brigalow Belt North bioregion to the Desert Uplands and Mitchell Grass Downs bioregions, and from the Southeast Queensland bioregion, through the Brigalow Belt to the Mulga Lands and Channel Country bioregions in the southwest of the state.	Species records typically occur along the coast and along inland areas between Adelaide and Cairns. Records within 20 km are older than 2000. The nearest recent species record (2021) is present approximately 45 km north of the Project Area near Mt Elliot.	**Potential** Habitat types containing *Eucalyptus* spp. and *Corymbia* spp. are present within the Study Area; however, the nearest record is located 45 km from the Study Area. No Koala sightings or presence data were recorded during recent surveys in the area, but the habitat within the Study Area was considered suitable for the species to occur at low densities. Koalas may potentially utilise the Study Area for dispersal (GHD, 2021).
Greater large-eared horseshoe bat	*Rhinolophus robertsi* (**syn.** *R. philippinensis*)	V	E	The greater large-eared horseshoe bat prefers lowland rainforest, along gallery forest-lines creeks within open eucalypt forest, *Melaleuca* forest with rainforest understorey, open savannah woodland and tall riparian woodland of Melaleuca, forest red gum (*Eucalyptus tereticornis*) and Moreton Bay ash (*C. tessellaris*).The species roosts in caves and underground mines located in rainforest, open eucalypt forest and woodland, and may utilise road culverts, basal hollows of large trees, dense vegetation, rockpiles and areas beneath creekbanks. The species is found only in northern Queensland, from the Iron Range southwards to Townsville and west to the karst regions of Chillagoe and Mitchell-Palmer. The southern limit of its rage has not been clarified, and it may be present south of Townsville at Mt Elliott and Cape Cleveland (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur along the coast north of Cairns. The nearest species record is located approximately 300 km to the north of the Project Area.	**Unlikely** Suitable habitat for the species to persist is present within the Study Area, however the nearest recent record is found over 300 km from the Study Area.
Bare-rumped sheathtail bat	*Saccolaimus saccolaimus nudicluniatus*	V	E	The bare-rumped sheathtail bat occurs mostly in lowland areas, typically in a range of woodland, forest and open environments. The type locality for the bare-rumped sheathtail bat is Babinda Creek near Cardwell, North Queensland, with syntypes collected from Gowrie Creek near Cardwell. Occasional individuals have been collected from a narrow coastal region (less than 40 km inland) between Ayr and Cooktown, North Queensland, with one isolated specimen from north of Coen on Cape York Peninsula (20 specimens held in the Queensland Museum). Other observations include a road-killed individual on Magnetic Island off Townsville; a sighting of up to 15 individuals flushed from a roost tree in the Iron Range	Species records occur inland from the coast between Townsville and Cape Tribulation, with scattered records around Darwin. Records are located around Townsville extending east to Jerona which is 40 km north of the Project Area, and are older (pre-2000). More recent records are present near Cairns (2012) > 300 km north of the Project Area.	**Potential** Suitable open woodland habitat is present within the Study Area, but there are no recent records within 80 km. During recent surveys in the Study Area, bat recordings were identified to the genus level (*Saccolaimus* sp.), and suitable roosting and foraging trees were found to occur within the Study Area (GHD, 2021).

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
				area, Cape York, Queensland ; and likely acoustic detection in an area to the west of Townsville (Department of Climate Change Energy the Environment and Water, 2023b).	The species was positively recorded for the Ross River Dam to Douglas Water Treatment Plant project in 2021 (AECOM 2021)	
Short-beaked echidna	*Tachyglossus aculeatus*	-	SLC	The short-beaked echidna lives in forests and woodlands, heath, grasslands and arid environments. This species can live anywhere with a good supply of food, and regularly feast on ants and termites. The short-beaked echidna is found throughout Australia, including Tasmania (WetlandInfo, 2018).	Species records are common across all of Australia. The closest species record is approximately 8 km to the south of the Study Area.	**Likely** Due to the broad habitat requirements of the species the habitat within the Study Area is likely to be suitable and recent records occur near the study area.
Water mouse	*Xeromys myoides*	V	V	Habitat for the water mouse includes mangroves and the associated saltmarsh, sedgelands, clay pans, heathlands and freshwater wetlands, and in central Queensland, they have only been captured in the high inter-tidal zone in tall, closed fringing mangrove forest containing only *Ceriops tagal* and/or *Bruguiera* species and in saline grassland adjacent to closed forest of *Ceriops tagal* and/or *Brugiera* species and *Avicennia marina* (Department of Climate Change Energy the Environment and Water, 2023b). This species has been recorded in coastal saltmarsh, mangrove and adjacent freshwater wetland habitats in the Northern Territory, Queensland and New Guinea. Until recently In Queensland, the species was known from the Proserpine area south to near the Queensland/ New South Wales border. However, in 2017, a population was identified in Cairns.	Species records typically occur along the coastline of Queensland between the Gold Coast and Cairns. There are no records within 20 km of the Project Area. The nearest record (2017) is located at Airlie Beach approximately 150 km south-east of the Project Area.	**Unlikely** Suitable coastal habitat is absent from the Project Area. The nearest record is located 150 km away from the Study Area.
Reptiles						
Ornamental snake	*Denisonia maculata*	V	V	The ornamental snake's preferred habitat is within, or close to, habitat that is favoured by its prey - frogs. The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions in Queensland Regional Ecosystem Land Zone 4, but also lake margins and wetlands (Agnew 2010 pers. comm.; Brigalow Belt Reptiles Workshop 2010; Wilson & Knowles 1988). Gilgai formations are found where deep-cracking alluvial soils with high clay contents occur (Brigalow Belt Reptiles Workshop 2010). The species is known only from the Brigalow Belt North and parts of the Brigalow Belt South biogeographical regions. The core of the species' distribution occurs within the drainage system of the Fitzroy and Dawson Rivers (McDonald et al. 1991; Cogger et al. 1993) (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur inland from the coast in central Queensland, with a few records in northern NSW. The nearest recent records (2012-2013) occur approximately 130 km southwest of the Project Area south of Charters Towers. More records occur further inland.	**Unlikely** Suitable open woodland on moist, alluvial soil is present in the Study Area, but there are no records within at least 100 km of the Study Area.
Yakka skink	*Egernia rugosa*	V	V	Habitat requirements for the yakka skink are poorly known; however, this species is known from rocky outcrops, sand plain areas and dense ground vegetation, in association with open dry sclerophyll forest (ironbark) or woodland, brigalow forest and open shrubland. In the Brigalow Belt bioregion, core habitat includes: poplar box (*Eucalyptus populnea*) woodland, mulga (*Acacia aneura*) woodland, white cypress pine (*Callitris glaucophylla*); usually in association with eucalypt species such as *E. populnea, E. melanophloia* or *Corymbia tessellaris*, ironbark (typically *E. melanophloia)* woodland, and disturbed, treated and cleared areas of suitable habitat, grazed or ungrazed, where suitable microhabitat features still remain. Colonies have been found in large hollow logs, cavities or burrows under large fallen trees, tree stumps, logs, stick-raked piles, large rocks and rock piles, dense ground-covering vegetation, and deeply eroded gullies, tunnels and sinkholes (Department of Climate Change Energy the Environment and Water, 2023b). The known distribution of the Yakka Skink extends from the coast to the hinterland of sub-humid to semi-arid eastern Queensland. This vast area covers portions of the	Species records are typically present throughout inland south eastern Queensland to Emerald, with rare occurrences across northern Queensland. The nearest species record (1980) is located approximately 70 km southwest at Mt Cooper. Records within 300 km of the Project Area are rare.	**Unlikely** Suitable habitat for the species may be marginally present within the Study Area but is likely to flood too often for the species to persist. The nearest recent record is found over 300 km from the Study Area.

