APPLICATION ON NOTIFICATION – CROWN DEVELOPMENT

Applicant:	OZ Minerals Prominent Hill Operations Pty Ltd
Development Number:	010/V055/18
Nature of Development:	Overhead high voltage power line to provide electricity to the Oz Minerals Prominent Hill Mine, comprising a 275 kV transmission line from the Carriewerloo Substation 20 km north of Port Augusta to the Mount Gunson South Substation (a distance of approximately 109 km) and a 132 kV transmission line from the Mount Gunson South Substation to a connection point with the existing Prominent Hill 132 kV transmission line near Olympic Dam (a distance of approximately 128 km). Approximately 70% of the line runs parallel to the existing BHP and ElectraNet transmission lines. The power line would be supported on either lattice towers, monopoles or guyed structures, depending on the voltage of the line and the function of the structure.
Type of development:	Crown development
Zone / Policy Area:	Buffer Zone / Rural Landscape Zone – Roxby Downs (Municipality) Council. Pastoral Zone – Land Not-within-a-Council Area (Flinders). Remote Areas Zone - Land Not-within-a-Council Area (Eyre, Far North, Riverland and Whyalla)
Subject Land:	Various land parcels along a route alignment starting from a point approximately 20km north of Port Augusta and heading in a north-westerly direction to a point approximately 10km west of Olympic Dam
Contact Officer:	Lee Webb
Phone Number:	7109 7066
Start Date:	12 September 2018
Close Date:	**5 October 2018**

During the notification period, hard copies of the application documentation can be viewed at the Department of Planning, Transport and Infrastructure, Level 5, 50 Flinders Street, Adelaide during normal business hours. Application documentation may also be viewed during normal business hours at the local Council office (if identified on the public notice).

Written representations must be received by the close date (indicated above) and can either be posted, hand-delivered, faxed or emailed to the State Commission Assessment Panel (SCAP). A representation form is provided as part of this pdf document.

Any representations received after the close date will not be considered.

Postal Address:
The Secretary
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5001

Street Address:
Development Division

Department of Planning, Transport and Infrastructure
Level 5, 50 Flinders Street ADELAIDE

Email Address: scapreps@sa.gov.au
Fax Number: (08) 8303 0753

DEVELOPMENT ACT, 1993, S49/S49A – CROWN DEVELOPMENT
REPRESENTATION ON APPLICATION

Applicant:	OZ Minerals Prominent Hill Operations Pty Ltd
Development Number:	010/V055/18
Nature of Development:	Overhead high voltage power line to provide electricity to the Oz Minerals Prominent Hill Mine, comprising a 275 kV transmission line from the Carriewerloo Substation 20 km north of Port Augusta to the Mount Gunson South Substation (a distance of approximately 109 km) and a 132 kV transmission line from the Mount Gunson South Substation to a connection point with the existing Prominent Hill 132 kV transmission line near Olympic Dam (a distance of approximately 128 km).
Zone / Policy Area:	Buffer Zone / Rural Landscape Zone – Roxby Downs Council. Pastoral Zone – LNWCA (Flinders). Remote Areas Zone - LNWCA (Eyre, Far North, Riverland and Whyalla).
Subject Land:	Various land parcels along a route alignment starting from a point approximately 20km north of Port Augusta to a point approximately 10km west of Olympic Dam
Contact Officer:	Lee Webb
Phone Number:	7109 7066
Close Date:	**Friday 5 October 2018**
During the notification period, hard copies of the application documentation can be viewed at the Department of Planning, Transport and Infrastructure, Level 5, 50 Flinders Street, Adelaide during normal business hours. Application documentation may also be viewed during normal business hours at the local Council office (if identified on the public notice).	

My name:_____

My phone number: _____

PRIMARY METHOD(s) OF CONTACT: Email address: _____

Postal address:_____

_____Postcode_____

You may be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard in support of your submission.

My interests are:
- [ ] owner of local property
- [ ] occupier of local property
- [ ] a representative of a company/other organisation affected by the proposal
- [ ] a private citizen

The address of the property affected is .....Postcode.....

The specific aspects of the application to which I make comment on are: .....

.....

.....

.....

.....

I
- [ ] wish to be heard in support of my submission
- [ ] do not wish to be heard in support of my submission

(Please tick one)

by
- [ ] appearing personally
- [ ] being represented by the following person : .....

(Cross out whichever does not apply)

Date: ..... Signature: .....

Return Address: The Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide, SA 5001 or scapreps@sa.gov.au

Government of South Australia

Department of Planning, Transport and Infrastructure

DEVELOPMENT ACT 1993

SECTION 49 – PUBLIC INFRASTRUCTURE

NOTICE OF APPLICATION FOR CONSENT TO DEVELOPMENT

Notice is hereby given that an application has been made by **OZ Minerals Prominent Hill Operations Pty Ltd** to construct an overhead high voltage power line to provide electricity to the Oz Minerals Prominent Hill Mine in the Far North. The proposal comprises a 275 kV transmission line from the Carriewerloo Substation, 20 km north of Port Augusta, to the Mount Gunson South Substation (a distance of approximately 109 km) and a 132 kV transmission line from the Mount Gunson South Substation to a connection point with the existing Prominent Hill 132 kV transmission line near Olympic Dam (a distance of approximately 128 km). The power line would be supported on either lattice towers, monopoles or guyed structures, depending on the voltage of the line and the function of the structure. **Development Application Number: 010/V055/18.**

The proposed site covers various land parcels along a route alignment starting from a point approximately 20km north of Port Augusta and heading in a north-westerly direction to a point approximately 10km west of Olympic Dam. Approximately 70% of the line runs parallel to the existing BHP and ElectraNet transmission lines. A full list of project land holdings are contained in the development application.

The subject land is located within the Pastoral Zone of the Land Not Within a Council Area (Flinders) Development Plan (Consolidated 29 November 2012); the Remote Areas Zone of the Land Not Within a Council Area (Eyre, Far North, Riverland and Whyalla) Development Plan (Consolidated 18 October 2012); and the Buffer Zone and Rural Landscape Zone of the Roxby Downs (Municipality) Development Plan (Consolidated 18 October 2012).

The application may be examined during normal office hours at the office of the State Commission Assessment Panel (Level 5, 50 Flinders Street, Adelaide) and at the office of the Roxby Council (6 Richardson Place, Roxby Downs). Application documentation may also be viewed on the SCAP website at: http://www.saplanningcommission.sa.gov.au/scap/public_notices.

Any person or body who desires to do so may make representations concerning the application by notice in writing delivered to the Secretary, State Commission Assessment Panel (GPO Box 1815, Adelaide SA 5001), **NOT LATER THAN FRIDAY 5 OCTOBER 2018.** Submissions may also be made via email to scapreps@sa.gov.au

Each person or body making a representation should state the reason for the representation and whether that person or body wishes to be given the opportunity to appear before the Panel to further explain the representation.

Representations may be made available for public inspection.

Should you wish to discuss the application and the public notification procedure please contact **Lee Webb** on **(08) 7109 7066** or lee.webb@sa.gov.au

Alison Gill
SECRETARY
STATE COMMISSION ASSESSMENT PANEL

PN3207

www.sa.gov.au

PN3207
28x2 (63mm)
Transcontinental, Adelaide Advertiser
12 September 2018

SECTION 49 & 49A – CROWN DEVELOPMENT
DEVELOPMENT APPLICATION FORM

PLEASE USE BLOCK LETTERS

COUNCIL: Out of Council Areas and Roxby Downs (Municipality)

APPLICANT: OZ Minerals Prominent Hill Operations Pty Ltd

ADDRESS: 2 Hamra Drive Adelaide Airport SA 5950

CROWN AGENCY: Department for Energy and Mining

FOR OFFICE USE

DEVELOPMENT No: _____

PREVIOUS DEVELOPMENT No: _____

DATE RECEIVED: / /

CONTACT PERSON FOR FURTHER INFORMATION

Name: Harvey Fernandez

Telephone: 0408 847 315 [work] _____ [Ah]

Fax: _____ [work] _____ [Ah]

Email: harvey.fernandez@ozminerals.com

❒ Complying	Decision: _____
❒ Merit	Type: _____
❒ Public Notification	Finalised: / /
❒ Referrals	

NOTE TO APPLICANTS:

(1) All sections of this form must be completed. The site of the development must be accurately identified and the nature of the proposal adequately described. If the expected development cost of this Section 49 or Section 49A application exceeds $100,000 (excl. fit-out) or the development involves the division of land (with the creation of additional allotments) it will be subject to those fees as outlined in Item 1 of Schedule 6 of the *Development Regulations 2008.* Proposals over $4 million (excl. fit-out) will be subject to public notification and advertising fees.
(2) Three copies of the application should also be provided.

	Decision required	Fees	Receipt No	Date
Planning:				
Land Division:				
Additional:				
Minister's Approval				

EXISTING USE: Primary production / grazing

DESCRIPTION OF PROPOSED DEVELOPMENT: Construction and operation of an electricity transmission line approximately 237 km in length.

LOCATION OF PROPOSED DEVELOPMENT: 20 km north of Port Augusta to 10 km west of Olympic Dam on various land titles, as described in the attached Development Application

House No: _____ Lot No: ____ Street: _____ Town/Suburb: _____

Section No [full/part] _____ Hundred: _____ Volume: _____ Folio: _____

Section No [full/part] _____ Hundred: _____ Volume: _____ Folio: _____

LAND DIVISION:

Site Area [m^2] _____ Reserve Area [m^2] _____ No of existing allotments _____

Number of additional allotments [excluding road and reserve]: _____ Lease: **YES** ❒ **NO** ❒

DEVELOPMENT COST [do not include any fit-out costs]**:** $ 200,000,000

POWERLINE SETBACKS: Pursuant to Schedule 5 (2a)(1) of the *Development Regulations 2008,* if this application is for a building it will be forwarded to the Office of the Technical Regulator for comment unless the applicant provides a declaration to confirm that the building meets the required setback distances from existing powerlines. The declaration form and further information on electricity infrastructure and clearance distances can be downloaded from the DPLG website (www.dac.sa.gov.au).

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the *Development Act 1993*

SIGNATURE: _____ _____ Dated: 27 / 07 / 2018

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

Development Application

July 2018

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ACKNOWLEDGEMENTS

OZ Minerals recognises that the sense of place and belonging of the Kokatha People and the Barngarla People is linked to their identity, creation stories, travel, trade, ceremonies, family and places held sacred. We recognise the deep and ongoing feelings of relationship and attachment they hold for their lands.

OZ Minerals acknowledges both the Kokatha and Barngarla connection to 'country', the contribution of Traditional Owners to their region and the enduring importance of values, cultural authority, cultural norms and customary laws.

The Far North region of South Australia also has a long and rich history of pastoralism. The proposed Electricity Transmission Line Project is located on a number of Pastoral Stations. OZ Minerals recognises the importance of the land to its owners and their operations and acknowledges their cooperation in developing the Project.

OZ Minerals places great value on our relationships with all stakeholders and seeks to work in partnership, to create value wherever possible.

DISCLAIMER

This Development Application has been prepared for submission to the South Australian State Commission Assessment Panel under the *Development Act 1993* (SA). No one other than the South Australian Minister for Planning should rely on the information contained in the Development Application to make, or refrain from making, any decision.

In preparing the Development Application, OZ Minerals Prominent Hill Operations Pty Ltd has relied on information provided by specialist consultants, government agencies and other third parties. OZ Minerals Prominent Hill Operations Pty Ltd has not fully verified the accuracy or completeness of that information, except where expressly acknowledged in the Development Application.

The Development Application has been prepared for information purposes only and, to the full extent permitted by law, OZ Minerals Prominent Hill Operations Pty Ltd, in respect of all persons other than the South Australian Minister for Planning:

- Makes no representation and gives no warranty or undertaking, express or implied, in respect to the information contained herein; and
- Does not accept responsibility and is not liable for any loss or liability whatsoever arising as a result of any person acting, or refraining from acting, on any information contained in this Development Application.

NOTE ON CURRENCY

Where possible, the information contained in this Development Application is up to date as at July 2018. This was not possible where parts of the Development Application were prepared from information provided by third parties (as discussed in in the second paragraph above) prior to the Development Application being finalised.

COPYRIGHT

EXECUTIVE SUMMARY

OZ Minerals proposes to develop an electricity transmission line to secure power to the existing Prominent Hill mine located in northern South Australia (the Project). OZ Minerals is an Australian-based modern mining company with a focus on copper. Listed on the Australian Securities Exchange (ASX100), OZ Minerals has a growth strategy focused on creating value for all stakeholders, including shareholders, employees, traditional owners, pastoralists and the wider communities in which we operate.

OZ Minerals owns and operates the Prominent Hill copper-gold mine located approximately 130 km south-east of Coober Pedy and is developing the Carrapateena copper-gold mine located approximately 160 km north of Port Augusta. Carrapateena is currently being constructed with commissioning scheduled for Q4 2019, after which the mine will ramp up to steady state production.

This Development Application Report (the Report) supports the Development Application and addresses the environmental and social impacts associated with the construction and operation of the electricity transmission line. The Report aims to demonstrate that the impacts and risks that may be associated with the Project have been identified and can be adequately mitigated and/or managed.

Project Summary

To secure the electricity supply to the Prominent Hill mine, OZ Minerals is proposing to construct a 237 km long electricity transmission line (the Project). The 237 km transmission line will run from the Carriewerloo Substation, located 20 km northwest of Port Augusta, to near Olympic Dam where it will connect to the existing OZ Minerals Prominent Hill 132 kV transmission line. Electricity for the Prominent Hill mine is currently provided via connection of the existing 132 kV Prominent Hill transmission line to the BHP Olympic Dam Substation, itself supplied via a 275 kV transmission line to the Davenport Substation near Port Augusta. The Project will also connect to the existing Mount Gunson South Substation and in the future provide electricity to OZ Minerals' Carrapateena Project.

The proposed transmission line will run parallel to the existing BHP and ElectraNet Pty Ltd (ElectraNet) transmission lines for approximately 70% of its length but will divert east just north of Woomera, following the Olympic Dam Highway to remain outside the boundary of the Woomera Prohibited Area.

If approved, the Project will ensure the grid connection for OZ Minerals' two major South Australian mines and provide additional capacity for the provision of electricity to the Upper North, thereby opening the region for further growth.