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
				Brigalow Belt, Mulga Lands, South-east Queensland, Einasleigh Uplands, Wet Tropics and Cape York Peninsula Biogeographical Regions.		
Mount Cooper striped skink	*Lerista vittata*	V	E	In the Mount Cooper area, south-west of Charters Towers, *Lerista vittata* has been found in a variety of habitats. These habitats include Ironbark, Semi-Evergreen Vine Thicket and Spinifex communities (Brigalow Belt Reptiles Workshop 2010; Cogger et al. 1993; Wilson & Knowles 1988). *Lerista vittata* was first described at Mount Cooper Station, approximately 80 km south-east of Charters Towers, Queensland. A second population has been tentatively identified approximately 100–200 km NNW of Hughenden on the Chudleigh Plateau. However, these specimens vary from the Mt Cooper specimens in colouration and appear to be geographically isolated. Further research and collections are required to determine whether the Mt Cooper and Chudleigh Plateau populations are conspecific or represent two distinct taxa (Brigalow Belt Reptiles Workshop 2010; Couper pers. comm. 2010). Four museum specimens were collected from Mount Cooper Station by Greer and colleagues in 1983. Other specimens from Chudleigh Plateau (Kidston Dam, Blackbraes National Park and Gilberton Station) are tentatively identified as *L. vittate* (Department of Climate Change Energy the Environment and Water, 2023b).	Species records exclusively occur in a small area at Mt Cooper near Charters Towers in Queensland, with one record near Gilberton. There are no records within 20 km of the Project Area. The species has only been recorded at Mt Cooper (2014), 70 km to the south-west and potentially at Gilberton 380 km to the west.	**Unlikely** Suitable ironbark habitat is marginally present in the Project Area, but the nearest records are 70 km southwest of the Study Area.
Other Migratory Species						
Estuarine crocodile	*Crocodylus porosus*	Mi	V	Estuarine crocodiles mostly occur in tidal rivers, coastal floodplains and channels, billabongs and swamps up to 150 km inland from the coast. Preferred nesting habitat includes elevated, isolated freshwater swamps that do not experience the influence of tidal movements. Floating rafts of vegetation also provide important nesting habitat. In Queensland the saltwater crocodile inhabits reef, coastal and inland waterways from Gladstone on the east coast, throughout the Cape York Peninsula and west to the Queensland - Northern Territory border (Department of Climate Change Energy the Environment and Water, 2023b).	Species records typically occur along the coastline and inland of mainland Australia and Tasmania between Gladstone and Broome. The nearest recent record (2018) occurs approximately 50 km north, adjacent to Mt Elliot. There are no records within 20 km.	**Unlikely** Suitable nesting habitat may be present within the Study Area but there are no recent records within 50 km, and Clare Weir north of the Study Area acts as a significant barrier to movement for the species.
Plants						
Hoop pine orchid	*Bulbophyllum globuliforme*	V	NT	*Bulbophyllum globuliforme* occurs in notophyll vine forest and some microphyll vine forest with *Araucaria cunninghamii* (hoop pine) emergents. In Queensland, it appears to grow solely on the scaly bark of the branches and upper trunk of older hoop pine trees with other epiphytes such as the vulnerable *Bulbophyllum weinthalii*. It occurs between altitudes of 500 to 900 m. It is suspected that hoop pines need to be at least 100 years old before they are suitable as habitat for this orchid. This orchid appears to favour the underside of tree limbs (Barker, 1999) (Booth, 2015).	Species records are scattered in pockets along the east coast mostly near Brisbane and Sydney, with stray records occurring in north and central Queensland. The nearest species record (2005) is located > 150 km northwest of the Project Area and is the only record in north and central Queensland.	**Unlikely** Suitable vine forest habitat is not present in the Study Area, and records of the host Hoop Pine also do not occur within 20 km. There are no species records within 150 km of the Study Area.
Bluegrass	*Dichanthium setosum*	V	LC	*Dichanthium setosum* is associated with heavy basaltic black soils and red-brown loams with clay subsoil (often in gilgai). Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis, Myoporum debile, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Bothriochloa decipiens, Macrozamia stenomera, Medicago minima, Leptorhynchos squamatus, Lomandra aff. longifolia, Ajuga australis, Calotis hispidula and Austrodanthonia spp., Dichopogon spp., Brachyscome spp., Vittadinia spp., Wahlenbergia* spp. and *Psoralea* spp. In Queensland this species has been reported from the Leichhardt, Morton, North Kennedy and Port Curtis regions (Department of Climate Change Energy the Environment and Water, 2023b).	Species records are typically found inland from the coast in northern NSW, with scattered records in Queensland, WA and Tasmania. The nearest species record (1990) is found approximately 80 km south of the Project Area on the banks of Dalrymple Lake.	**Unlikely** Suitable soil type is unlikely to be present in the Study Area. Records are sparse and there are no records within 80 km of the Study Area.

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
Black ironbox	*Eucalyptus raveretiana*	V	LC	*Eucalyptus raveretiana* grows along watercourses and occasionally on river flats. It occurs in open forest or woodland communities. The species prefers sites with moderately fertile soil and adequate sub-soil moisture. The alluvial soils in which it grows are sands, loams, light clays or cracking clays (Department of Climate Change Energy the Environment and Water, 2023b). *Eucalyptus raveretiana* occurs in scattered and disjunct populations in central coastal and sub-coastal Queensland, from Charters Towers and Ayr, and south to Rockhampton (Bean, 2009).	Species records typically occur along the central Queensland coast, with some records straying inland and occurring further north and south near Mareeba and Brisbane. The only record within 20 km of the Project Area is from 1949. More recent records occur beyond 40 km, with the nearest occurring 42 km north-east at Rita Island.	**Known** Suitable habitat occurs along the bank of the Burdekin River. Whilst there are no recent records within 40 km (ALA), the species was recorded within the Study Area during a recent field survey (GHD, 2021) and confirmed during 2023 field surveys (this report).
-	*Leichhardtia brevifolia* (**syn.** *Marsdenia brevifolia*)	V	V	North of Rockhampton, *Marsdenia brevifolia* grows on serpentine rock outcrops or crumbly black soils derived from serpentine in eucalypt woodland, often with *Eucalyptus fibrosa* and *Corymbia xanthope*. At Hidden Valley near Paluma, plants grow in woodland on granite soils and on Magnetic Island the species occurs in open forest on dark acid agglomerate soils. This species occurs in north and central Queensland where it is known from near Townsville, Springsure and north of Rockhampton (Department of Climate Change Energy the Environment and Water, 2023b)	Species records are located in northeast Queensland around Townsville, and in the Rockhampton area and further inland. There are no records within 50 km. The nearest recent record (2014) is located inland from Paluma National Park approximately 150 km north-west of the Project Area.	**Unlikely** Suitable eucalypt woodland is likely present in the Study Area, but rock outcrops or suitable soil do not occur. There are no records within 50 km of the Study Area.
-	*Omphalea celata*	V	V	*Omphalea celata* occurs in fragmented semi evergreen vine thicket or araucarian microphyll vine forest. Recorded along watercourses in steep sided gorges and gullies on weathered metamorphic or granitic soils. Associated species include *Eucalyptus raveretiana, E. tereticornis, Lysiphyllum hookeri and Ficus opposite* (Booth, 2012).	Species records are isolated to Gloucester Island and around Eungella National Park on the central Queensland coast. The nearest species records (2020-2022) are present approximately 200 km south of the Project Area in Eungella National Park.	**Unlikely** Suitable substrate type is unlikely to occur in the Study Area. There are no recent records within 200 km of the Study Area.
Lesser swamp-orchid	*Phaius australis*	E	E	*Phaius australis* is commonly associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where broad-leaved paperbark (*Melaleuca leucadendra*) or swamp Mahogany (*Lophostemon suaveolens*) grows. It is typically restricted to swamp-forest margins, where it occurs in swamp sclerophyll forest, swampy rainforest, or fringing open forest. *P. bernaysii* differs from *P. australis* in the flower colour and is indistinguishable when not in flower. This species is endemic to Australia and occurs in southern Queensland and northern New South Wales (Department of Climate Change Energy the Environment and Water, 2023b).	Species records are abundant in central parts of the east coast of Australia, with rare occurrences towards the north and south. There are no records within 200 km of the Project Area, from Cardwell to Mackay.	**Unlikely** The species prefers coastal wetland habitat which does not occur in the Study Area. There are no recent records within 200 km of the Study Area.
Square tassel fern	*Phlegmariurus tetrastichoides*	V	V	The square tassel fern is an epiphyte on rainforest trees, occurring in north-eastern Queensland, from the Daintree, south to Hinchinbrook Island, and west of Mackay, from sea level to 1100 m altitude (Department of Climate Change Energy the Environment and Water, 2023b). All known populations occur in areas of remnant vegetation.	Species records occur 150 km north in the Paluma Range National Park, and 180 km south east in Eungella National Park.	**Unlikely** Suitable rainforest habitat does not occur in the Study Area. There are no records within 150 km of the Study Area.
Granite nightshade	*Solanum graniticum*	E	E	*Solanum graniticum* occurs in eucalypt woodland on hillsides in shallow soils derived from granite and granodiorite. In most cases *Eucalyptus drepanophylla* is present and in many instances a dominant component of the vegetation - often with *Allocasuarina littoralis* and *Lophostemon confertus* at the location of the Gloucester subpopulation (REs 8.12.12d, 8.12.29b, 11.12.16, 8.12.14c, 8.12.6b, 8.12.14a); *Corymbia erythrophloia* at the location of the Eungella Dam subpopulation (RE 11.12.1) and *Corymbia leichhardtii* at the location of the Mt Zero-Taravale subpopulation (RE 9.12.23). *Solanum graniticum* is a Queensland endemic, known from four locations: Gloucester Island: Cape Gloucester on the adjacent mainland north of Proserpine; Eungella Dam (Eungella Dam location) west of Mackay (approx. 120 km SSE of the Gloucester location); and Mount Zero-Taravale Sanctuary (Mt Zero-Taravale location) northwest of Townsville (approx. 285 km WNW of the Gloucester location) (see Figure 1). The species is naturally very rare. With large distances between the locations in rugged terrain that has been relatively poorly surveyed for plants, it is likely that further	Species records occur around central to north Queensland from Eungella National Park in the south to Paluma National Park in the north. There are no records within 50 km of the Project Area. The nearest record (2022) is located approximately 80 km south near Sonoma State Forest.	**Unlikely** Whilst suitable eucalypt woodland habitat is mapped within the Study Area, suitable granitic soil type and preferred land zones for this species do not occur in the Study Area. There are no records within 50 km of the Project Area.

Common name	Scientific Name	EPBC Act Status[1]	NC Act Status[2]	Preferred Habitat and Distribution	Records (Atlas of Living Australia, 2023)	Likelihood of Occurrence in the Study Area
				locations occur within the extent of occurrence for *S. graniticum*, however the cryptic nature of this species and its inconspicuous form could render discovery of unknown populations by targeted survey effort difficult (Threatened Species Scientific Committee, 2021).		
-	*Solanum sporadotrichum*	-	NT	*Solanum sporadotrichum* grows in association with semi-evergreen vine thicket, notophyll rainforest or littoral rainforest with *Brachychiton australis*, *Gyrocarpus americanus*, *Flindersia collina*, *Araucaria cunninghamii*, *Acacia fasciculifera* and *Drypetes deplanchei*, or in eucalypt open forest or woodland. Soils are moderately to very fertile (Bean, 2004; Queensland Herbarium, 2012). *Solanum sporadotrichum* is endemic to Queensland. In subcoastal areas the species extends from Magnetic Island (near Townsville) to Calder Island (50 km northeast of Mackay). The species occurs west of Townsville from Fanning River Station, 25 km northeast of Mingela to Mount Wickham. *S. sporadotrichum* occurs within Magnetic Island National Park, Gloucester Island National Park, Dryander State Forest and Conway National Park (Bean, 2004; Queensland Herbarium, 2012) (Wearne, 2012).	Species records mostly occur in central Queensland from Townsville to Clairview, with sparse records near Gold Coast and Coffs Harbour on the east coast. The nearest recent records (2018) are located 80 km west of the Project Area near Mingela.	**Unlikely** Suitable vine thicket and rainforest habitat is unlikely to be present in the Study Area and there are no recent records within at least 50 km.
-	*Tephrosia leveillei* (**syn.** *T. flagellaris*)	V	LC	*Tephrosia leveillei* has been recorded growing on alluvial plains in *Eucalyptus cullenii* woodland with *C. erythrophloia*, *Erythrophleum chlorostachys* and *Grevillea glauca*, and in tall open forest of Eucalyptus and Corymbia species over dense *Heteropogon contortus* on red sand. *T. leveillei* is currently known from the area between Chillagoe and Forty Mile Scrub (five collections) with one collection further south, near Ravenswood (Department of Climate Change Energy the Environment and Water, 2023b).	Species records occur from the coast to inland areas of north Queensland and in isolated locations in inland NT. All species records within 70 km of the Project Area are older than 1984 or have high spatial uncertainty. The nearest recent record (2012) is located in Nairana National Park approximately 195 km south of the Project Area.	**Unlikely** Suitable alluvial plain with open Eucalypt and Corymbia woodland are likely to be present in the Study Area, however there are no recent records within at least 100 km of the Study Area.

Appendix D

MSES Significant Residual Impact Assessments

Appendix D MSES Significant Residual Impact Assessments

This section contains assessments to determine the significant residual impact for the Project, utilising the Project Area that is considered to represent a conservative maximum impact area.

Introduction

An environmental offset condition may be imposed under various State assessment frameworks (such as the *Planning Act 2016* and EP Act) for an activity prescribed under the EO Act, if the activity will, or is likely to have a significant residual impact on a prescribed environmental matter that is an MSES.

MSES are defined as:

- Regulated vegetation (Category B, Category C, Category R, essential habitat, regulated vegetation within the defined distance of a watercourse, and vegetation within 100 m of a wetland).
- Connectivity areas (in non-urban areas).
- Wetlands and watercourses (declared high-value waters, high ecological significance wetlands, and wetland protected areas).
- Designated precincts in Strategic Environmental Areas.
- Protected wildlife habitat.
- Protected areas (national parks, regional parks, and nature refuges).
- Declared Fish Habitat Areas and highly protected zones of State Marine Parks.
- Waterways providing for fish passage.
- Marine plants.
- Legally secured offsets areas.

As per Section 8 of the EO Act, a significant residual impact is generally an adverse impact, whether direct or indirect, of a prescribed activity on all or part of a prescribed environmental matter that:

a. Remains, or will or is likely to remain, (whether temporarily or permanently) despite on-site avoidance and mitigation measures for the prescribed activity; and

b. Is, or will or is likely to be, significant.

MSES within the Project Area

As discussed in Section 5.0, the following MSES are identified as potentially occurring within the Project Area:

- Regulated vegetation: within the defined distance of a watercourse
- Connectivity
- Protected wildlife habitat

After all reasonable avoidance and on-site mitigation measures for the Project have been or will be undertaken (Section 8.2), the Project may impact on MSES. A significant residual impact assessment has been undertaken for the Project in accordance with the criteria provided in the Significant Residual Impact Guidelines (Department of State Development Infrastructure and Planning, 2014a) For the purpose of the impact assessments, total clearing of the Project Area has been assumed.

It is important to note that the below assessments are not to be used to determine if the Project requires assessment for potential impacts on MNES protected by the Commonwealth EPBC Act or if an offset would be required under this Act.

To avoid duplication of offset conditions 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 and the same or substantially the same matter has not been subject to assessment under the EPBC Act. As such, the MSES values presented in this section are those that have not already been assessed as MNES values (Department of the Environment, 2013). As such, significant residual impact assessments for protected wildlife habitat have only been completed for the known, likely or potential conservation significant species that have not already been assessed under the EPBC Act policy statement 'Significant Impact Guidelines 1.1 – Matters of National Environmental Significance' (Department of the Environment, 2013).

Regulated Vegetation – Within the Defined Distance of a Watercourse

Regulated vegetation excludes regrowth vegetation and has been defined as Category B areas on the regulated vegetation map. Regulated vegetation within a defined distance to a watercourse is mapped within the Project Area. The defined distance is determined using the table below (Table 18).

Table 18 Defined distance for regulated vegetation (coastal bioregions)

Watercourse Stream Order	Distance from the Defining Bank (metres)
1 or 2	10
3 or 4	25
5 or greater	50

The Burdekin River is a Stream Order 9 watercourse located immediately adjacent to the Project Area. The defining bank of the watercourse was mapped using the hill shade layer of Queensland Globe (Queensland Government, 2023) and buffered by 50 m based on Table 18. This layer was then clipped against ground-truthed Category B vegetation.

The total area of regulated vegetation within the defined distance to the watercourses is provided in Table 19.

Table 19 Mapped regulated vegetation within the defined distance to a watercourse

Regulated Vegetation	RE	VM Status	Area Mapped within Project Area (ha)
Category B	11.3.35	Least Concern	0.32

A significant residual impact assessment has been completed for the regulated vegetation within a defined distance to a watercourse against Section 3.1 of the Significant Residual Impact Guideline (Department of State Development Infrastructure and Planning, 2014b) (Table 20).

Table 20 Significant residual impact assessment for regulated vegetation within the defined distance of a watercourse

Impact Criteria	Assessment
An action is UNLIKELY to have a significant residual impact on regulated vegetation within the defined distance of a watercourse if the action will result in:	
Clearing of 'least concern' RE not containing Essential Habitat up to 1ha for lineal infrastructure (e.g. roads and rail)	**Yes.** The Project only intersects least concern RE 11.3.35 and is not mapped as Essential Habitat. The total area impacted is 0.32 ha required for the purposes of a OHTL and associated infrastructure, as such the action is considered unlikely to have a significant residual impact.

A significant residual impact is considered unlikely to occur on regulated vegetation within the defined distance of a watercourse as the clearing is of a 'least concern' RE, the Project Area does not contain Essential Habitat and clearing is less than 1 ha for lineal infrastructure (powerline infrastructure).

Connectivity Areas

DES has developed a Landscape Fragmentation and Connectivity (LFC) tool to assist in identifying and quantifying any significant impact on connectivity for an individual impact area. The measure of impact significance is based on how the prescribed activity will change the size and configuration of remnant vegetation areas and the level of fragmentation that will result at the local scale (5 km radius) given regard to the regional scale (20 km radius).

The LFC tool determined that Project related impacts on connectivity areas are not significant (Table 21).

Table 21 LFC tool results for connectivity (state-mapped remnant vegetation)

Impact Criteria	Assessment Result
Significance test one	The regional total area is 128485.46 The regional extent of core remnant is 75739.37 The regional extent of core remnant is 58.95 percent This level of regional fragmentation sets a local impact threshold of: 20.0 percent The table below lists the local impact thresholds for categories of regional core remnant extent: REGIONAL CORE CATEGORY LOCAL IMPACT THRESHOLD < 10 2.0 10 - 30 5.0 30 - 50 10.0 50 - 70 20.0 70 - 90 30.0 >90 50.0 Area of core at the local scale (pre impact): 6637.69 Area of core at the local scale (post impact): 6630.56 Percent change of core at the local scale (post impact): 0.11 percent
Significance test two	The number of core remnant areas occurring on the site: 1 The number of core remnant areas remaining on the site post impact: 1
Result	his analysis has determined any impact on connectivity areas is **NOT SIGNIFICANT** (A significant reduction in core remnant at the local scale is False OR a change from core to non-core remnant at the site scale is True).