Existing Environment

The Project is located in northern South Australia, an arid to semi-arid region subject to hot summers and cool-to-mild winters, with low sporadic rainfall throughout the year. The region is characterised by extensive sand sheets and flat plains with highly permeable sandy soils with low topographic relief; erosional and depositional plains with defined drainages ending in several salt lakes and ephemeral lagoons; and dunes, interdune swales and claypan depressions. Typical vegetation includes open woodlands, open mallee scrub, chenopod shrublands and tall mulga shrublands. Twenty different vegetation associations were identified in the Project Area across five key habitat / landform types: sandplain / low plain, dunes and swales, stony tablelands / Arcoona plateau, salt lakes and ephemeral claypans and ephemeral creeklines. The condition of vegetation in these associations recorded during the field survey was generally medium according to the Native Vegetation Council's Rangelands Assessment Method. No vegetation associations listed as threatened at a regional, state or national level were observed within the 10 km Study Area corridor.

Desktop review of the Biological Database of South Australia (BDBSA) records from historical surveys conducted in the region indicate that 469 flora species have been recorded within the Study Area. Two nationally threatened flora species have the potential to occur within the Study Area: *Frankenia plicata* (Braided Sea-heath) and *Senecio megaglossus* (Large-flower Groundsel). One state threatened flora species is known to occur within the Project Area - *Santalum spicatum* (Sandalwood). The Project Area is defined as a 500 m wide corridor along the transmission line alignment. Annual weeds such as *Carrichtera annua* (Wards Weed), were observed with sparse to moderate cover intermittently throughout the Study Area. Other weeds present included common species largely considered as naturalised within the rangelands, including *Carthamus lanatus* (Star Thistle), *Sonchus oleraceus* (Sow Thistle), *Malvastrum americanum* (Malvastrum) and *Brassica tournefortii* (Wild Turnip).

Biological Database of South Australia records for the Study Area include 282 fauna species, including two amphibian species, 177 birds (including six exotic species), 26 mammals (including eight exotic species) and 77 reptiles. Of these, 24 bird, one mammal and two reptile species are identified as rare or threatened, including five nationally threatened fauna species and ten migratory species identified as possibly occuring within the Study Area.

The region is the largest and least populated area of South Australia. The largest population centres near the Project are Port Augusta, Roxby Downs, Woomera, and Pimba. Pastoral grazing is the most extensive industry (in terms of area); however, mining provides the main source of revenue. The transmission line corridor is located within the region associated with the Barngarla and Kokatha people.

Surface waters in the region are scarce and largely ephemeral, with surface water flows occurring for short periods following only significant rainfall events. Extensive flat plains with highly permeable sandy soils in the southern section of the proposed alignment (south of Pernatty Lagoon to Port Augusta), allow rapid infiltration of surface waters, and well-defined drainage lines and catchments have formed several large terminal salt lakes and ephemeral lagoons in the northern section of the proposed alignment. Stone-free areas with cracking clay (gilgai) are an important component of this land system and accept much of the runoff during smaller rainfall events.

The Project Area lies within the Stuart Shelf geological province, a relatively thin sequence of sedimentary rocks that overlays the Gawler Craton. The most significant groundwater systems of the Stuart Shelf include the Andamooka Limestone Aquifer (approximately 50 m below ground level at Olympic Dam and trending shallower and becoming unsaturated to the South) and the Tent Hill Aquifer, which comprises the lower, fractured (i.e. permeable) zone of the Arcoona Quartzite and the Corraberra Sandstone (approximately 160 – 200 m below ground level at Olympic Dam). Shallow perched groundwater can be present in shallow alluvial sediments within the Stuart Shelf, and have been primarily found to align with ephemeral creek features. There are no known groundwater springs in the Study Area.

Assessment of Effects and Impacts

OZ Minerals has developed an assessment framework that supports a project throughout its lifecycle to manage environmental and social impacts and risks in a transparent and repeatable manner. The assessment framework draws on the requirements of ISO 14001, State and Commonwealth regulation and internationally recognised frameworks such as those established by the International Finance Corporation of the World Bank Group.

Impact significance assessment was undertaken for the following pathways:

- Soil and landforms
- Surface water
- Groundwater
- Air quality
- Noise
- Ecology
- Visual amenity
- Cultural heritage
- Traffic
- Land use
- Socio-economic environment.

All identified potential impact events were assessed to be not significant, representing a negligible-to-low level of impact. Similarly, all unplanned events were assessed to represent a negligible-to-low risk when considered following the application of design and management controls, with the exception of the risks associated with the introduction of new weed species, unauthorised access to the Project site and infrastructure and construction traffic-related safety risks, which were all assessed as moderate and will be a focus for further mitigation during transmission line construction and operation.

Consultation and Engagement

OZ Minerals is committed to collaboration, building trust and understanding what is important to stakeholders. OZ Minerals is also committed to facilitating genuine stakeholder participation in a culturally appropriate manner and has a dedicated team of professionals to ensure that this occurs. Meaningful communication is important so that community members and stakeholders have the opportunity to meet with OZ Minerals staff and find out about its activities. In particular, it is imperative for OZ Minerals to hear directly from locals to listen and align with community values.

Meaningful engagement and consultation activities have been held with stakeholders and community members during the conceptual development of the Project and the preparation of this Development Application. Community meetings and targeted stakeholder meetings were held in June 2018 in the towns of Port Augusta, Roxby Downs, Andamooka, Port Pirie, Whyalla and Adelaide. Attendees at those meetings were encouraged to complete a Stakeholder Engagement Survey so OZ Minerals can monitor its performance against community expectations, understand what is important to community members and conduct future communications in a manner that stakeholders find beneficial.

The Project is aligned with the strategic priorities of the Government of South Australia and the regional development priorities of local and regional governing agencies. This alignment provides a platform to create opportunities through collaboration and partnership.

The Project is dedicated to working with the South Australian Government, community and stakeholders more broadly, and has a focus on building trust and mutually beneficial partnerships.

Traditional Owners

OZ Minerals respects the rights of the traditional owners and their cultural values and heritage. For this reason, the names, locations and maps of archaeological and anthropological sites have been removed from this document. Any reference to mythology and storylines that OZ Minerals has learnt through its partnering agreement with the Kokatha People, and ongoing engagement with the Barngarla People, has not been included. The importance of the area to the traditional owners has been considered in the Project design work, and the subsequent studies undertaken occur with ongoing and meaningful consultation.

Conclusion

OZ Minerals has a demonstrated capability supported by strong Corporate Governance, Performance Standards and Management Systems.

This Development Application presents OZ Minerals' strategic vision for the Project and ensures the continued electricity supply for the Prominent Hill mine, a major copper-gold mine that contributes significantly to the South Australian economy by the payment of royalties and taxes, the employment of people and the use of local and regional businesses.

Ongoing engagement with stakeholders will focus on the management of environmental and social values. This focus ensures engagement activities are meaningful, transparent and occur in a manner that facilitates genuine stakeholder participation, and the upholding of the shared values that have been identified through the consultation process.

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1 INTRODUCTION

1.1 Project Background

OZ Minerals Prominent Hill Operations Pty Ltd (OZ Minerals) proposes to develop a transmission line (the Project) to provide electricity to the existing Prominent Hill mine located in the Upper North of South Australia. The 237 km transmission line will run from the Carriewerloo Substation, located 20 km northwest of Port Augusta, to near Olympic Dam where it will connect to the existing OZ Minerals Prominent Hill 132 kV transmission line. Electricity for the Prominent Hill mine is currently provided via connection of the existing 132 kV Prominent Hill transmission line to the BHP Olympic Dam Substation, itself supplied via a 275 kV transmission line to the Davenport substation near Port Augusta. The Project will also connect to the existing Mount Gunson South Substation and in the future provide electricity to OZ Minerals Carrapateena Project. The Project location is shown in Figure 1.1.

The transmission line will be constructed and operated under a Build, Own, Operate and Maintain (BOOM) contract with ElectraNet Pty Ltd (ElectraNet), which is the owner and operator of the South Australian transmission network. OZ Minerals will lead land access, approvals and environmental compliance aspects of the Project and will oversee the Project to the operational phase.

The Project will consist of a:

- 275 kV transmission line extending approximately 109 km from the Carriewerloo Substation at the SolarReserve Aurora Solar Energy Project (ASEP) to the Mount Gunson South Substation
- 132 kV transmission line extending approximately 128 km from the Mount Gunson South Substation to the existing Prominent Hill transmission line near Olympic Dam.

Approximately 70% of the proposed alignments of the transmission lines run parallel to the existing BHP and ElectraNet transmission lines. However, north of the Woomera 132 kV section, it diverges east, following the Olympic Dam Highway to remain outside the boundary of the Woomera Prohibited Area (WPA), before crossing the highway south of Roxby Downs to re-join the existing transmission line alignments. A detailed description of the Project is provided in Chapter 5.

OZ Minerals is working in close collaboration with SolarReserve who are developing the Aurora Solar Energy Project, a 150 MW concentrated solar and photovoltaic (PV) development approximately 30 km north of Port Augusta. OZ Minerals has entered into an infrastructure sharing agreement with ElectraNet, and a cost sharing arrangement with SolarReserve for the 35 km long 275 kV transmission line that will extend southwards from the Aurora Project site to connect to the South Australian electricity grid, as shown in Figure 1.1. Development approval has already been obtained by SolarReserve for the Aurora Project and the transmission line.

In addition, ElectraNet is planning to undertake an extension of the Mount Gunson South Substation to accommodate the Project, and a variation to the existing Development Approval for this substation was submitted in May 2018.

The Project under this Development Application encompasses the 275 kV transmission line from Carriewerloo Substation (at the Aurora Project site) to Mount Gunson South and the 132 kV transmission line onwards to Olympic Dam (as shown in Figure 1.1). ElectraNet's existing operations and assets, including substations, transmission lines and access tracks, are excluded from this Development Application.

1.2 Development Application Process

This Development Application Report has been prepared by OZ Minerals and submitted under the sponsorship of the Department of the Premier and Cabinet (DPC, now Department for Energy and Mining, DEM), for lodgement with the State Commission Assessment Panel (SCAP). The application is being lodged under the public infrastructure provisions of Section 49 of the *Development Act 1993* (SA). Further information is provided in Section 3.1.

1.3 Alignment with South Australian Strategic Priorities

As a major infrastructure project, this development will ensure the ongoing cost competitiveness of two of South Australia's major mines, thereby sustaining state revenue and employment at Prominent Hill, Carrapateena and its surrounds. It will also provide electricity transmission infrastructure to the Upper North, thereby opening the region for future growth both for electricity generators and the extractives industry. By providing power to OZ Mineral's Carrapateena and Prominent Hill Projects, the Project also supports the South Australian Government's Copper Strategy (Government of South Australia, 2016).

The Project aligns with several stated policies of the Government of South Australia.

Specifically, the Project aligns with policies within the Government of South Australia's 'Strong Plan' including:

- 'Affordable, reliable energy' for South Australia (SA) through 'A reliable grid' and 'Securing our future'
- 'Building the infrastructure a strong SA needs' to ensure the SA economy 'can become more productive towards 2036 and beyond'.

In addition, ensuring the ongoing cost competitiveness of the Prominent Hill and Carrapateena mining operations will assist with the 'Royalties for regions' policy where 30% of the State Government's revenue from mineral and petroleum royalties will fund key infrastructure improvements in addition to other productivity and safety enhancing projects for the region.

This Project will provide a secure supply of electricity to OZ Minerals' Prominent Hill and Carrapateena mining operations through connection of these operations to the South Australian electricity network via a dedicated transmission line. It will also provide vital electricity transmission infrastructure to the Upper North, opening the region for future growth for electricity generators and the extractives industry.

1.4 Purpose of this Report

The purpose of this report is to present relevant information for the Development Application for the Project, for assessment by the SCAP under Section 49 of the *Development Act 1993* (SA). This report provides information for the assessment manager, referral agencies and other stakeholders to assess the potential impacts of the development and associated management measures.

The assessment contained in this report covers the construction and operation of the proposed transmission line and works that may be reasonably anticipated to be associated with the Project.

1.5 Structure of this Report

The structure and content of this Report is shown in Table 1.1.

Table 1.1: Structure of this Report

Chapter	Contents
Development Application Report	
Chapter 1: Introduction	Presents a brief background to the Project and outlines the purpose and structure of the report.
Chapter 2: Proponent Details	Provides the details of the proponent and provides information on the land tenure for the Project.
Chapter 3: Legislative Framework	Describes the applicable legislative framework and planning considerations. Describes and summarises the assessment of the Project against relevant Development Plans.
Chapter 4: Impact Assessment Methodology	Describes the Impact Assessment Framework implemented to assess and manage potential environmental and socials impact and potential risks.
Chapter 5: Project Description	Describes the Project Area and the Project components.
Chapter 6: Soil and Landform	Describes the existing baseline conditions for each environmental and social aspect. Discusses predicted effects related to that aspect. Presents the identified impacts and risks and the proposed mitigation where relevant.
Chapter 7: Surface Water	
Chapter 8: Groundwater	
Chapter 9: Air Quality	
Chapter 10: Noise	
Chapter 11: Ecology	
Chapter 12: Visual Amenity	
Chapter 13: Cultural Heritage	

Chapter	Contents
Chapter 14: Traffic	
Chapter 15: Land Use	
Chapter 16: Socio-Economic	
Chapter 17: Project Engagement	Summarises the approach to stakeholder engagement, feedback received from consultation and how this has been integrated into the Project.
Chapter 18: Management Capability	Describes OZ Minerals' management capability to manage both impact and risk through the lifecycle of the Project. Outlines the framework for environmental, social and health and safety management.
Chapter 19: References	Lists the sources of information used.
Chapter 20: Abbreviations and Glossary	Summary of abbreviations and terms used in the document.
Appendices	
Appendix A. Section 49 Endorsement	Provides a copy of the letter of support and endorsement by the Department of Premier and Cabinet (now Department of Energy and Mining) under Section 49 of the *Development Act 1993* (SA).
Appendix B. Preliminary Plans of the Alignment for the Proposed Transmission Line	Presents the preliminary plans of the proposed transmission line alignment.
Appendix C. Development Plan Assessment	Presents the results of an assessment against the objectives and principles of the relevant Development Plans.
Appendix D1. Ecology Baseline Assessment	Present the detailed specialist studies undertaken for the proposed Project.
Appendix D2. Ecological Impact Assessment	
Appendix D3. Ecology EPBC Act Significant Impact Assessment	
Appendix E. Visual Assessment	
Appendix F1. Traffic Baseline Assessment	
Appendix F2. Traffic Assessment of Effects	
Appendix G1. Socio-economic Baseline Assessment	
Appendix G2. Socio-economic Assessment of Effects	
Appendix H. Draft Construction Environmental Management Plan	Presents the Draft Construction Environmental Management Plan (CEMP) for the Project.
Appendix I. Impact Assessment Framework Tables	Presents the individual Impact Assessment Framework tables and provides a detailed explanation of the impact assessment methodology.

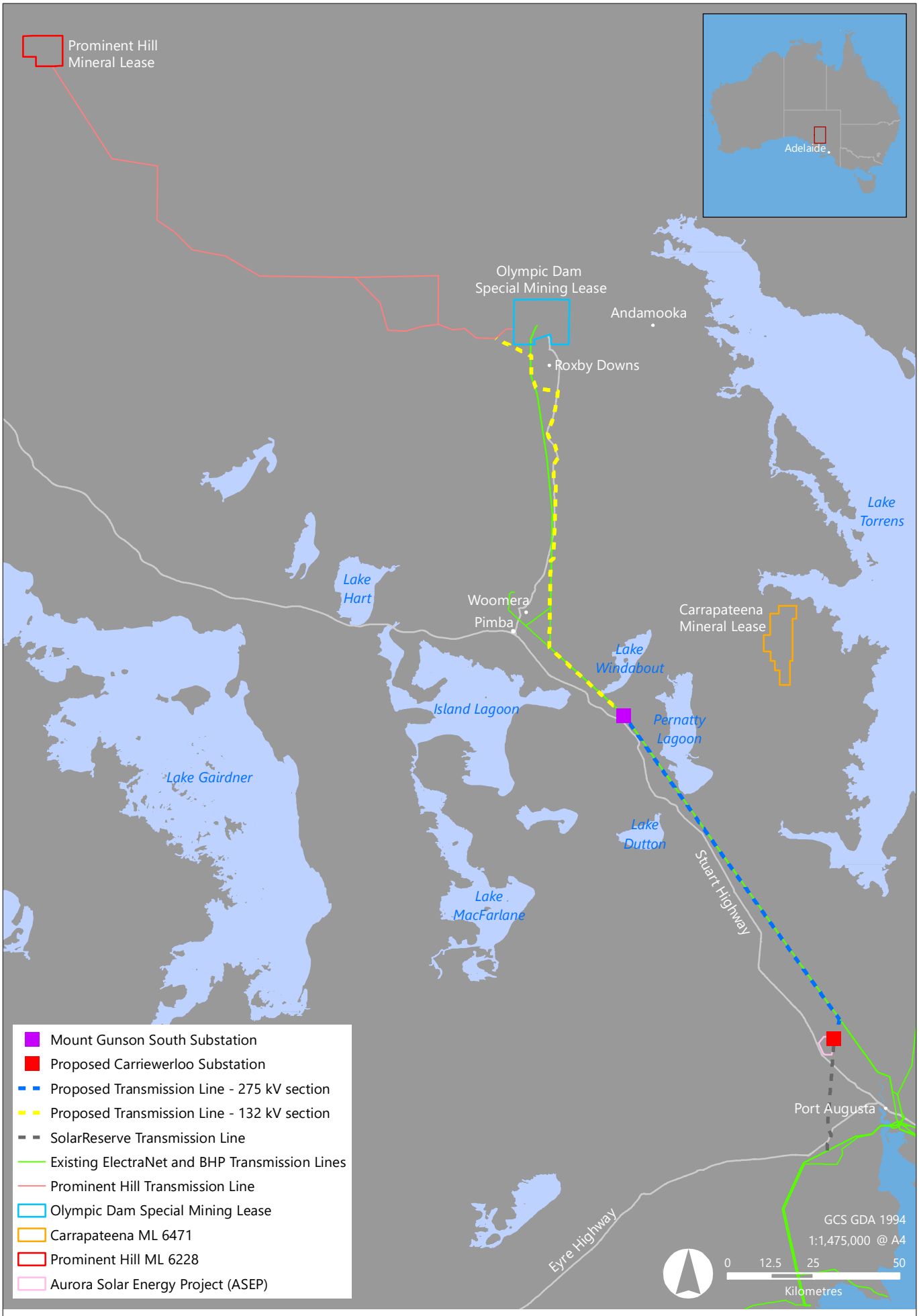

Figure 1.1: Project Location

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

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2 PROPONENT DETAILS

2.1 Project Proponent

2.1.1 Applicant Details

This Development Application is being made by OZ Minerals Prominent Hill Operations Pty Ltd. The applicant's details are summarised in Table 2.1.

Table 2.1: Applicants Details

Applicant Details	
Applicant:	OZ Minerals Prominent Hill Operations Pty Ltd
Registered ABN:	ABN 63 091 546 691
Registered Address:	2 Hamra Drive, Adelaide Airport, South Australia 5950
Contact Person:	Luke Sandery

2.1.2 About OZ Minerals

OZ Minerals was formed in 2008 through the merger of two Australian non-ferrous metals mining businesses – Oxiana and Zinifex. Listed on the Australian Securities Exchange (ASX100), OZ Minerals owns and operates the Prominent Hill copper-gold-silver mine and is developing one of Australia's largest copper-gold resources at Carrapateena, in the Upper North. OZ Minerals is one of Australia's largest copper producers.

2.2 Landowners

2.2.1 Native Title

The land within which the Project is proposed is subject to the Barngarla Native Title Determination (National Native Title Tribunal (NNTT) Number SCD2016/001) and the Kokatha People (Part A) Native Title Determination (NNTT Number SCD2014/004), as shown in Figure 2.1.

2.2.2 Land Tenure

The proposed alignment crosses 15 land titles under a combination of tenures including freehold, pastoral lease, unalienated Crown land and Crown Leases by a total of eight different parties. For approximately 70% of its length, the transmission line parallels the existing BHP and ElectraNet lines, which are located on a freehold land corridor and ElectraNet easements respectively. Where it parallels

both BHP and ElectraNet lines, the proposed line is planned to be offset to the west of the existing ElectraNet 132 kV line.

The Project is in the preliminary design phase and the current alignment (and potentially the land parcels intercepted) may change in some locations as land access negotiations, cultural heritage clearances and detailed design progress. The final alignment is expected to be located within 500 m of the alignment shown in Figure 2.2. In addition, temporary laydown areas and access tracks may be located on different land parcels to the transmission line, pending the results of landowner negotiations and detailed construction planning.

An overview of land tenure on the alignment is presented in Table 2.2 and shown on Figure 2.2.

OZ Minerals has held meetings with all affected landowners throughout the planning of the Project to discuss the level of impact the transmission line may have on their properties, design alternatives and options, property management requirements, continuity of current operations, access arrangements and compensation.

OZ Minerals is negotiating appropriate tenure for the land crossed by the transmission line; this will generally consist of easements.

OZ Minerals is developing operating protocols in consultation with relevant landowners that address the interaction of the Project with the existing land uses, including where relevant, communication protocols, dispute resolution, and safety and emergency procedures. The operating protocols will form part of the agreements that are being negotiated with each landowner in respect to the granting of easements required for the transmission line.

Table 2.2: Property Detail Summary for the Proposed Alignment of the Transmission Line

Registered Proprietor / Leaseholder	Property Description	Pastoral Station	Certificates of Title
275 kV section			
John Wilkinson and Kootaberra Pty Ltd	Pastoral Lease 2373	Kootaberra Station	CL6204/748
Kootaberra Pty Ltd	Pastoral Lease 2257	Mt Arden Station	CL 6180/595
Buckleboo Nominees Pty Ltd	Pastoral Lease 2496	Carriewerloo Station	CL 6181/119
Nutt Bros Nominees Pty Ltd	Pastoral Lease 2377	Oakden Hills Station	CL 6178/725
Colin & Jillian Greenfield	Pastoral Lease 2353	Pernatty Station	CL 1330/26
132 kV section			
The Crown – Minister for Sustainability, Environment and Conservation	Unalienated Crown Land	n/a	CR 5435/350 CR 5441/919 CR 6017/774 CR 5345/754
BHP Billiton Olympic Dam Corporation Pty Ltd	Freehold	n/a	CT 5480/618 CT 5441/918
BHP Billiton Olympic Dam Corporation Pty Ltd	Pastoral Lease 2480 Pastoral Lease 2338 Pastoral Lease 2333	Purple Downs Station Roxby Downs Station Andamooka Station	CL 6166/900 CL 6166/901 CL 6166/903
Handbury Asset Management Pty Ltd	Pastoral Lease 2347	Arcoona Station	CL 6176/268

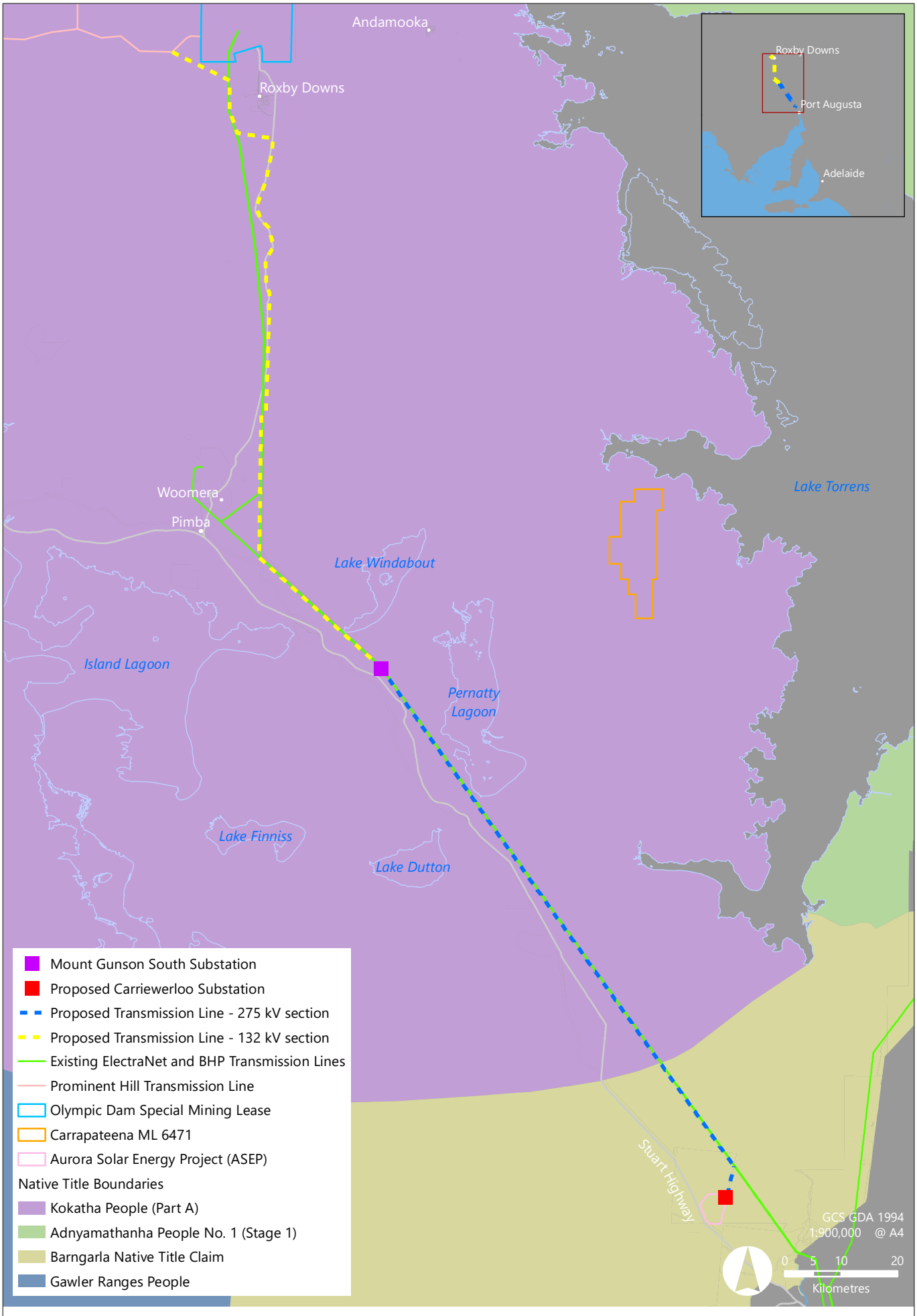

Figure 2.1: Native Title

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

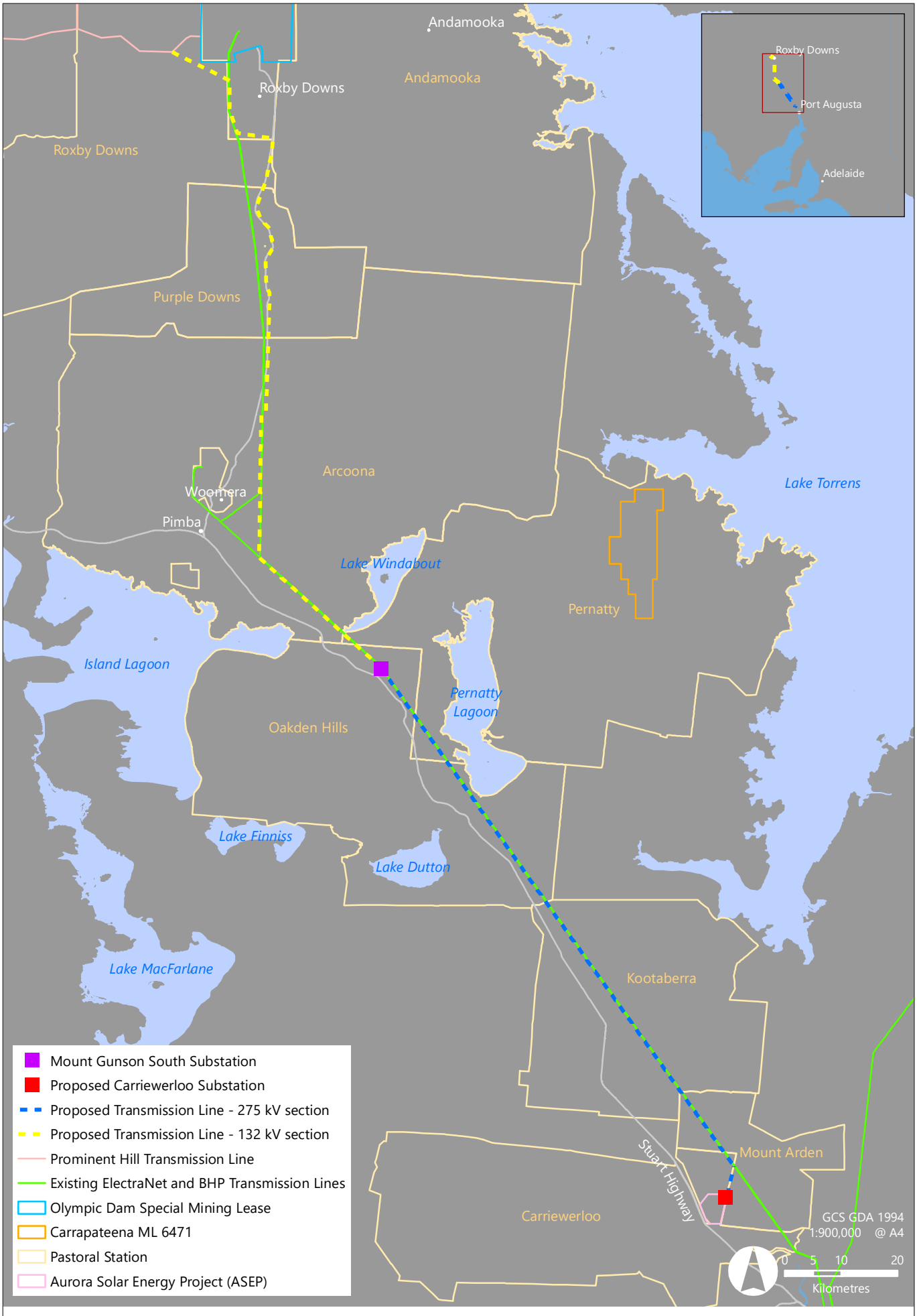

Figure 2.2: Pastoral Stations

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

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3 LEGISLATIVE FRAMEWORK

This section provides a summary of the legislative framework and approval process for the Project and provides an overview of other planning and environmental approvals that are likely to be required.