Protected Wildlife Habitat

Protected wildlife habitat is defined as an area of habitat (e.g. foraging, roosting, nesting or breeding habitat) for an animal or plant that is endangered or vulnerable, near threatened or a special least concern (non- migratory) animal under the NC Act.

Offsets may be required for the following protected wildlife habitat:

- an area that contains plants that are ‘endangered’, ‘vulnerable’ or ‘near threatened’ wildlife;
- a habitat for an animal that is ‘endangered’, ‘vulnerable’ or ‘near threatened’ wildlife or a special least concern animal (non-migratory), including areas or features used by an animal for foraging, roosting, nesting or breeding.

As discussed above, to avoid duplication of offset conditions 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 and the same or substantially the same matter has not been subject to assessment under the EPBC Act. As such, significant residual impact assessments for protected wildlife habitat have only been completed for the known, likely or potential conservation significant species that have not already been assessed under the EPBC Act policy statement ‘Significant Impact Guidelines 1.1 – Matters of National Environmental Significance’ (Department of the Environment, 2013).

Significant residual impact assessments have been prepared for the following species:

- Greater glider
- Short-beaked echidna

All other species identified as likely or potentially occurring are MNES species and have been excluded from significant residual impact assessments.

Greater glider (Petauroides volans sensu lato)

Description and Status

Petauroides volans sensu lato is listed as Vulnerable under the NC Act.

This species was formerly the only species in the genus. Two subspecies were recognised: *P. v. minor* (in north-eastern Qld) and *P. v. volans* (in south-eastern Australia) (Van Dyck & Strahan, 2008). Jackson & Groves (2015) split the species into three separate species: *P. minor* (Atherton Tablelands and coastal central and northern Qld), *P. armillatus* (inland central Qld), and *P. volans* (from south-east Qld to Vic). McGregor et al. (2020) agreed with this taxonomic arrangement within *Petauroides* on the basis of genomic-scale nuclear markers and external morphological data. (Department of Climate Change Energy the Environment and Water, 2022).

The greater glider is the largest gliding possum in Australia, with a head and body length of 35−46 cm and a long furry tail measuring 45−60 cm. Its tail is not prehensile. This species has thick fur that increases its apparent size. The fur is white or cream in colour below and varies from dark grey, dusky brown through to light mottled grey and cream above. It has large furry ears and a short snout.

Distribution

The greater glider (southern and central) occurs in eastern Australia, where it has a broad distribution from around Proserpine in Qld, south through NSW and the ACT, to Wombat State Forest in central Vic. It occurs across an elevational range of 0−1200 m above sea level (Department of Climate Change Energy the Environment and Water, 2022).

Habitat requirements

The greater glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. During the day, this species spends most of its time denning in hollowed trees, with each animal inhabiting up to twenty different dens within its home range. It is primarily folivorous, with a diet mostly comprising the leaves and flowers of Myrtaceae (e.g. eucalypt) trees. Home ranges of this species are typically relatively small (1 - 4 ha) but are larger in lower productivity forests and more open woodlands (up to 16 ha). They are larger for males than for females, with male home ranges being largely non-overlapping. A study on the greater glider population in the Seven Mile Beach National Park area found that while the species can cover distances up to 100 m, they usually glide less than 30 m and have a steeper trajectory than other species of glider (NSW Scientific Committee, 2016).

Hollows develop slowly in Australian eucalypts, with figures most often quoted as minimum lag times of 150 - 360 years from germination to the beginning of hollow development (Gibbons & Lindenmayer, 2002). A fall in the number of hollows below a minimum critical threshold for greater gliders could cause a decline in any local population and compromise population viability in the longer term if there is not a new cohort of hollow trees available to replace trees lost (Lindenmayer et al., 1997).

Threats

The greater glider is considered to be particularly sensitive to forest clearance and to intensive logging. Notwithstanding relatively small home ranges (1 – 4 ha), but in part because of low dispersal ability, this species may be sensitive to fragmentation, have relatively low persistence in small forest fragments, and disperse poorly across vegetation that is not native forest.

It has been identified that the species requires a Recovery Plan, however one has not yet been developed. Although taxonomically different, the related Mahogany glider (*Petaurus gracilis*) does have a Draft Recovery Plan (Jackson & Diggins, 2020).

As per the species Conservation Advice (Department of Climate Change Energy the Environment and Water, 2022), all known threats include:

- Habitat loss and fragmentation
- Too intense or frequent fires
- Timber production
- Climate change
- Barbed wire fencing entanglement
- Hyper-predation by owls
- Competition from sulphur-crested cockatoos
- Phytophthora root fungus.

Outcome

The Project is unlikely to have a significant residual impact on the greater glider (Table 23).

- **Table 22 Significant residual impact assessment for short-beaked echidna**

Impact Criteria	Assessment
An action is LIKELY to have a significant residual impact on habitat for an animal that is 'Endangered or Vulnerable' wildlife if the action will:	
Lead to a long-term decrease in the size of a local population?	**No.** This species has potential to occur within the Project Area and potentially utilises 2.7 ha for breeding, foraging and dispersal which may be directly impacted by the Project (worst-case scenario). This loss of habitat is considered minimal compared to the extensive areas of potential habitat in the local area. Furthermore, the clearing corridor (40m) will not pose a barrier for the species. The species will continue to persist within the current distribution, regardless of impacts of habitat within the Project Area. Therefore, the Project is unlikely to lead to a long-term decrease in the size of a population of the species.
Reduce the extent of occurrence of the species?	**No.** Due to the relatively small size of the patch and existing connectivity to adjacent denning habitat within the broader landscape it is unlikely the isolated patch will reduce the extent of occurrence of the species. No species were observed during previous field surveys.
Fragment an existing population?	**No.** Any individuals present within the Project Area are likely to only constitute a very small portion of the total population. A small area of potential habitat will be impacted by the Project (2.7 ha). However, as this species is mobile and the Project Area is only 40 m in width it is unlikely to create a barrier to movement, the Project is considered unlikely to fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation?	**No.** This species is relatively mobile, and the Project is unlikely to create a new barrier to movement between the Project Area and adjacent available habitat. Therefore, the Project is unlikely to result in a genetically distinct population forming as a result of habitat isolation.

Impact Criteria	Assessment
An action is LIKELY to have a significant residual impact on habitat for an animal that is 'Endangered or Vulnerable' wildlife if the action will:	
Result in invasive species that are harmful to the species becoming established in the endangered or vulnerable species' habitat?	**No.** The Project is not anticipated to result in invasive species. A separate weed survey has been undertaken and the management of potential invasive species will be detailed in the Projects Construction Environmental Management Plan (CEMP). Based on these management measures the Project is considered unlikely to result in the introduction of a harmful invasive species.
Introduce disease that may cause the population to decline	**No.** A threat to this species includes the root fungus *Phytophthora* which is known to impact on the health of eucalypts. This threat is considered 'minor'. It is unlikely that the Project will introduce a disease to the extent that this species would decline. The CEMP for the Project will detail the biosecurity measures to prevent the introduction and spread of disease.
Interfere with the recovery of the species?	**No.** The Commonwealth SPRAT profile identifies that a Recovery Plan for the greater glider is required; however no such plan exists at the time of this report. In Queensland, there are no species-specific management actions currently in place for the greater glider. As the Project is unlikely to exacerbate current recognised threats to the species, or introduce these threats in the local area, it is unlikely the Project will interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species?	**No.** Potential habitat suitable for breeding, foraging and dispersal occurs within the Project Area, however there is no information to suggest this habitat is ecologically significant. A total of 2.7 ha of potential habitat will be directly impacted via vegetation clearing. Given the relatively small direct loss of potential habitat and the species' mobility the Project is considered unlikely to cause disruption to ecologically significant locations of the species.

Potential Impacts and Mitigation Measures

Refer to Section 8.0 of this report for species-specific and general avoidance, minimisation and mitigation measures.

Short-beaked echidna (Tachyglossus aculeatus)

The short-beaked echidna is listed as Special Least Concern under the NC Act.

The short-beaked echidna is found throughout Australia, including Tasmania. It is Australia's most widespread native animal (The Australian Museum, 2018). No systematic study of the ecology of the short-beaked echidna has been published, but studies of several aspects of their behaviour have been conducted. Individuals are solitary wanderers: they have large, overlapping home ranges (up to 50 ha) and only maintain a fixed shelter or nest site when rearing their young in a burrow (Augee et al., 2006). They avoid extremes in temperature by sheltering in hollow logs, rock crevices and vegetation. Limited only by an insufficient supply of ants or termites, short-beaked echidnas live in a range of climates and habitats.

This species is not threatened with extinction, but human activities, such as hunting, vehicles, habitat destruction, and the introduction of foreign predatory species and parasites, have reduced its distribution in Australia (The Australian Museum, 2018). This species can live anywhere with a good supply of food, and regularly forages on ants and termites, and are most common in forested areas with abundant, termite-filled, fallen logs.

The solitary short-beaked echidna looks for a mate between May and September; the precise timing of the mating season varies with geographic location. The short-beaked echidna is an egg-laying mammal (monotreme) and lays one egg at a time. The eggs hatch after about 10 days and the young, emerge blind and hairless. Clinging to hairs inside the mother's pouch, the young echidna suckles for two or three months. Once it develops spines and becomes too prickly, the mother removes it from her pouch and builds a burrow for it. It continues to suckle for the next six months (The Australian Museum, 2018).

Occurrence and Potential Habitat

This species is considered likely to occur within the Project Area. This is a generalist species that may utilise all remnant and high value regeneration vegetation habitat within the Project Area.

The extent of potential habitat for the species is 3.2 ha including both remnant and non-remnant areas. An assessment against the Significant Residual Impact Guideline for this species is provided in Table 23.

Outcome

The Project is unlikely to have a significant residual impact on the short-beaked echidna (Table 23).

Table 23 Significant residual impact assessment for short-beaked echidna

Impact Criteria	Assessment
An action is LIKELY to have a significant residual impact on habitat for an animal that is 'Special Least Concern' wildlife if the action will:	
Lead to a long-term decrease in the size of a local population?	**No.** This species is considered likely to occur within the Project Area and potentially utilises 3.2 ha for breeding, foraging and dispersal which may be directly impacted by the Project (worst-case scenario). This species is common throughout its distribution. This loss of habitat is considered minimal compared to the extensive areas of potential habitat in the local area. To mitigate the death of any short-beaked echidnas during construction, open trenches will be checked for trapped fauna in the morning and at the end of the day by a spotter catcher. The Project is considered unlikely to lead to a significant reduction in the foraging or breeding success of a local population or a long-term decrease in the size of a local population.
Reduce the extent of occurrence of the species?	**No.** This species occurs across Australia and is considered common. The Project Area is highly modified, surrounded by urbanisation and disturbance. Given this species is relatively mobile, and is considered a generalist, it is unlikely the Project will reduce the extent of occurrence of the species.
Fragment an existing population?	**No.** Discrete sub-populations of short-beaked echidna are not known, and available population information indicates that this species is stable throughout its range. Any individuals present within the Project Area are likely to only constitute a very small portion of the total population. A small area of potential habitat will be impacted by the Project (3.2 ha). However, as this species is relatively mobile and the Project is unlikely to create a barrier to movement that doesn't already exist in the highly modified area, the Project is considered unlikely to fragment an existing population.

Impact Criteria	Assessment
An action is LIKELY to have a significant residual impact on habitat for an animal that is 'Special Least Concern' wildlife if the action will:	
Result in genetically distinct populations forming as a result of habitat isolation?	**No.** This species is widely distributed and common. It has broad habitat requirements and as such impacts to potential habitat within the Project Area is unlikely to have population-level impacts. This species is relatively mobile and the Project is unlikely to create a new barrier to movement between the Project Area and adjacent available habitat. Therefore, the Project is unlikely to result in a genetically distinct population forming as a result of habitat isolation.
Cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species?	**No.** Potential habitat suitable for breeding, foraging and dispersal occurs within the Project Area, however there is no information to suggest this habitat is ecologically significant. A total of 3.2 ha of potential habitat will be directly impacted via vegetation clearing. Given the relatively small direct loss of potential habitat, the highly modified nature of the Project Area, and the species' mobility and common occurrence, the Project is considered unlikely to cause disruption to ecologically significant locations of the species.

Appendix H

Weed Survey Report

Prepared for
Powerlink Queensland
ABN: 82 078 849 233

AECOM

Weed Survey Report

Powerlink Burdekin River Pump Station Project

31-Jan-2024
Powerlink Burdekin River Pump Station Project
Doc No. 60714900
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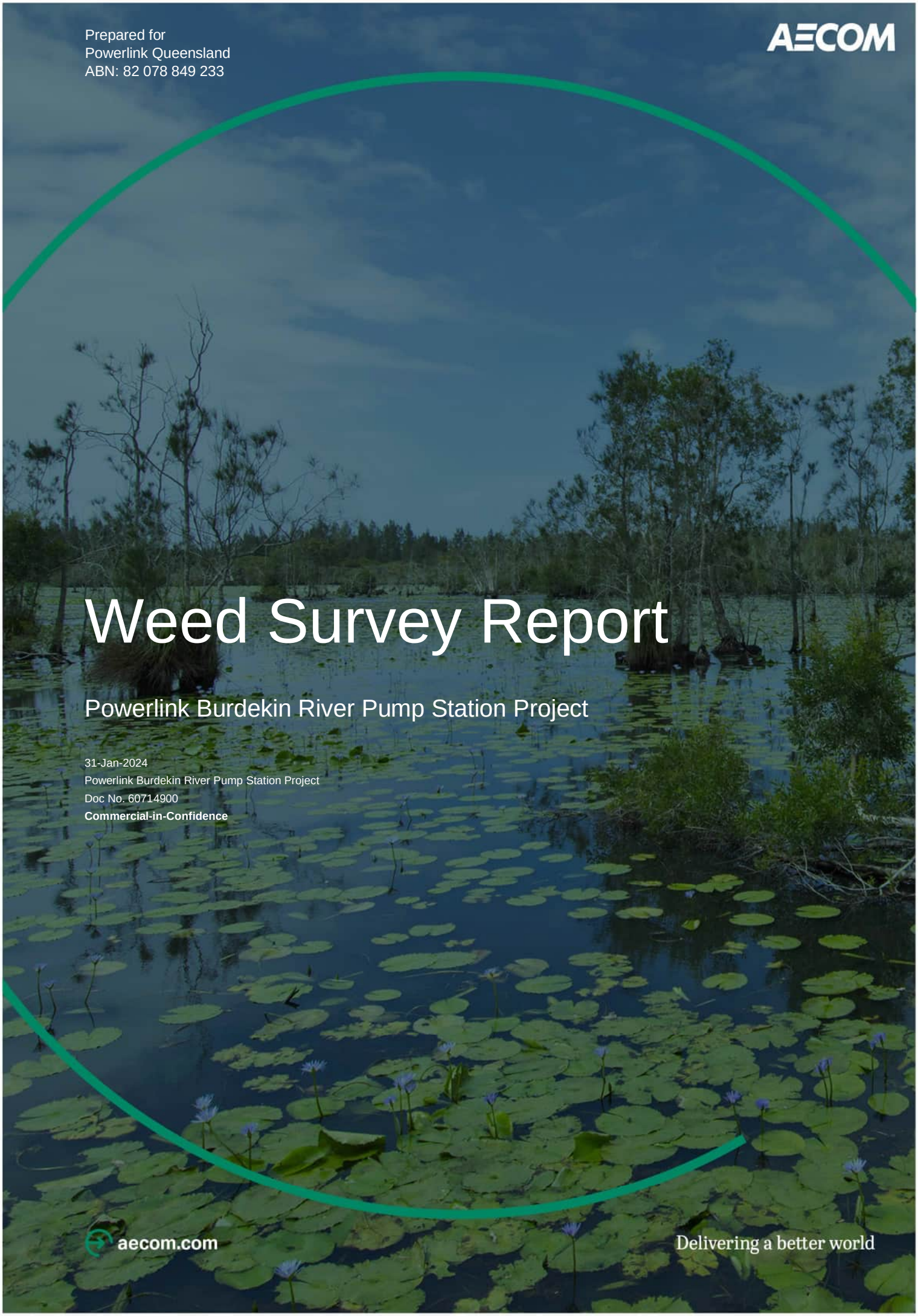

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Weed Survey Report

Powerlink Burdekin River Pump Station Project

Client: Powerlink Queensland

ABN: 82 078 849 233

Prepared by

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31-Jan-2024

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Quality Information

Document	Weed Survey Report
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Date	31-Jan-2024
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Checker/s	Kate Brodie
Verifier/s	Chris Todd

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Rev	Revision Date	Details	Approved	
			Name/Position	Signature
0	01-Dec-2023	Draft Issue	Rouven Lau Project Manager	
A	31-Jan-2024	Final Issue	Rouven Lau Project Manager	

Table of Contents

1.0 Introduction

1.1 Project Background

AECOM Australia Pty Ltd (AECOM) has been commissioned by Powerlink Queensland (Powerlink) to undertake a field survey to identify the existing introduced flora (weed) species, along with potential project risks, mitigation measures and associated legislative requirements for the Burdekin River Pump Station (the Project) into Powerlink's transmission network.

The Project comprises the following components:

- A new 132kV Substation (adjoining the approved pump station).
- A new Overhead Transmission Line (OHTL) to establish a 132kV single circuit tee off into the new Landers Creek Substation. The OHTL will be located within a proposed new easement within Lot 289 on SP117630, Lot 33 on SP331997, Lot 34 on SP331997 and Lot 22 on GS1042.
- The proposed new easement is 40 metres (m) wide, being 20 m either side of the OHTL centreline, with one partial section being 50 m.

The proposed OHTL and Lander's Creek substation will be collectively referred to as the Burdekin River Pump Station Project (the Project). The Project is located on Ayr Dalbeg Road, 15.7 km south of the town of Clare in the Burdekin Shire Regional Council.

This report is supported by the Project's Ecology Technical Report (AECOM, 2023).