3.1 *Development Act 1993*

The *Development Act 1993* (SA) provides the framework establishing South Australia's planning and development system and its statutory procedures. It is the key legislation for Project approval.

3.1.1 Development Application

The Project has been sponsored by DEM as a public infrastructure project (Appendix A) and will be assessed under the public infrastructure provisions of Section 49 of the *Development Act 1993* (SA).

Under this process, the Development Application prepared by OZ Minerals is provided to DEM for lodgement to the State Commission Assessment Panel (SCAP). This process includes referral to local Councils and government agencies, and a public notification given in the form of a public advertisement. Any person may make comment during the notification period within the prescribed timeframe (15 business days) and request to be heard before the SCAP. The SCAP assesses the application, considers any comments made by local Councils and other government agencies and then prepares a report to the Minister who can approve or refuse the application (see Figure 3.1).

The public infrastructure provisions of the Development Act do not involve specific terms of reference or guidelines for the assessment. This Development Application has been prepared in accordance with the guidance provided in the Guide to the Assessment of Crown Development and Public Infrastructure (Planning SA, 2002) and the Guide for Applicants – Crown Development Applications (DPTI, 2018). The *Development Regulations 2008* (SA) also require that prescribed particulars are contained in an application under Section 49, including:

- A description of the nature of the proposed development
- Details of the location, siting, layout and appearance of the proposed development.

This report provides information that addresses these aspects.

Figure 3.1: Development Act (Section 49) Assessment Process

3.1.2 Development Plan Assessment

All Development Applications prepared under Section 49 are assessed by the SCAP to identify whether they are consistent with the objectives of the relevant Development Plan.

A development plan is a statutory policy document which guides the type of development that can occur within a council area. Planners use development plans to assess development applications. Every council in South Australia has a development plan that specifies the type of development that can occur in that council area.

Development plans separate land within each council area into a number of different zones, including commercial zones, residential zones and industrial zones amongst a range of others. This aims to ensure that the lifestyle needs of residents and business can be achieved in the most beneficial manner. Development plans outline what land uses are envisaged in a zone and those uses which are not contemplated.

Development plans contain objectives, principles and policies that will control and affect the design and location of proposed land use activities. These policies cover a range of social, environmental and economic matters and have been established to support the longer-term direction of the state's planning strategy. The plans can also spell out the desired character for a given area, zone, policy area or precinct

Where the SCAP is of the view that an application is not consistent with the relevant Development Plan, or where the Council opposes a development, the Minister must, if he or she approves the development, report to Parliament on the matter. This ensures that Parliament is informed on adherence to Development Plans (Planning SA, 2002).

An assessment against the relevant Development Plans has been carried out for the Project (Appendix C) and a brief overview is provided here.

The transmission line is proposed on land zoned under the following Development Plans (Figure 3.2):

- Land not Within a Council Area (Flinders) on land zoned as Pastoral
- Land not Within a Council Area (Eyre, Far North, Riverland and Whyalla) (specifically 'Far North') on land zoned as Remote Areas
- Roxby Downs (Municipality) Development Plan within the Buffer Zone and Rural Landscape Zone.

The economic development of the Far North is dependent on growth in mining and both infrastructure and mining are envisaged forms of development in the region.

Overall, the Project is consistent with objectives and associated principles in the Development Plans, including those relevant to supporting mining development and the need for strategic infrastructure assets, conservation of scenic values, prevention of conflict between land uses, preservation of heritage values, and protection of natural resources.

In relation to the Principles of Development Control of the Roxby Downs (Municipality) Development Plan, the proposed transmission line is not necessarily an envisaged form of development in either the

Buffer Zone or Rural Landscape Zone. However, the installation of the transmission line appears to be anticipated due to the identified 'services corridor' within these Zones in the Development Plan and does not compromise the achievement of the overall objectives and principles for either of those two zones.

A summary of the assessment against the relevant Development Plans is provided in Table 3.1, and the full assessment is contained in Appendix C.

Table 3.1: Planning Assessment Summary Table

Development Plan	Assessment
Land Not Within a Council Area (Flinders) Development Plan	The Project is consistent with the Flinders region and Council-wide Objectives and Principles of Development Control outlined in the Development Plan. **Pastoral Zone** The Project aligns with objectives of the zone. The development will have a limited visual impact, similar to other existing transmission lines in the Pastoral Zone. Otherwise, does not significantly impact/detract from the natural environment and character of the zone. Further, the land beneath the proposed transmission line will not be fenced, thereby allowing livestock grazing to continue under this infrastructure with minimal impact on stock movements.
Land Not Within a Council Area Eyre, Far North, Riverland and Whyalla Development Plan	The vast majority of the proposed transmission line traverses the 'Far North' Development Plan. The Project is consistent with the Objectives and Principles of Development Control outlined in the Development Plan. **Remote Areas Zone** The transmission line reflects the objectives of this zone as it is an infrastructure development that will support mining operations in the region and is not located within sensitive environmental, cultural or hazardous areas or close to towns. The most notable impact is of localised visual amenity from sections of the Olympic Dam Highway where the view is already affected by the existing transmission lines.
Roxby Downs (Municipality) Development Plan	The Project is consistent with the regional and Council-wide Objectives and Principles of Development Control outlined in the Development Plan. **Buffer Zone** A key objective of the Buffer Zone is to preserve the 'natural open character of the zone and the regeneration of the natural vegetation'. The transmission line will maintain the natural open character of the Buffer Zone albeit with some visual impacts. This will be minimised by the placement of the transmission line within (or as close as possible to) the identified 'service corridor' and adjoining the existing BHP lines after it meets this corridor. The transmission line will not prevent natural regeneration of the zone or its use for passive recreation. While virtually all forms of development are listed as non-complying within this Zone, the identified 'services corridor' within the Zone identifies that the installation of key service infrastructure required for the successful operation of valuable land use activities such as mining, is anticipated and supported. Accordingly, the proposal is broadly supported by the Zone's policy provisions.

Development Plan	Assessment
	Rural Landscape Zone While the proposed infrastructure is not specifically envisaged in the Zone, the proposed transmission line will follow the 'services corridor' alignment as closely as possible (as it does in the Buffer Zone) and as such, there will be minimal protrusion into the Rural Landscape Zone. This alignment is also adjacent the existing transmission lines on the western boundary of this zone, ensuring suitable co-location of infrastructure to minimize its impact. The alignment along the far western boundary ensures that encouraged activities (e.g. community recreation) can occur with minimal interruption Furthermore, all areas temporarily disturbed for construction will be revegetated with the exception of the line access tracks, and thus the proposed transmission line will not compromise the Zone's key objective of regeneration of natural vegetation. While not necessarily an envisaged form of development in this zone, the installation of the transmission lines appears to be somewhat anticipated due to the identified 'services corridor' and will not compromise the achievement of the Development Plan's overall objectives and principles for either of these two zones.