1.2 Study Area and Project Area

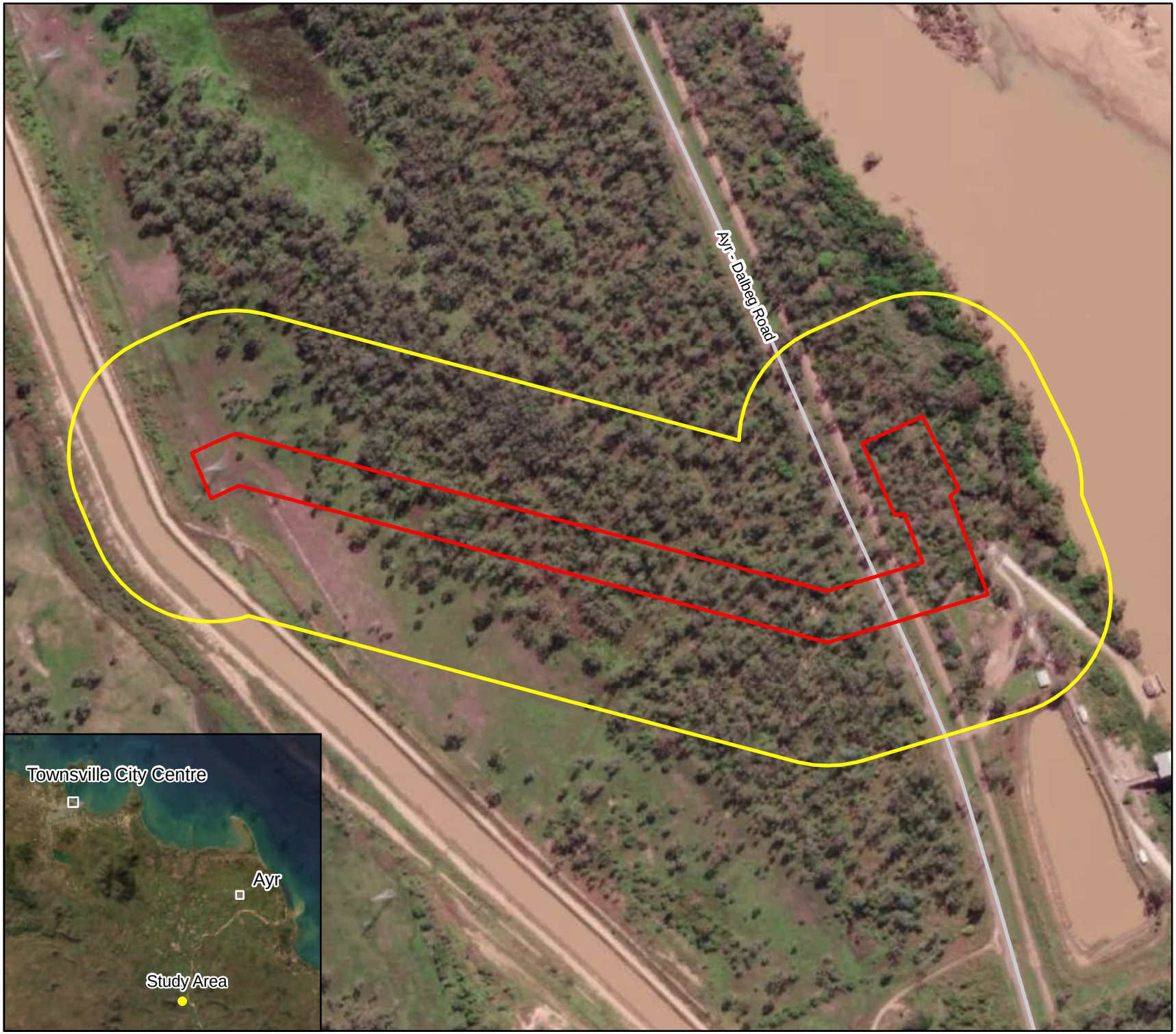
The Project is located on Ayr Dalbeg Road, approximately15.7 km south of the town of Clare in the Burdekin Shire Regional Council. The Project Area is considered as the maximum clearing footprint for Project activities; this includes the substation and the transmission line (Project), along with a 40 m clearing corridor along the transmission line (Figure 1). The Project Area is approximately 3.2 ha representing a conservative maximum clearing footprint for the Project. The Project Area is abutted by the Burdekin River immediately adjacent to the east and intersects a waterway in the western part of the Project. The Ayr Dalbeg Road intersects the Project Area towards the east.

The Study Area considered during the field survey includes the Project Area with a 100m buffer to understand the ecological values in the broader area (Figure 1). The Study Area includes part of the Burdekin River to the east and is intersected by a canal to the west. The Study Area is approximately 22 ha.

1.3 Objectives and Investigation Scope

The objective of this assessment was to document the introduced flora species occurring within the Project Area. The scope of works for the weed survey and associated report included the following:

- Identify weed species within the Project Area including:
  - Weeds of National Significance (WoNS)
  - Prohibited Matters as defined by Schedule 1 of the *Biosecurity Act 2014*
  - Restricted Matters as defined by Schedule 2 of the *Biosecurity Act 2014*
  - Regionally declared species listed in relevant Council Biosecurity Management Plan
- Capture weed type, density, species, date and method of survey.
- Summarise the field survey in a report, including the survey methods and results, and a summary of weed species present.



AECOM

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Meters

Legend

- Project Area
- Study Area

Powerlink Burdekin Haughton Pump Load Weed Survey Report

Figure 1
Project Area & Study Area

Service Layer Credits: Queensland Government 2023, World Imagery: Earthstar Geographics
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2.0 Legislative and Policy Context

2.1 Commonwealth - Weeds of National Significance

One of the primary objectives of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to conserve Australian biodiversity which includes provisions for managing invasive species as threatening processes. The Australian Weeds Strategy was developed by the Commonwealth in conjunction with all State and Territory governments to provide a national framework for the management of weeds and to reduce associated impacts on the environment. Under the strategy, 32 of Australia's most significant weed species are listed as Weeds of National Significance (WoNS) based on their invasiveness and potential for spread, as well as environmental, social and economic impacts. National management strategies and manuals have been published for all WoNS. WoNS identified within the Project Area are listed in Section 4.0.

2.2 Queensland - *Biosecurity Act 2014*

The *Biosecurity Act 2014* (Biosecurity Act) is administered by the Department of Agriculture and Fisheries (DAF). The Act provides management measures to protect agricultural and tourism industries and the environment from pests, diseases and contaminants.

Under the Act, invasive plants and animals are categorised as either a 'Prohibited Matter' or a 'Restricted Matter'. Exotic flora species identified as restricted matter within the Project Area are mentioned within Section 4.0.

Powerlink has a general biosecurity obligation under the Biosecurity Act to ensure they do not spread a pest, disease or contaminant. Under the general biosecurity obligation, individuals and organisations whose activities pose a biosecurity risk must:

- Take all reasonable and practical steps to prevent or minimise each biosecurity risk;
- Minimise the likelihood of causing a 'biosecurity event', and limit the consequences if such an event is caused; and
- Prevent or minimise the harmful effects a risk could have, and not do anything that might make any harmful effects worse.

The Biosecurity Act also requires every local government in Queensland to develop a biosecurity plan for their area.

2.3 Local – Burdekin Shire Biosecurity Plan 2020-2025

All local governments in Queensland are obligated to develop a biosecurity plan for their area outlining strategies for preventing introduction of, eradicating and containing pest flora and fauna within each area. The Burdekin Shire Council developed the Burdekin Shire Biosecurity Plan 2020-2025 (the Plan) (Burdekin Shire Council, 2020) to help approach management of invasive matter (flora and fauna) within the Burdekin Shire guided by the Queensland Department of Agriculture and Fisheries' *Queensland Invasive Plants and Animals Strategy 2019 – 2024* (Department of Agriculture and Fisheries, 2019). The Plan outlines a list of local priority alert species relevant to the Burdekin Shire. Appendix 4 of the Plan also identifies stakeholder responsibilities, which are obligations for pest management within the Burdekin Shire specific to relevant agencies and actions.

The Plan classifies the priority weed species into management objectives based on a risk matrix approach of the extent of risk against the feasibility of control. The management objectives are briefly defined below (Burdekin Shire Council, 2020):

- **Limited Action:** The species has low feasibility for control and targeted action is not likely to reduce the risk, but may be targeted for control if it poses a threat of spread to higher-priority areas.
- **Asset Protection:** Aims to reduce the overall economic, environmental, and/or social impacts of the species and may include targeted management.

- **Containment:** Aims to prevent the ongoing spread of the species in the management area within identified core infestation zones and exclusion zones.
- **Eradication:** Aims to completely remove the species from the management area.
- **Prevention:** Aims to prevent a species that is not present in the area from arriving and establishing.

Locally important weed species identified in the Project Area with their local management objectives are listed in Section 4.0.

3.0 Assessment Method

3.1 Desktop Assessment

A desktop assessment was undertaken in August 2023 and repeated in November 2023 to characterise and identify potential flora and fauna values that may be present in the Study Area. This included a review of the weed species potentially occurring within 20 km of the Project Area using the Wildlife Online database (Department of Environment and Science, 2023). A report was generated of weed species identified within this area (Appendix A).

Information collected as part of the desktop assessment was reviewed and used in the preparation of the field survey, to understand potential species presence and determine appropriate survey techniques.

3.2 Field Survey

A field survey was conducted on 04 and 05 September 2023 to ground-truth the introduced flora species identified in the desktop search. The survey consisted of an ecologist traversing the Project Area and visiting predetermined survey locations to calculate a weed density in a 20 x 20 metre plot. The survey sites are shown in Figure 2.

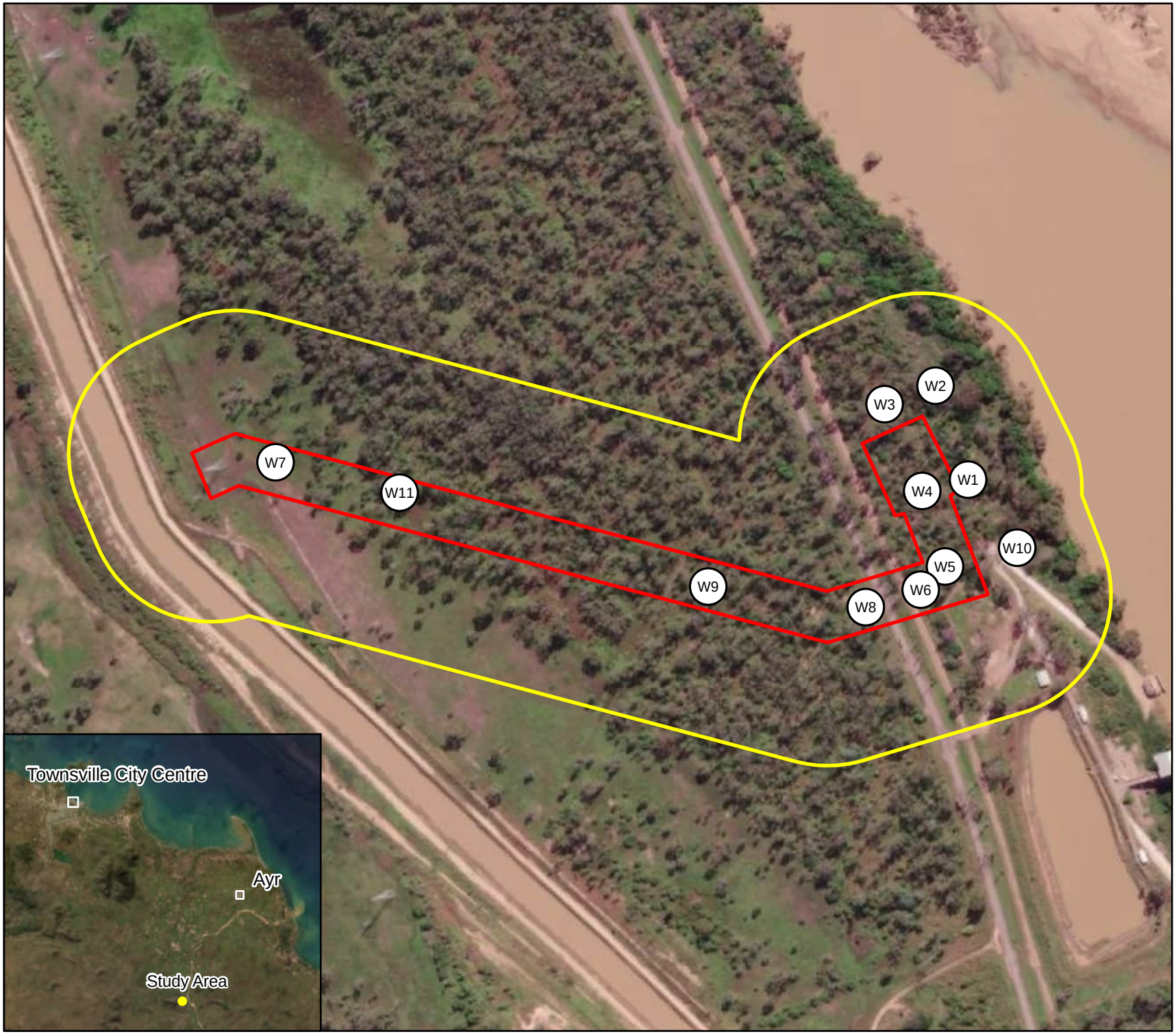
3.3 Specimen Identification and Nomenclature

Specimens of plant taxa that could not be identified in the field were collected and preserved in accordance with the requirements of the Queensland Herbarium (Bean, 2016). Specimens were then identified using herbaria keys and other identification reference books as well as through comparison with the herbarium reference collection. Nomenclature used in this report follows the Queensland Herbarium flora census (Laidlaw, 2022). Exotic flora species are signified in text by an asterisk (*) and comprise species classified as naturalised from the flora census.

3.4 Limitations

All field assessments are subject to limitations in the detection success of targeted species, particularly when conducted as a single event rather than ongoing over a long period of time. These limitations may result in ‘false-absence’ records where a species is not recorded but is present. However, to account for this a likelihood of occurrence assessment was undertaken in which the information from the survey was considered along with other information sources to determine the likelihood of occurrence.

Limitations associated with the flora field survey relate to the variability of vegetation communities across the survey location, as well as the detectability and presence of species at different times (e.g. flowering periods and emergence of annual species). A single field study cannot confirm that every species was detected. However, the survey was sufficient in characterising vegetation communities and species diversity within the Study Area.



AECOM

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Meters

Legend

- Project Area
- Study Area
- Weed survey sites

Powerlink Burdekin Haughton Pump Load Weed Survey Report

Figure 2
Weed Survey Sites

4.0 Assessment Results

A total of 34 introduced species including two WoNS were identified as potentially occurring within 20 km by the desktop assessment. 32 introduced flora species were confirmed to occur in the Study Area during field surveys, with two WoNS and six species listed as Category 3 restricted matter under the Biosecurity Act (Table 1). Five species are listed as local priority weeds of varying management categories.

Table 1 Introduced weed species including WoNS or restricted matter under the *Biosecurity Act 2014*

Scientific name	Common name	WoNS list	Biosecurity Act status	Local Biosecurity Plan[1]
*Albizia lebbeck**	Indian siris	No	-	-
*Alternanthera sp.**	Joyweed	No	-	-
*Argemone ochroleuca**	Mexican poppy	No	-	-
*Argyreia nervosa**	Elephant ear vine	No	Category 3 restricted matter	-
*Basilicum polystachyon**	Basilicum	No	-	-
*Bidens pilosa**	Cobblers pegs	No	-	-
*Bothriochloa pertusa**	Indian bluegrass	No	-	-
*Cascabela thevetia**	Yellow oleander	No	Category 3 restricted matter	-
*Chamaecrista rotundifolia**	Wynn cassia	No	-	-
*Chloris virgata**	Feathertop Rhodes grass	No	-	-
*Cryptostegia grandiflora**	Rubber vine	Yes	Category 3 restricted matter	Asset Protection
*Cucumis melo**	Muskmelon	No	-	-
*Erigeron bonariensis**	Fleabane	No	-	-
*Erigeron bonariensis**	Fleabane	No	-	-
*Gomphrena celosioides**	Gomphrena	No	-	-
*Jatropha gossypiifolia**	Bellyache bush	Yes	Category 3 restricted matter	Asset Protection
*Macroptilium atropurpureum**	Siratro	No	-	-
*Megathyrsus maximus**	Guinea grass	No	-	-
*Melinis repens**	Red natal	No	-	-
*Mesosphaerum suaveolens**	Hyptis	No	-	-
*Passiflora foetida**	Stinking passionflower	No	-	-
*Praxelis clematidea**	Praxelis	No	-	-
*Psidium guajava**	Guava	No	-	-
*Ricinus communis**	Castor oil plant	No	-	-

Scientific name	Common name	WoNS list	Biosecurity Act status	Local Biosecurity Plan[1]
*Sesbania cannabina**	Sesbania pea	No	-	-
*Sida cordifolia**	Flannel weed	No	-	-
*Sporobolus sp.**	Giant rats tail grass	No	Category 3 restricted matter	Containment
*Stachytarpheta jamaicensis**	Blue snakeweed	No	-	-
*Stylosanthes scabra**	Stylo	No	-	-
*Themeda quadrivalvis**	Thatch grass	No	-	Locally declared weed
*Xanthium occidentale**	Noogoora burr	No	-	-
*Ziziphus mauritiana**	Chinee apple	No	Category 3 restricted matter	Asset protection

[1] Weed listed under the Burdekin Shire Biosecurity Plan 2020-2025 (Burdekin Shire Council, 2020)

A total of eleven weed survey sites were assessed to determine the percent cover of each introduced species in a 20 x 20 metre plot. The results are presented in Table 2.

The field survey recorded the following dominant weed species (Table 2):

- Guinea grass (*Megathyrsus maximum**) occurred at 9 of the 11 sites, ranging from 5% to 80% cover.
- Rubber vine (*Cryptostegia grandiflora**) occurred at 3 sites, with a 2% to 40% cover, primarily located in the western portion of the Project Area.
- Chinee apple (*Ziziphus mauritiana**) occurred at 8 of the 11 sites, with a 5% to 15% cover.
- Bellyache bush (*Jatropha gossypiifolia**) occurred at 5 sites with a 1% to 15% cover, located on the eastern portion of the Project Area near the Burdekin River.

Most weed species occurred within the ground and shrub stratum, except for Indian siris (*Albizia lebbeck**) which was a small tree, and rubber vine (*Cryptostegia grandiflora**) which reached the canopy in some areas.