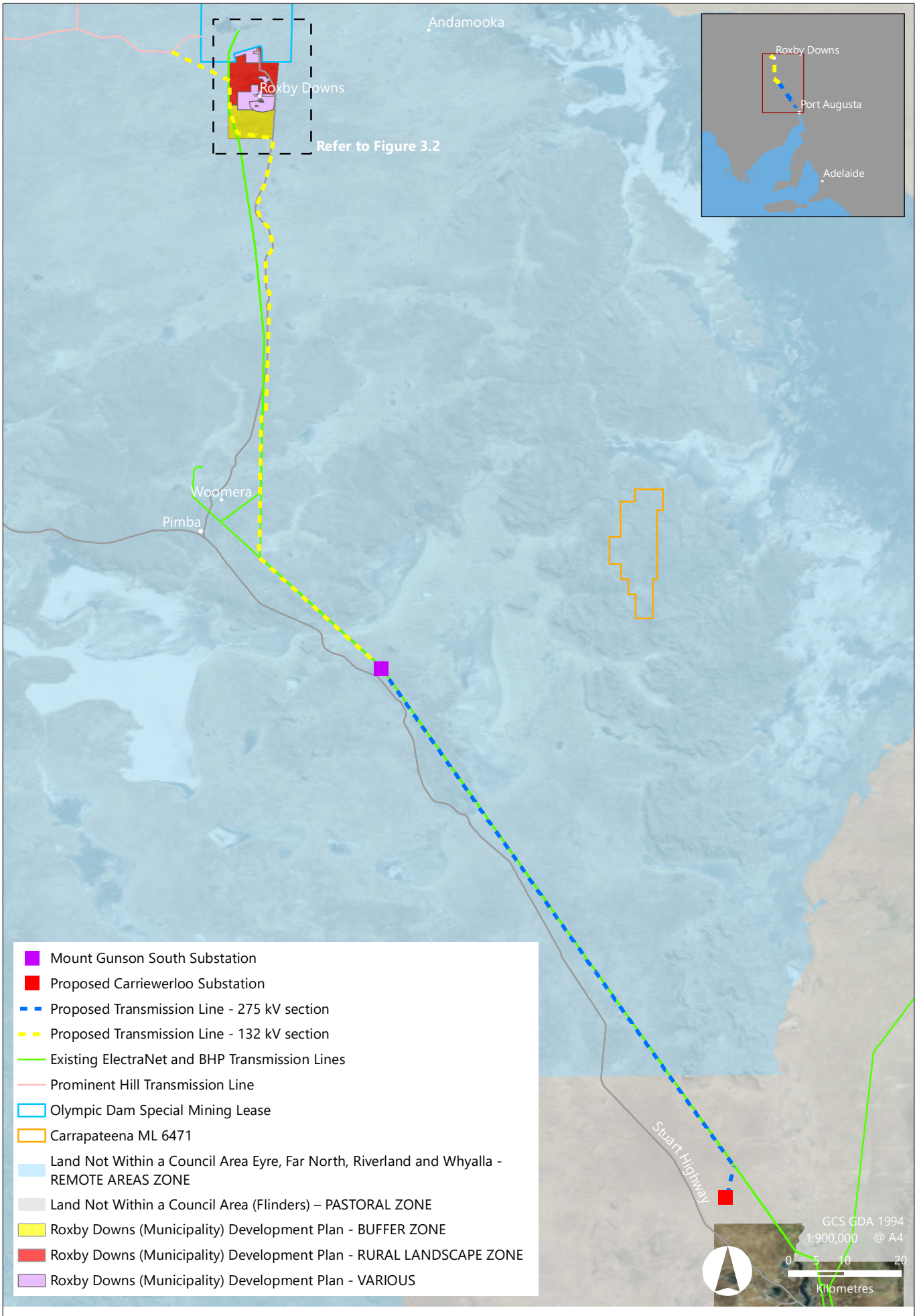

Figure 3.2: Development Plan Zones

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

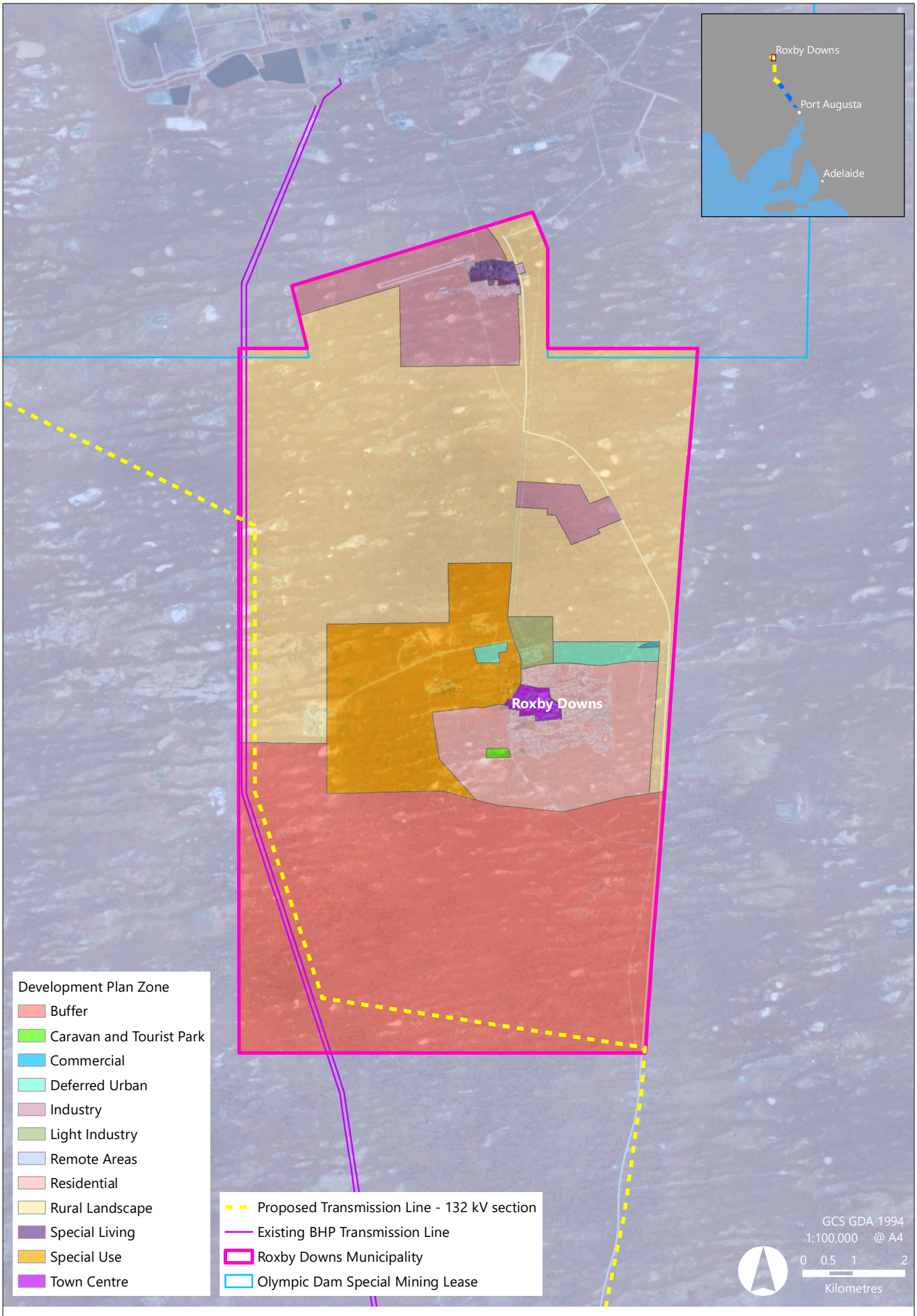

Figure 3.3: Roxby Downs (Municipality) Development Plan Zones

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

3.1.3 Building Rules Certification

The Development Act requires public infrastructure projects involving building work to be assessed and certified as complying with the Building Rules (to the extent that is appropriate in the circumstances) by a private certifier or by a person determined for this purpose by the Minister. The Building Rules include the Building Code of Australia and they cover issues such as structural adequacy, fire safety, health and amenity, equitable access for people with disabilities, and energy efficiency.

Any required assessment and certification against the Building Rules is planned to be undertaken by a private certifier.

3.2 Other Key Legislation

A range of other legislation is potentially relevant for Project approvals, including:

Commonwealth Legislation

- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
- *Environmental Protection and Biodiversity Conservation Act 1999*
- *Native Title Act 1993*

South Australian Legislation

- *Aboriginal Heritage Act 1988*
- *Electricity Act 1996*
- *Environment Protection Act 1993*
- *Fire and Emergency Services Act 2005*
- *Heritage Places Act 1993*
- *Local Government Act 1999*
- *National Parks and Wildlife Act 1972*
- *Native Title (South Australia) Act 1994*
- *Native Vegetation Act 1991*
- *Natural Resource Management Act 2004*
- *Road Traffic Act 1961* (SA)
- *Rail Safety National Law (SA) Act 2012*
- *Roads (Opening and Closing) Act 1991*
- *South Australian Public Health Act 2011 and South Australian Public Health (Wastewater) Regulations 2013*

Key legislation relevant to Project approvals is discussed further in the following sections.

Secondary approvals that may be required for the Project are described in Section 18.3.2.

3.2.1 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Cth)

Matters of national environmental significance are important to all Australians and, given the interconnectedness of the global biosphere, internationally as well. The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) aims to balance the protection of these crucial environmental and cultural values with our society's economic and social needs by creating a legal framework and decision-making process based on the guiding principles of ecologically sustainable development. Specifically, the EPBC Act aims to:

- Provide for the protection of the environment, especially matters of national environmental significance
- Conserve Australia's biodiversity
- Protect biodiversity internationally by controlling the international movement of wildlife
- Provide a streamlined environmental assessment and approvals process where matters of national environmental significance are involved
- Protect our world and national heritage
- Promote ecologically sustainable development.

A person must not take an action that has, will have, or is likely to have a significant impact on any matter of national environmental significance (MNES) or other protected matters without approval from the Australian Government Minister for the Environment (the Minister). If a person believes that there is a chance or possibility that a project may result in a significant impact to a MNES, they must refer the project to the Department of the Environment and Energy (DEE). This referral is then released to the public, as well as relevant state, territory and commonwealth ministers, for comment on whether the project is likely to have a significant impact on a MNES. Alternatively, if, following a self-assessment, the person believes that there is not a real chance or possibility that the project will result in a significant impact to a MNES, the person may decide to not refer the project.

The purpose of the referral process is to determine whether a proposed action will need formal assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The referral document is the principal basis for informing the Minister's decision as to whether approval is necessary and, if so, the type and level of assessment that will be taken.

OZ Minerals has undertaken a self-assessment of the potential for the Project to result in a significant impact to MNES and has concluded that the Project will result in no significant impacts on MNES. A conserted effort has been invested to understand the potential for MNES to be present within the Project Area and subsequently, to understand the potential impacts on MNES. This includes completing targeted in-field assessment of flora and fauna habitats (Appendix D1: Ecology Baseline Assessment), which has informed a detailed Significant Impact Assessment for relevant protected matters. The Significant Impact Assessment is included as Appendix D3: EPBC Act Significant Impact Assessment. This assessment builds upon the understanding of ecological values within the region.

The Significant Impact Assessment predicts that the action can be undertaken in a manner that prevents significant impacts upon MNES, and on this basis the proposed action has not been referred under the

EPBC Act. Successful implementation of mitigation measure to avoid or reduce impacts would result in a further reduction in the likelihood of impacts to MNES. The measures proposed to avoid and minimise impacts on MNES are outlined throughout Chapter 6 to Chapter 16.

3.2.2 *Native Title Act 1993* (Cth) and *Native Title Act 1994* (SA)

The Commonwealth *Native Title Act 1993* (Cth) and the *Native Title Act 1994* (SA) provide for the recognition and protection of native title. Native title can be claimed on some areas of land or water (e.g. on vacant or unallocated Crown land) but is extinguished by freehold land tenure and certain other forms of land title.

The Commonwealth Act also regulates Indigenous Land Use Agreements (ILUAs), which are voluntary agreements made with native title parties about the use and management of land and waters.

OZ Minerals is in the process of negotiating agreements with the native title groups on the transmission line and appropriate processes under Native Title legislation will be followed in relation to any agreements and granting of easements over land subject to Native Title.

3.2.3 *Aboriginal Heritage Act 1988* (SA)

The *Aboriginal Heritage Act 1988* (SA) provides protection for any Aboriginal sites, objects or remains (whether previously recorded or not). Under Section 23 of the Act, damage, disturbance or interference with Aboriginal sites; damage to Aboriginal objects; or disturbance, interference and removal of objects or remains must not be undertaken without approval from the Minister for Aboriginal Affairs and Reconciliation.

Cultural heritage surveys are being undertaken with the Barngarla People and the Kokatha People and, as discussed in Section13. OZ Minerals will continue to work with the Barngarla People and the Kokatha People, and Aboriginal Affairs and Reconciliation (where relevant) as the Project progresses through detailed design and construction to ensure Project activities comply with the requirements of the Act.

3.2.4 *Heritage Places Act 1993* (SA)

The *Heritage Places Act 1993* (SA) provides for the identification and conservation of places and related objects of heritage significance to South Australia. The Act provides protection for archaeological artefacts of heritage significance and under the Act it is an offence to damage a Heritage Place.

There are no known Heritage Places or objects within the Project Area (a 500 m wide corridor along the transmission line alignment, defined in Section 5.2).

3.2.5 *Environment Protection Act 1993* (SA)

The *Environment Protection Act 1993* (SA) provides a regulatory framework for protection of South Australia's environment, including land, air and water. It imposes a general environmental duty not to undertake an activity that pollutes or might pollute the environment, unless all reasonable and practicable measures have been taken to prevent or minimise any resulting environmental harm. It also

imposes an obligation to report incidents causing or threatening serious or material harm to the Environment Protection Authority (EPA), where applicable.

The Act also defines prescribed activities of environmental significance, which require authorisation and licensing under the Act. The Project may involve prescribed activities of environmental significance, including concrete batching and operation of mobile reverse osmosis plants. An EPA licence will be obtained for these activities, if required.

A number of Environmental Protection Policies operate under the Act that are relevant to the Project, including the *Environment Protection (Water Quality) Policy 2015*.

3.2.6 *National Parks and Wildlife Act 1972* (SA)

The *National Parks and Wildlife Act 1972* (SA) establishes the system of conservation reserves in South Australia and provides protection for native plants and animals. The Project is located approximately 55 km from Lake Torrens National Park.

3.2.7 *Native Vegetation Act 1991* (SA)

The *Native Vegetation Act 1991* (SA) and *Native Vegetation Regulations 2017* (SA) apply to the management and clearance of native vegetation on private and public land in South Australia.

The Project will fall under Regulations 12 and 16 of the Native Vegetation Regulations, under the Infrastructure provisions of Schedule 1, Part 6 (clause 34).

The Regulations permit clearance for infrastructure was approved under the Development Act where the Minister has declared that the clearance is in the public interest or is required in connection with the provision of infrastructure to a building or proposed building, or to any place.

The clearance requires written approval from the Native Vegetation Council (NVC) and under Regulation 16 will be subject to a condition that:

- Clearance is undertaken in accordance with an approved management plan that results in a Significant Environmental Benefit (SEB), or
- A payment is made into the Native Vegetation Fund of an amount considered by the Native Vegetation Council as being sufficient to achieve SEB.

In addition, Regulation 8 and Schedule 1, Part 1 (clause 2) cover clearance of vegetation incidental to the repair or maintenance of infrastructure, or the repair or maintenance work of the Crown.

An application for clearance of native vegetation will be submitted under this Act and OZ Minerals will achieve a SEB as required under the Act to offset vegetation clearance, either as an on-ground offset or a payment into the Native Vegetation Fund.

3.2.8 *Natural Resources Management Act 2004* (SA)

The *Natural Resources Management Act 2004* (SA) applies to a range of aspects of natural resources management. Of relevance to the Project are provisions in the Act addressing activities that affect surface water and groundwater resources, as well as management of pest plants and animals.

The Act and the South Australian Arid Lands Natural Resources Management Plan set out a number of 'water affecting activities' that must not be undertaken without a permit, including construction of buildings or structures in a watercourse, lake or floodplain and depositing solid material in a watercourse or lake.

The Project potentially triggers the need for a permit for some construction activities (e.g. access track construction across watercourses). However, in accordance with Section 129(e) of the *Natural Resources Management Act 2004* (SA) and Schedule 8, Item 12 of the Development Regulations, a separate water affecting activity permit will not be required as it is covered by the development approval process.

Drilling of new water wells requires a permit under the Act.

3.2.9 *Electricity Act 1996* (SA)

The *Electricity Act 1996* (SA) and the *Electricity (Principles of Vegetation Clearance) Regulations 2010* (SA) regulate the electricity supply industry, make provisions for safety and technical standards and specify the requirements for vegetation clearance around transmission lines (see Section 5.6).

3.2.10 Defence Act 1903 (Cth)

The proposed transmission line is adjacent to but outside the Woomera Prohibited Area (WPA) in the northern part of the alignment. The following information is provided for context, however, approvals under legislation relevant to the WPA are not required.

The WPA is a Prohibited Area regulated by the *Defence Act 1903* (Cth), *Defence Regulation 2016* (Cth) and the *WPA Rule 2014*. The WPA is an extensive area used by Defence for the testing of war materiel. The WPA comprises extensive lands north of the Indian Pacific railway, from north of Watson in the south-west up to its north-west corner in the Great Victoria Desert (that stretches across the South Australia-Western Australia border), across to Coober Pedy, and west of Roxby Downs down to Woomera in the south-east (Department of Defence, 2018).

In the immediate vicinity of the Project, the underlying tenure of the WPA is Crown Land (owned by the South Australian Government) and operated under Pastoral Lease by various lessees.

Access to the WPA for non-Defence use requires Defence approval.

OZ Minerals' existing Prominent Hill operation sits within the WPA, in the 'Green Zone' ('infrequent Defence use') and operates under a Deed of Agreement between OZ Minerals and Department of Defence.

The existing BHP transmission lines to Olympic Dam traverse the Red Zone ('continuous Defence use') and the Amber Zone ('periodic Defence use').

The proposed transmission line has been aligned outside the eastern boundary of the WPA.

4 IMPACT ASSESSMENT METHODOLOGY

4.1 Impact Assessment Framework

OZ Minerals has developed an assessment framework that supports a project throughout its lifecycle to manage environmental and social impacts and risks in a transparent and repeatable manner. OZ Minerals uses the framework to assess all its proposed mining operations and related infrastructure. A detailed description of the assessment methodology is provided in Appendix I.

The assessment framework draws on the requirements of ISO 14001, State and Commonwealth regulation and internationally recognised frameworks such as those established by the International Finance Corporation of the World Bank Group.

The following sections provide an overview of key components of the OZ Minerals assessment framework and how they relate to this document, and include:

- Source-pathway-receptor model
- Effect and impact
- Unplanned events (Risk)
- Design controls and management controls
- Assessment framework outputs.

The S-P-R (source-pathway-receptor) model is used to identify credible potential impacts of the Project. If an impact is identified then an assessment of the significance of that impact is undertaken to ensure that adequate controls have been applied, and that the impact is managed to a justifiable level.

The OZ Minerals impact assessment framework approach has been applied and presented in this document to suit the requirements of the Development Act as well as the requirements of the Department of Planning, Transport and Infrastructure and referral agencies. Consequently, the assessment for each aspect of the environment has been presented independently from Chapter 6 to Chapter 16, and in Appendix I.

4.1.1 Source-Pathway-Receptor Model

The framework builds upon the foundation of the S-P-R model, adjusted to articulate the effect to pathways, and impacts on receptors. When an S-P-R linkage is confirmed, an assessment of impact significance assessment is completed. OZ Minerals defines source, pathways and receptors as:

Source: A project element that can interact with the environment.