Table 2 Weed species and percent cover per survey site

Scientific name	Stratum[1]	Percent cover (%)										
		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11
*Albizia lebbeck**	T2	5										
*Alternanthera sp.**	G	1		1	2		10	1		1	3	
*Argemone ochroleuca**	G					1						
*Argyreia nervosa**	G/S			1	1	1					5	
*Basilicum polystachyon**	G					1						
*Bidens pilosa**	G						1				1	
*Chamaecrista rotundifolia**	G						1					
*Chloris virgata**	G						5					
*Cryptostegia grandiflora**	G/S/T					2		35				40
*Cucumis melo**	G				1							
*Erigeron bonariensis**	G		1	1	1	1	1					
*Gomphrena celosioides**	G						1					
*Jatropha gossypiifolia**	S2	1	15	1		2					1	
*Macroptilium atropurpureum**	G						1	1			1	
*Megathyrsus maximus**	G	35	5	10	10	15	30		80	40	60	
*Melinis repens**	G			1	1	2	2			1		
*Mesosphaerum suaveolens**	G/S2		1	1			3					
*Passiflora foetida**	G	1	1	2	2	5	2	1		5	1	1
*Praxelis clematidea**	G		5	1	1							
*Psidium guajava**	S									1		
*Ricinus communis**	S2	1			1	1					20	

Scientific name	Stratum[1]	Percent cover (%)										
		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11
*Sida cordifolia**	G	2	2	2	1			1		1		1
*Stachytarpheta jamaicensis**	S2					1						
*Stylosanthes scabra**	S2						1	3		1		2
*Ziziphus mauritiana**	S1/S2		5		15	10		15	5	15	15	15

[1] Stratum key as per (Neldner et al., 2022): G = ground layer, S = shrub layer, T = tree layer

5.0 Conclusion and Recommendations

AECOM Australia Pty Ltd (AECOM) was engaged by Powerlink to undertake a field survey to identify the existing introduced flora (weed) species, along with mitigation measures and associated legislative requirements for the Burdekin River Pump Station (the Project) into Powerlink's transmission network.

The field survey recorded a total of 32 introduced weed species, including two WoNS, six Category 3 restricted matter listed under the Biosecurity Act, and five local priority species.

The primary mitigation measure is the implementation of weed and pest management strategies through the Environmental Management Plan to control the spread of weeds and pests in the Project Area. This includes:

- Pre-construction and post-construction weed surveys to be undertaken within the Project Area.
- Wash down protocols are required for any vehicles or machinery entering and leaving the Project Area. Any material brought into the Project Area will be inspected and cleaned.
- Ongoing monitoring of the Project Area to identify any new incidence of weed and pest infestation.

Additional weed management recommendations can be found in the Biosecurity Queensland invasive plant publications per species (Department of Agriculture and Fisheries, 2023).

This report may act as a pre-construction weed survey if construction occurs within the next few months, however if construction is delayed an updated field survey is recommended.

6.0 References

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Townsville City Council. (2020). *Townsville City Biosecurity Plan 2020 – 2024* (Issue September). https://www.townsville.qld.gov.au/__data/assets/pdf_file/0004/101011/Biosecurity-Plan-2020-2024-September2020.pdf

Appendix A

Desktop Search

Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: Introduced
Queensland status: All
Records: All
Date: All
Latitude: -19.9263
Longitude: 147.2162
Distance: 20
Email: taruna.venkatachalam@aecom.com
Date submitted: Tuesday 14 Nov 2023 13:43:04
Date extracted: Tuesday 14 Nov 2023 13:50:03

The number of records retrieved = 38

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	*Rhinella marina*	cane toad	Y			2
animals	birds	Estrildidae	*Lonchura punctulata*	nutmeg mannikin	Y			1
animals	mammals	Leporidae	*Lepus europaeus*	European brown hare	Y			1
animals	ray-finned fishes	Poeciliidae	*Gambusia holbrooki*	mosquitofish	Y			1
plants	land plants	Amaranthaceae	*Amaranthus spinosus*	needle burr	Y			2/2
plants	land plants	Apocynaceae	*Cryptostegia grandiflora*	rubber vine	Y			2/2
plants	land plants	Asteraceae	*Acanthospermum hispidum*	star burr	Y			1/1
plants	land plants	Asteraceae	*Eclipta prostrata*	white eclipta	Y			2/2
plants	land plants	Asteraceae	*Parthenium hysterophorus*	parthenium weed	Y			1/1
plants	land plants	Chenopodiaceae	*Chenopodium album*	fat-hen	Y			2/2
plants	land plants	Cleomaceae	*Tarenaya aculeata*		Y			1/1
plants	land plants	Convolvulaceae	*Argyreia nervosa*		Y			1/1
plants	land plants	Cucurbitaceae	*Cucumis anguria var. anguria*	West Indian gherkin	Y			1/1
plants	land plants	Euphorbiaceae	*Jatropha gossypiifolia*	bellyache bush	Y			1/1
plants	land plants	Euphorbiaceae	*Ricinus communis*	castor oil bush	Y			1/1
plants	land plants	Lamiaceae	*Leucas lavandulifolia*		Y			1/1
plants	land plants	Lamiaceae	*Ocimum americanum*		Y			1/1
plants	land plants	Leguminosae	*Alysicarpus vaginalis*		Y			1/1
plants	land plants	Leguminosae	*Crotalaria pallida var. obovata*		Y			1/1
plants	land plants	Leguminosae	*Leucaena leucocephala subsp. leucocephala*		Y			1/1
plants	land plants	Leguminosae	*Parkinsonia aculeata*	parkinsonia	Y			1/1
plants	land plants	Leguminosae	*Vachellia farnesiana*		Y			1/1
plants	land plants	Malvaceae	*Urena lobata*	urena weed	Y			1/1
plants	land plants	Martyniaceae	*Martynia annua*	small-fruited devil's claw	Y			2/2
plants	land plants	Molluginaceae	*Mollugo verticillata*		Y			2/2
plants	land plants	Papaveraceae	*Argemone ochroleuca subsp. ochroleuca*	Mexican poppy	Y			1/1
plants	land plants	Plantaginaceae	*Mecardonia procumbens*		Y			1/1
plants	land plants	Plantaginaceae	*Scoparia dulcis*	scoparia	Y			1/1
plants	land plants	Poaceae	*Dichanthium annulatum*	sheda grass	Y			1/1
plants	land plants	Poaceae	*Sorghum halepense*	Johnson grass	Y			2/2
plants	land plants	Poaceae	*Sorghum x almum*		Y			1/1
plants	land plants	Poaceae	*Sporobolus jacquemontii*		Y			1/1
plants	land plants	Poaceae	*Urochloa subquadripara*		Y			1/1
plants	land plants	Rhamnaceae	*Ziziphus mauritiana*	Indian jujube	Y			1/1
plants	land plants	Sapindaceae	*Cardiospermum halicacabum var. halicacabum*		Y			1/1
plants	land plants	Solanaceae	*Datura inoxia*		Y			1/1
plants	land plants	Solanaceae	*Nicotiana glauca*	tree tobacco	Y			1/1
plants	land plants	Solanaceae	*Solanum torvum*	devil's fig	Y			1/1

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.*
The codes are Extinct (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.*
The values of EPBC are Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) and Conservation Dependent (CD).

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Appendix I

Environmental Management Register / Contaminated Land Register

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Renee Weightman
Tomlins Street
Townsville QLD 4810

Transaction ID: 50896644 EMR Site Id: 02 November 2023
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 34 Plan: SP331997
4225 AYR DALBEG RD
MULGRAVE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please email emr.clr.registry@des.qld.gov.au

Administering Authority

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE

ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Renee Weightman
Tomlins Street
Townsville QLD 4810

Transaction ID: 50896643 EMR Site Id: 02 November 2023
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 289 Plan: SP117630
AYR DALBEG RD
MULGRAVE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
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If you have any queries in relation to this search please email emr.clr.registry@des.qld.gov.au

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SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Renee Weightman
Tomlins Street
Townsville QLD 4810

Transaction ID: 50896642 EMR Site Id: 02 November 2023
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 33 Plan: SP331997
4375 AYR DALBEG RD
MULGRAVE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please email emr.clr.registry@des.qld.gov.au

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400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
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SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Renee Weightman
Tomlins Street
Townsville QLD 4810

Transaction ID: 50896641 EMR Site Id: 21610 02 November 2023
Client Reference:
Cheque Number:

This response relates to a search request received for the site:
Lot: 22 Plan: GS1042

EMR RESULT

The above site IS included on the Environmental Management Register.

The site you have searched has been subdivided from the following site, which IS included on the EMR or the CLR.

Lot: 22 Plan: GS1018
Address: DALBEG ROAD
BARRATTAS 4809

The site has been subject to the following Notifiable Activity or Hazardous Contaminant.
LIVESTOCK DIP OR SPRAY RACE - operating a livestock dip or spray race facility.

For the majority of rural properties only a small area may be affected by the chemicals used in livestock dips and spray races. The Department of Environment and Science may hold further information relating to the location of the dip site within this property.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please email emr.clr.registry@des.qld.gov.au

Administering Authority