Pathway: The medium by which the effect originating from the source reaches a receptor.

Receptor: A discrete, identifiable attribute or associated entity that is measurably impacted, or may be perceived to be impacted, by an effect to a pathway.

Sources, pathways and receptors for the Project were initially identified at a workshop which generated a broad range of possible S-P-R linkages. These were subsequently refined into a list of credible and realistic S-P-R linkages as Project detail was developed, and detailed investigations and stakeholder consultation were undertaken. These are presented in Chapters 6 to 16 and summarised in Appendix I.

4.1.2 Effect and Impact

OZ Minerals has taken the approach to pathways and receptors as per the definitions above. The definitions of effect and impact are as follows:

Effect: An effect can occur on a pathway as a result of a source. It is a deviation from the expected and can be positive and/or negative.

Impact: Any certain and defined change to a receptor, whether adverse or beneficial, wholly or partially resulting from a source affecting a pathway.

For an impact to occur there needs to be a linkage between the source, pathway and receptor. Whilst an effect on a pathway may occur and not result in an impact (i.e. no link to the receptor), there may remain a perceived link (or assigned value) from the perspective of stakeholders. In such circumstances, the S-P-R linkage is assessed as material and an impact assessment is carried out. The materiality of an S-P-R linkage may also be acknowledged in the case of unplanned events, where there would ordinarily not be a linkage unless an unplanned event occurred. In this case a risk assessment is undertaken (see Section 4.1.3).

Materiality: The instance when particular impacts are considered to be significant on the basis of perception or stakeholder consultation.

Pathways identified for the Project include Land (Soil, Habitat, Visual Amenity, Cultural Heritage), Air (Dust, Noise and Light), Groundwater, Surface Water, and Socio-economic (Economy and Social Infrastructure). Impact identification numbers (Impact IDs) used throughout the assessment are grouped by pathway.

Receptors have been grouped into the following key categories:

- Communities – Aboriginal Communities, Local Communities and Third-Party Users (Pastoralists and Businesses)
- State – South Australia
- National – Australia (includes International Obligations that Australia has for matters of national environmental significance)
- Flora – Common, State or Nationally Significant Species
- Fauna – Common, State or Nationally Significant Species.

Once a S-P-R linkage is confirmed, an assessment of Impact Significance is carried out, which examines the receptor resilience, importance and the duration of the impact to derive an impact significance level. Uncertainty that exists through the impact assessment in terms of inputs, methods and the sensitivity of predictions to input variations, is then assessed and given an uncertainty rating. Uncertainties can include:

- Inputs associated with the options that remain as a part of the Project description
- The breadth and scope of the baseline studies; or
- The science undertaken in the determination of the magnitude of the effect or the impact.

The impact significance level can range from 1 to 125 and is further elevated if the uncertainty is high. OZ Minerals has adopted the approach that an impact is considered to be significant in those circumstances where the impact rating is greater than or equal to 48.

Final impact ratings that are not significant (<48) have been further categorised as either Very Low (1 to 4), Low (5 to 19) or Medium (20 to 47).

The assessment methods and rankings used are described in further detail in Appendix I.

The detailed assessments for all impact events identified for the Project are contained in Appendix I, and are summarised for each aspect of the environment in Chapters 6 to 16 of this document.

4.1.3 Unplanned Events (Risk)

The OZ Minerals assessment approach is based upon the distinction between impact (planned event) and risk (unplanned event). Both play an important part in project definition and form a part of this assessment.

Risk: The impact of uncertainty on objectives (ISO 31000:2009). It consists of two components—the consequence and its likelihood.

As mentioned in Section 4.1.2, an impact is a certain and defined change to a receptor resulting from a source affecting a pathway.

Importantly, an impact assessment quantifies and allows communication of the impact of a project to all stakeholders if it is constructed and operated in accordance with its scope and design.

Risk emerges when unplanned events that lie outside the previous assessment stages threaten to increase the impact of a project.

The Project risk assessment has been undertaken in accordance with ISO31000. The risk rankings and matrix utilised during the risk assessment process are described in Appendix I. The process undertaken captures the existing or proposed risk controls and assigns a consequence and likelihood rating to the residual risk.

Risk assessments undertaken for unplanned events are contained in Appendix I, and are summarised for each aspect of the environment in Chapters 6 to 16 of this document.

4.1.4 Control and Mitigation Strategies

OZ Minerals has considered the role of design controls and management controls in the assessment process. Where possible, a conservative effect assessment has been undertaken to ensure the potential impacts of the Project consider an uncontrolled scenario. Controls for the mitigation of potential impacts and unplanned events associated with the Project have been categorised for each pathway as either design controls or mitigation strategies.

The transmission line alignment, access track alignment and transmission structure placement are principal design controls. They have been selected to follow existing infrastructure corridors, avoiding areas of high cultural significance and important habitat for threatened species, and to minimise the potential for disturbance. As discussed in Chapter 5, there remains some uncertainty regarding the exact placement of infrastructure to mitigate impacts and risks associated with land access, species habitat and cultural heritage-related matters. This uncertainty has been addressed by nominating a 10 km Study Area corridor and using a 500 m wide transmission line alignment corridor for the purposes of assessment within this Report. Specific design controls for each aspect are detailed in the chapters of this report, together with management controls and mitigation strategies to further reduce the potential for impact as a result of Project activities. Controls are also collated in the attached Draft Construction Environmental Management Plan (CEMP) (Appendix H).

4.1.5 Assessment Framework Outputs

OZ Minerals has applied the impact assessment framework to assess information associated with the credible potential impacts originating from either the construction or operation of the Project.

The key outputs of the assessment framework are summarised as:

- Identification of credible potential S-P-R linkages (planned events) and providing sufficient justification behind the statement of impact, including an explanation of any uncertainty
- Identification of legislative requirements
- Determination of materiality of any potential impact based on perception or stakeholder consultation
- Assessment of impact significance
- Assessment of impact uncertainty by stating any uncertainty in any element of the assessment to develop a statement of impact
- Assessment of the relevant risks (unplanned events) that may lead to an impact.

The template for the assessment framework output with explanatory text included is shown in Table 4.1. The individual potential impact assessments are contained in Appendix I.

Potential Impact IDs are referenced throughout the DA. It is recommended that a copy of the Impact Assessment Framework Tables (Appendix I) be readily available to assist the reader to be able to quickly access these and understand the potential impacts.

Table 4.1: Assessment Methodology

IMPACT ID and Impact Title								**Applicable Alignment Section**	
Planned Event	**Potential Impact**	*Impact Statement*						**Phase**	*Construction/Operation/ALL*
	Source	*Project Element*		*Description of activity / element*					
	Pathway	*Medium upon which effect occurs*		*Description of pathway baseline and potential effect*					
	Receptor	*Environmental or social entity / attribute*		*Baseline description of environmental / social receptor*					
	Design Controls	*Elimination, substitution and engineering controls in place*							
	Is the Linkage Confirmed	Yes/No	*Statement if effect to receptor has been identified or statement why the linkage does not exist*			**Uncertainty: S-P-R, Impact Statement**	*Statement of confidence around linkage confirmation or impact statement*		
	Is the S-P-R Material?	Yes/No	**Justification**	*Addresses whether the particular impacts considered to be significant on the basis of perception or stakeholder consultation.*				**Legislative Requirements**	*Relevant legislative requirements identified*
	Impact Significance	**Resilience**		*Ranking (1, 3, 5)*		*Summary of adaptability to the effect / change*			
		Importance		*Ranking (1-5)*		*Summary of receptor importance*			
		Duration		*Ranking (1-5)*		*Statement of the duration of impact*			
		Significance Rating		*Rating (0-125)*		*Significant (>48) / Not Significant (<48)*			
	Impact Uncertainty	**Inputs**		*Ranking (A, B, C)*		*Assumptions made and quality of data used in predicting the effect on the pathway*			
		Method		*Ranking (A, B, C)*		*Quality of methods and models used in assessments*			
		Sensitivity		*Ranking (A, B, C)*		*Sensitivity of predictions to input variations*			
		Uncertainty Rating		*Significance Rating post Uncertainty Assessment) (0 – 125)*		*Significant (>48) / Not Significant (<48)*			
	Final Impact Rating	*Rating (0-125)*		**Final Impact Category**	*Not Significant (Very Low (1-4), Low (5-19) or Medium (20-47)) or Significant (>48)*				
Unplanned Event	**Risk Assessment**	**Risk Event**			**Management Controls**	**Risk** (post controls)			
						Consequence	**Likelihood**	**Risk**	
		Unplanned event associated with the impact			*Proposed management controls and mitigation measures to be implemented*	*See Appendix I for Risk Consequence Scale*	*See Appendix I for Likelihood Scale*	*See Appendix I for Risk Matrix*	

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5 PROJECT DESCRIPTION

This chapter defines the key elements of the Project. In many scenarios, Project elements may create a change in the baseline environment conditions (described in Chapters 6 to 16) and are considered a source.

Source: A Project element that can interact with the environment.

The key Project elements and their inputs and outputs have been used to inform studies where they interact with the environment for the purposes of determining the potential impacts of the Project.

The description of operations summarised in this document presents several options and scenarios, to allow for conservative environmental and social assessments, and to provide flexibility for detailed design or operational change and continual improvement, without compromising the ability to mitigate potential impacts or affecting the overall impact profile of the Project.

Where there remain decisions to be made by OZ Minerals in relation to the development of the alignment or associated infrastructure, the description of the proposed operations within this document cover all options still under consideration. For the environmental impact assessment presented in Chapters 6 to 16, either the worst-case option has been assessed as the source, or all options are assessed.

5.1 Project Overview

OZ Minerals proposes to construct a transmission line to secure the electricity supply to the existing Prominent Hill mine in the Upper North. The transmission line will run from 20 km north-west of Port Augusta to 10 km west of Olympic Dam and will be approximately 237 km long (see Figure 5.1). Prominent Hill currently obtains electricity from BHP's 275 kV transmission line from Davenport to Olympic Dam and the proposed transmission line will connect to the existing OZ Minerals Prominent Hill 132 kV transmission line that originates at Olympic Dam. It will also connect to the existing Mount Gunson South Substation and will in the future provide electricity to OZ Minerals' Carrapateena mine.

The proposed transmission line consists of:

- A 275 kV section extending approximately 109 km from the approved Solar Reserve Transmission line and proposed Carriewerloo Substation at the SolarReserve Aurora Solar Energy Project (ASEP), to the Mount Gunson South Substation
- A 132 kV section extending approximately 128 km from the Mount Gunson South Substation to the existing Prominent Hill transmission line near Olympic Dam.

The Project will provide electricity to OZ Minerals' two major South Australian mining operations and provide additional capacity for the provision of electricity to the Upper North, thereby opening the region for further growth.

The transmission line will be built under a Build, Own, Operate and Maintain (BOOM) contract with ElectraNet Pty Ltd (owner and operator of the South Australian transmission network). OZ Minerals will lead land access, approvals and environmental compliance aspects of the Project and will oversee the Project to the operational phase.

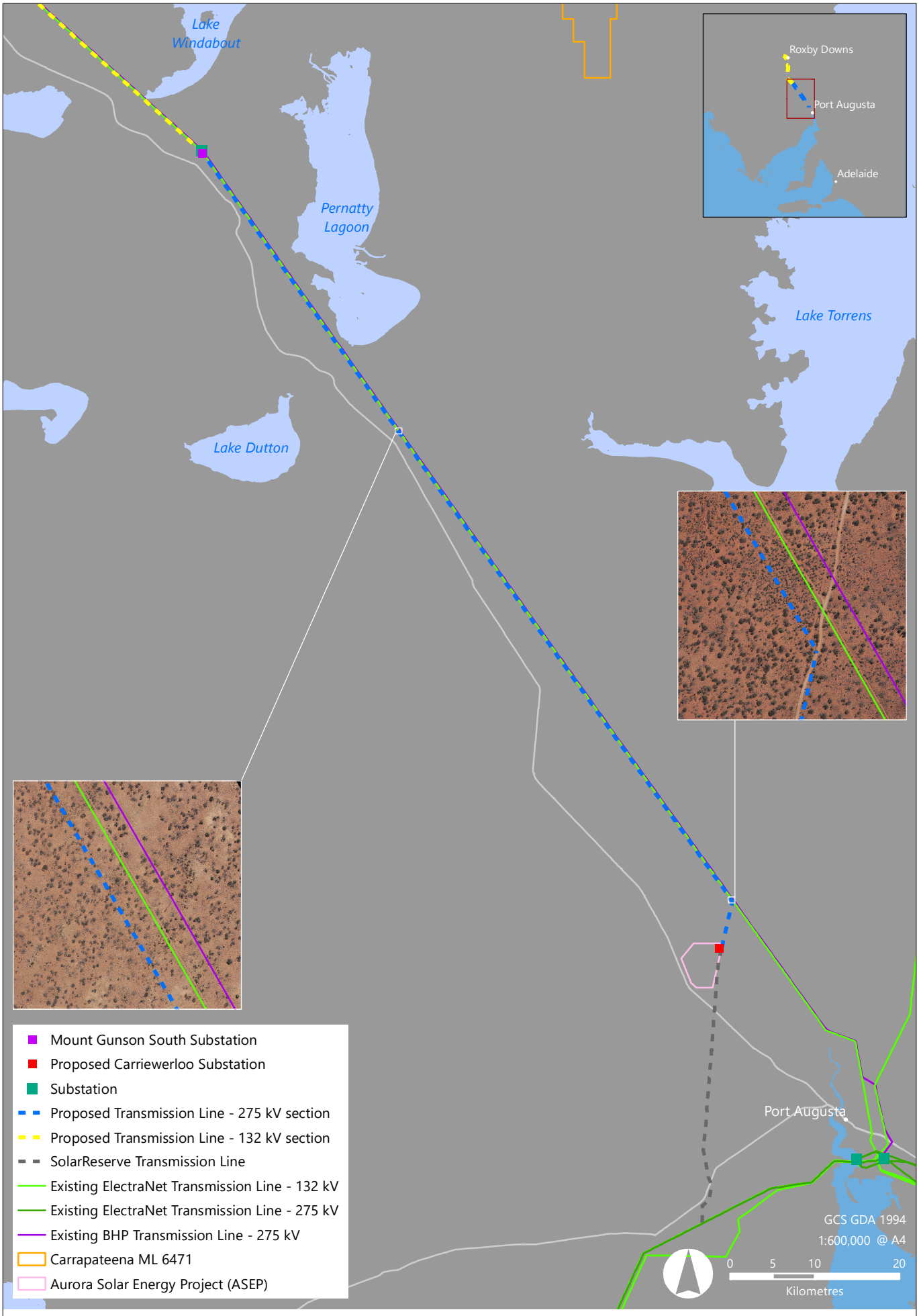


Figure 5.1a: Proposed Alignment and Existing Electricity Infrastructure

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

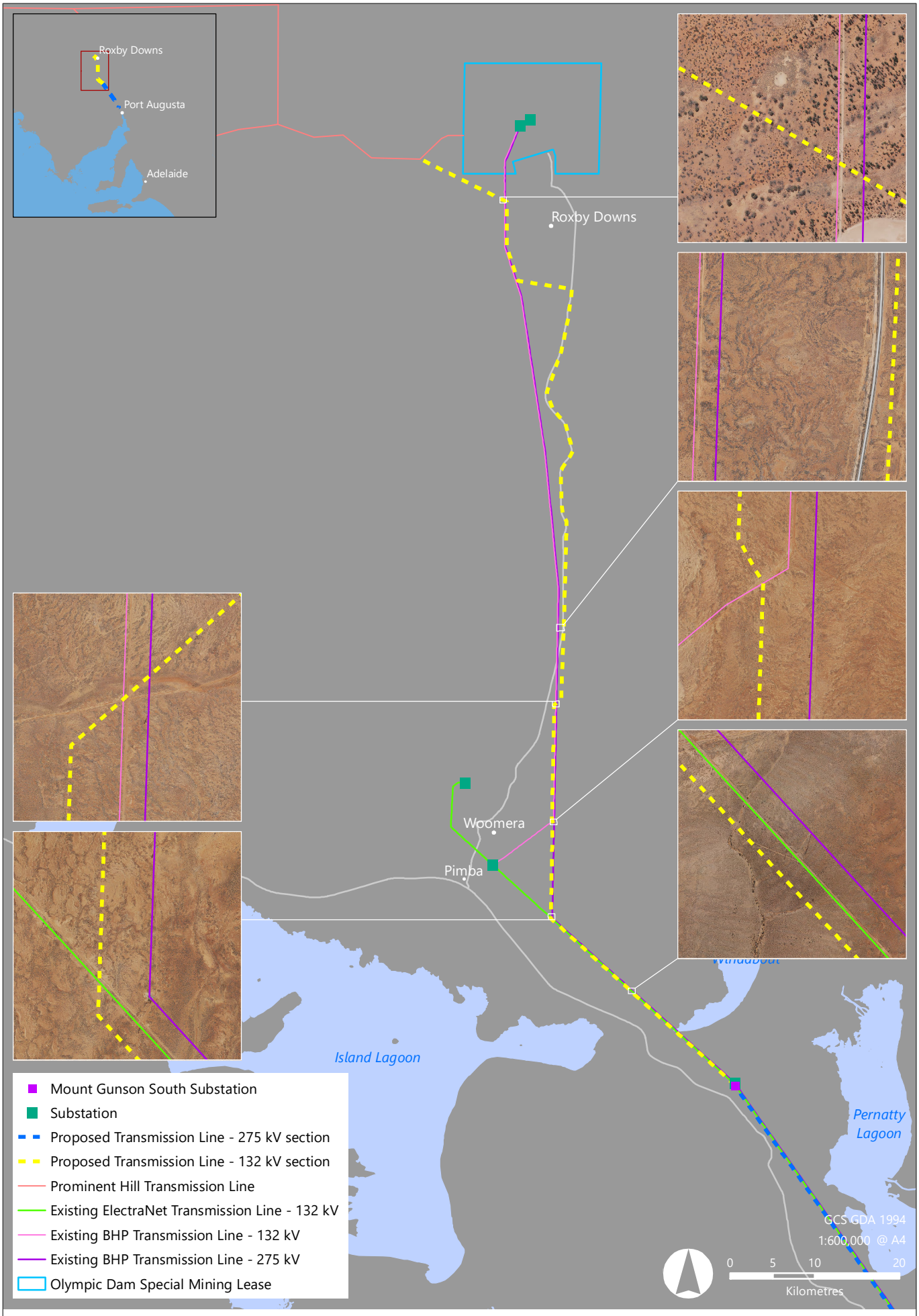


Figure 5.1b: Proposed Alignment and Existing Electricity Infrastructure

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

5.2 Project Area

The proposed transmission line is divided into two sections, with the substation at Mount Gunson South situated between the two. These sections are:

- The 275 kV section of transmission line extending approximately 109 km from the Carriewerloo Substation at the SolarReserve Aurora Solar Energy Project (ASEP) to the Mount Gunson South Substation
- The 132 kV section of transmission line extending approximately 128 km from the Mount Gunson South Substation to the Prominent Hill transmission line west of Olympic Dam.

The current alignment of the 275 kV and 132 kV sections of the proposed transmission line is shown in Figure 5.2 and Figure 5.3.

The term "Project Area" has been defined throughout this report as a 500 m wide corridor along the transmission line alignment. This report and supporting specialist reports also use the term 'Study Area', which is defined as a 10 km wide corridor along the transmission line alignment.

5.2.1 Alignment Considerations

The proposed transmission line alignment generally follows existing infrastructure easements (or in the case of the BHP transmission line, freehold land parcels), which contain infrastructure such as roads, tracks, transmission lines and pipelines. As noted above, the alignment is located outside BHP's freehold land corridor and other adjacent easements.

Development of the proposed alignment has considered a range of planning requirements including:

- Environmental constraints analysis (e.g. important habitat and surface water features)
- Social constraints analysis (e.g. cultural heritage, buildings, receptors, land uses)
- Infrastructure constraints analysis (e.g. roads, pipelines, electricity transmission infrastructure)
- Access restrictions posed by Defence in the Woomera Prohibited Area
- Future planned infrastructure
- Prescribed centreline clearance distances for buildings and structures and infrastructure (as per the *Electricity (General) Regulations 2012* (SA)).

5.2.2 Proposed Transmission Line Route

The proposed transmission line follows the route of the existing BHP and ElectraNet 275 kV and 132 kV transmission lines for approximately 70% of its length. These existing lines extend from the Davenport Substation, near Port Augusta, to Pimba and Woomera and onwards to Olympic Dam (see Figure 5.1).

The proposed alignment for the 275 kV section of the proposed line runs northwards from the SolarReserve Aurora site until it meets the existing BHP 275 kV and ElectraNet 132 kV transmission lines. It then runs west of these existing transmission lines until it reaches the Mount Gunson South Substation. The proposed line is offset to the west of the existing ElectraNet 132 kV line, adjacent to the ElectraNet easement.

North of Mount Gunson South, the alignment of the proposed 132 kV section will remain on the western side of the existing 132 kV and 275 kV transmission lines for approximately 50 km. The alignment then crosses the eastern side of the existing lines and follows Olympic Dam Highway to remain outside the boundary of the Woomera Prohibited Area (WPA) before crossing the highway approximately 6 km south of Roxby Downs to re-join the alignment of the existing transmission lines. South of the Olympic Dam Special Mining Lease, the alignment will again cross under the transmission lines to the western side before connecting to the existing 132 kV Prominent Hill transmission line.

The current proposed alignment is shown in Figure 5.2 to Figure 5.4. Detailed alignment plans are provided in Appendix B. It should be noted that as the Project is in the preliminary design phase, this alignment may change in some locations because of land access negotiations, cultural heritage clearances, micro positioning of footings and access tracks to avoid important habitat and as detailed design work progresses, however it is expected to be located within 500 m of the current alignment

There have been minor changes to the alignment since the specialist assessments contained in Appendix D to Appendix G were undertaken, principally in the area between Mount Gunson South Substation and Woomera, where the current alignment runs on the western side of the existing transmission lines rather than crossing to the east at Mount Gunson South and running on the eastern side. This change does not have a material impact on the conclusions of the assessments and is likely to result in lower impact, as the existing access track is expected to be used more extensively.

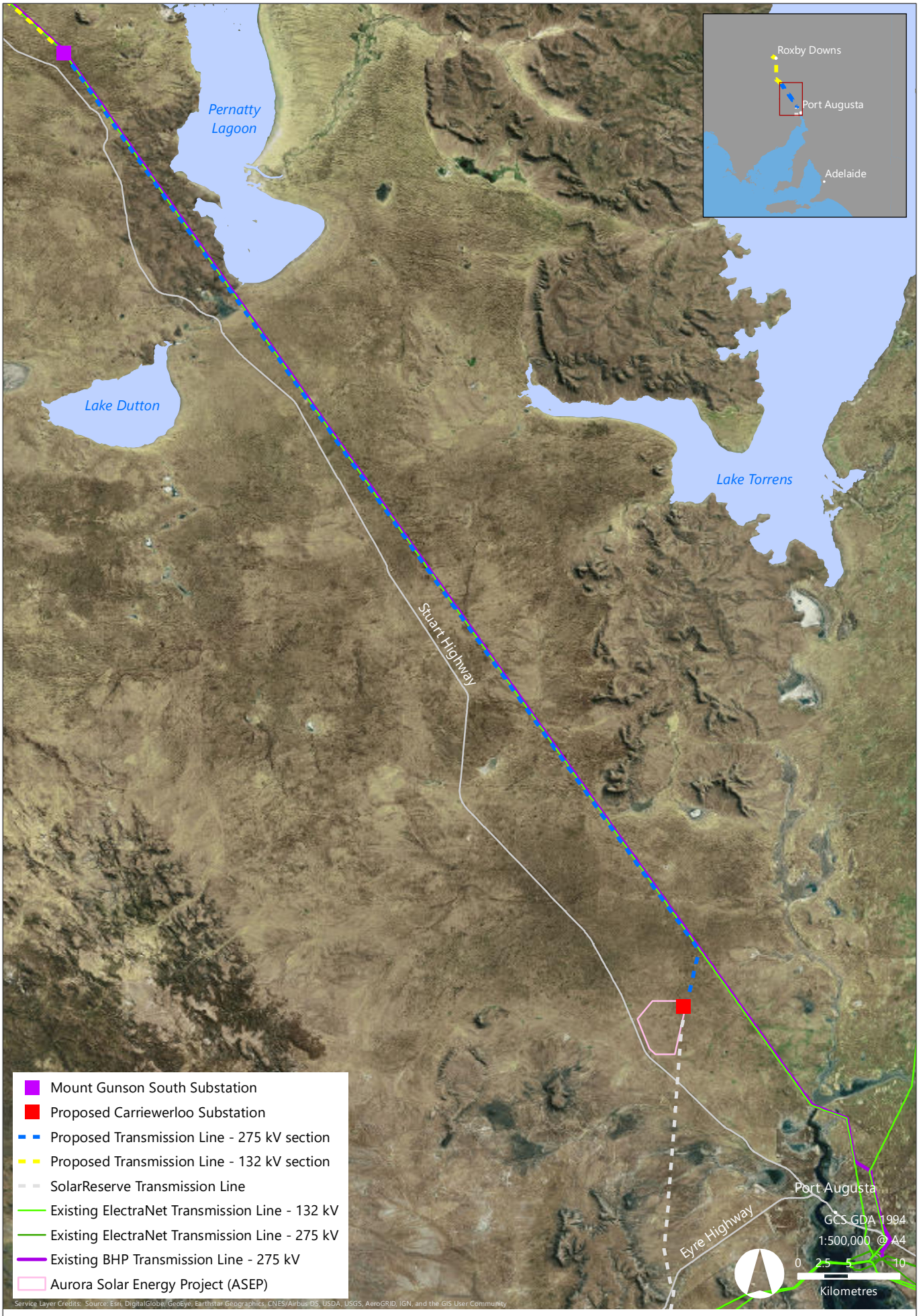


Figure 5.2: Proposed Transmission Line - 275 kV section

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

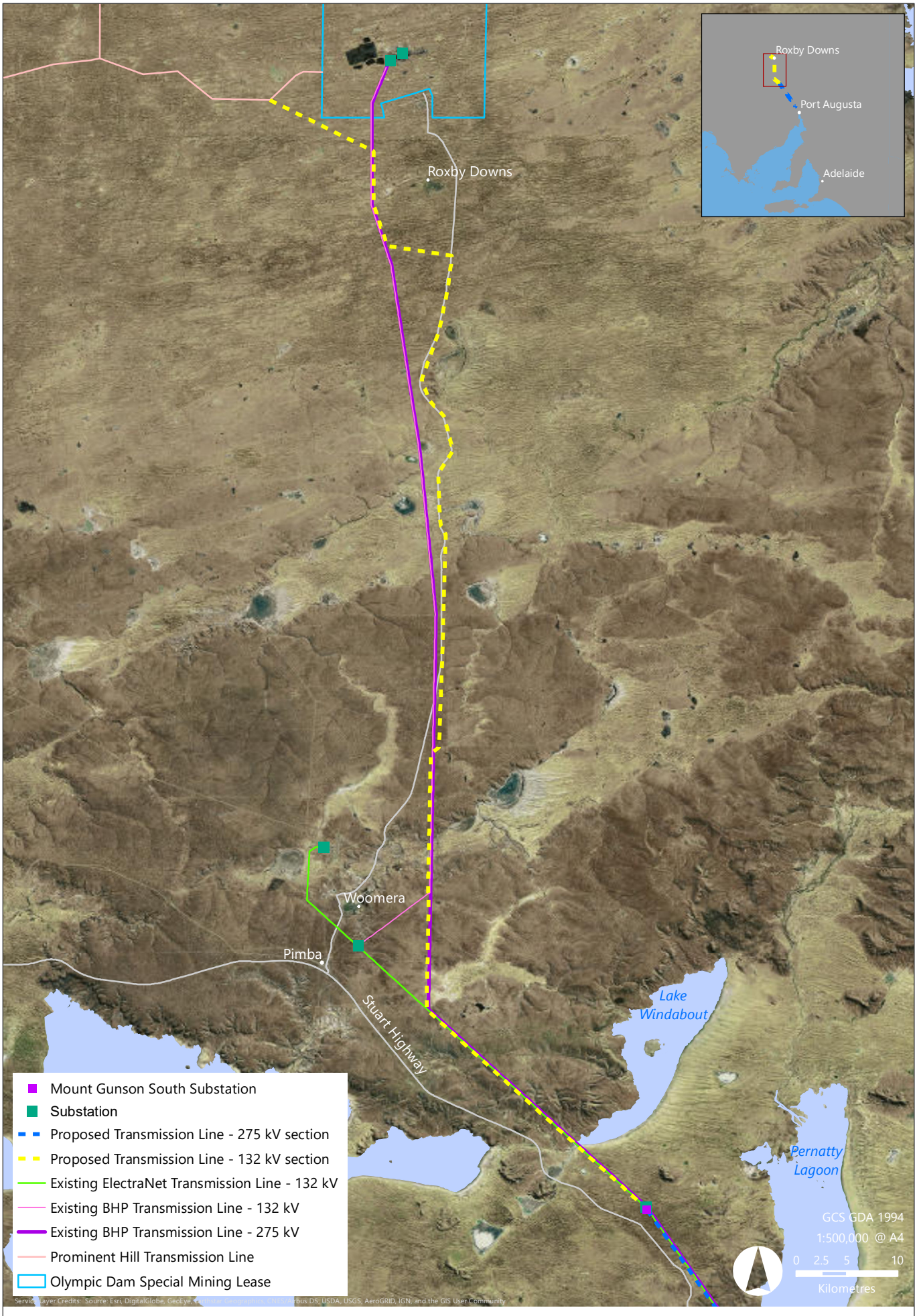


Figure 5.3: Proposed Transmission Line - 132 kV section

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

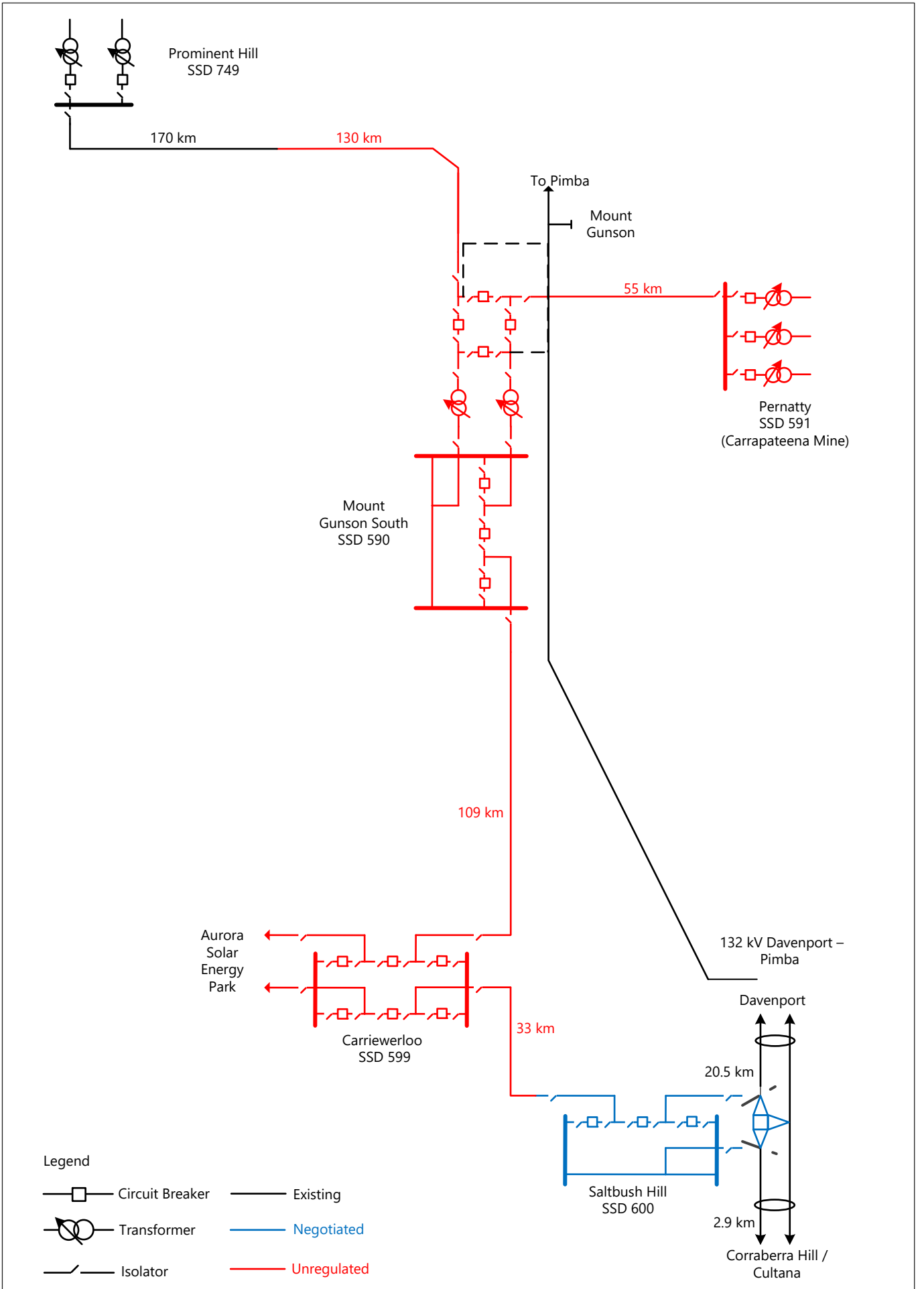


Figure 5.4: Simplified Single Line Diagram of Proposed Alignment

5.2.3 Refinement of the Alignment and Design

The alignment selection and design process involve sequential refinement as field assessment, landowner and stakeholder consultation and technical studies progress. This process is outlined in Figure 5.5.

At the time of preparation of this report, the Project was substantially progressed in the preliminary design phase.

Refinement of the alignment and pole placement will be ongoing through this phase and into detailed design and will involve feedback from ongoing investigations, including targeted ecological surveys and cultural heritage clearances for pole locations. As noted previously, the final alignment is expected to be located within 500 m of the current proposed alignment.

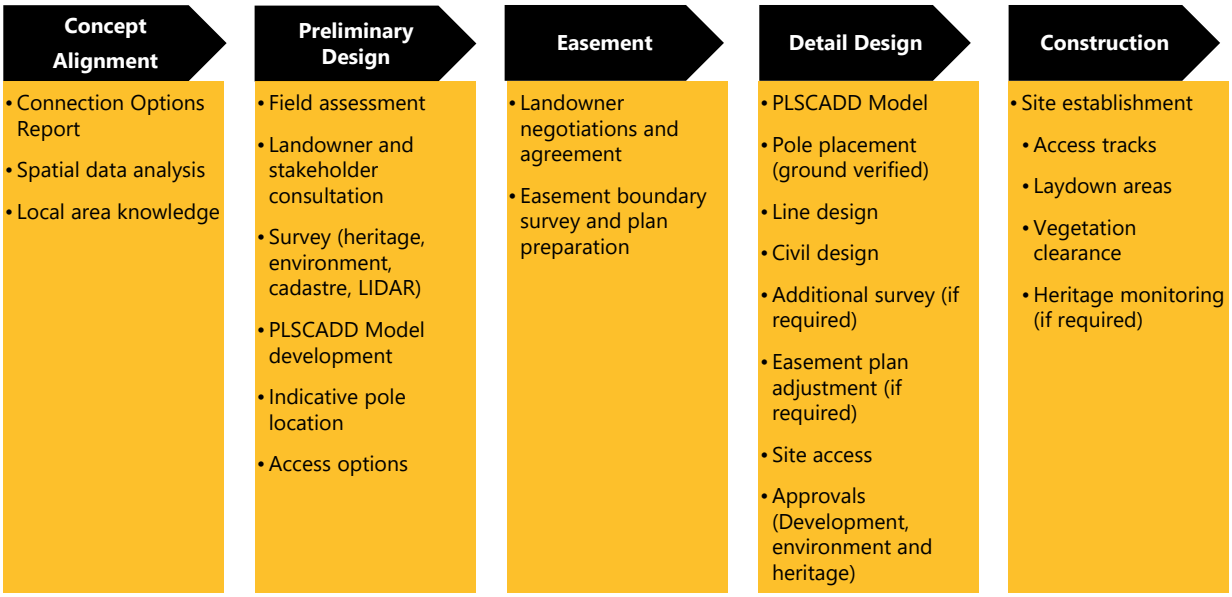


Figure 5.5: Typical Transmission Line Alignment Selection and Design Process

5.3 Project Schedule

Detailed design is planned to commence in the second half of 2018, with construction to follow in late 2018. The construction phase will take approximately 12 to 18 months to complete with energisation expected in mid-2020.

5.4 Key Infrastructure Components

This section outlines the key components of the Project. As detailed engineering design and construction planning has not yet been undertaken, indicative information is provided where relevant.

5.4.1 Transmission Structures

A range of tower and pole structures can be used to support electricity transmission lines depending on the voltage of the line and the function of the structure.

Two types of structures are proposed for the transmission line alignment, being lattice towers and steel monopoles. Lattice towers consist of a steel lattice framework, while monopoles consist of a single pole. A third option, guyed structures, is also being investigated for implementation in more sensitive areas along the corridor. Further information on these types of structures is provided in the discussion below.

275 kV Section

Lattice towers are expected to be used for the 275 kV line. These towers would typically be 50 to 60 m in height for a 275 kV line, with the taller height generally required for longer spans.

The design of the lattice towers will be site-dependent and will vary depending on the position of the conductors and the loads that the tower must bear. A large proportion of the towers (where the line is straight) will be suspension towers and have an identical design, while larger or more heavily constructed (strain or angle) towers will be used for turning the line through an angle, dead-ending (terminating) a line, or where increased spans or increased clearances and strength are required (for example at watercourse or road and rail crossings). Alternative designs (e.g. guyed lattice towers with a single footing and a number of supporting steel guy wires) may also be used.

Examples and schematics of lattice towers, representative of the towers that are likely to be used, are shown in Plate 5.1 and Figure 5.6 respectively.

Tower spacing for the 275 kV line is anticipated to be 450 – 500 m. This distance may change in locations that involve road crossings, turning of the alignment and environmental crossings. In these instances, larger spans (using larger towers) may be applied.

Lattice towers will be supported by concrete footings. Four footings (one for each tower leg) would typically be used for lattice towers on a 275 kV line. Footings would typically be approximately 5 m deep but may be up to 10 m deep in some soil types. A single footing plus several smaller footings for guy wire anchor points would be required for guyed structures. Footing design will vary with the design loads of the tower.

132 kV Section

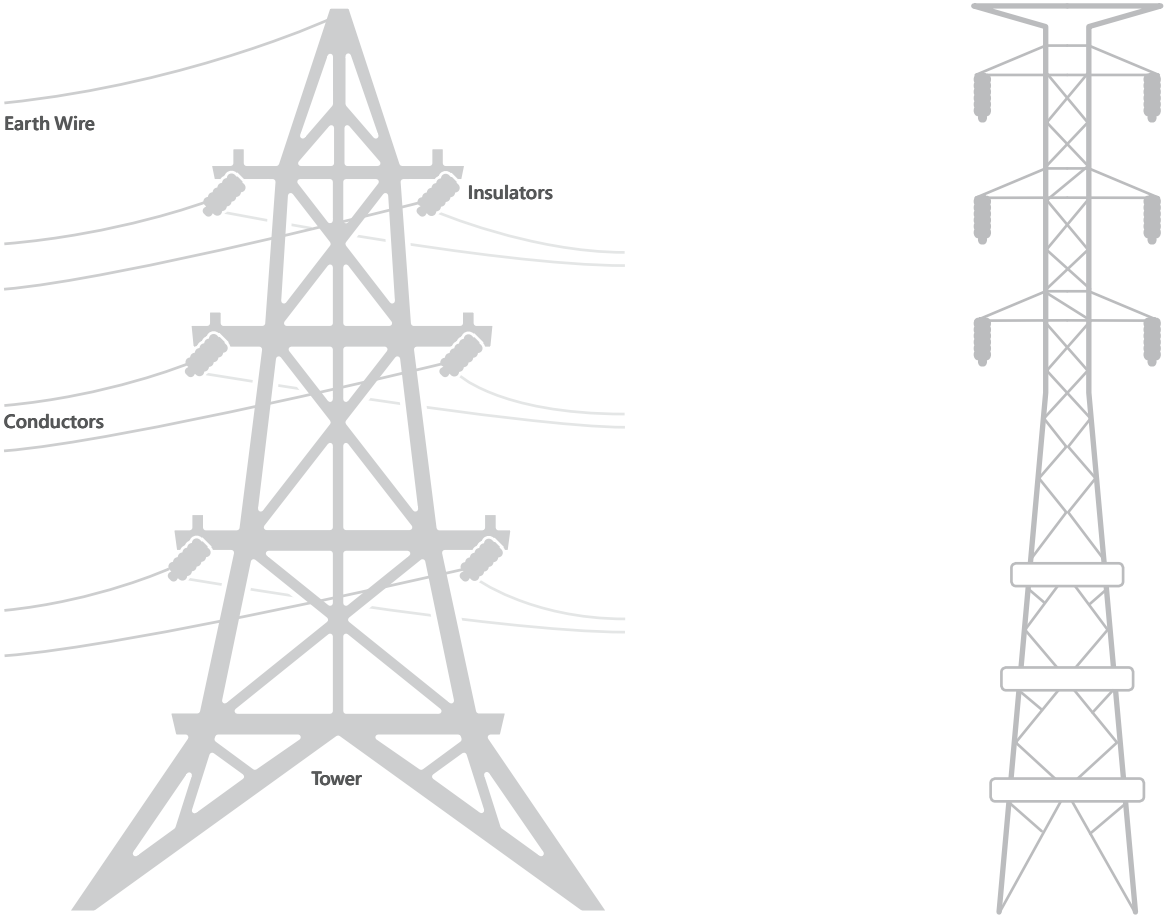
Steel monopoles or possibly smaller lattice towers will be used for the 132 kV line. Examples and schematics of monopoles or smaller lattice towers, representative of the towers that are likely to be used, are shown in Plate 5.2, Plate 5.3 and Figure 5.7. Large lattice towers similar to those used on the 275 kV line would be used in some locations (e.g. where larger spans are required).

Both tower types would be approximately 25 to 45 m in height for a 132 kV line. Larger lattice or monopole towers may also be used for turning the line through an angle, where increased spans or clearances are required such as road or rail crossings.

Tower spacing for the 132 kV line is expected to be approximately 300 m.

Monopole towers are generally bolted onto concrete foundations (see Plate 5.3). The foundations for monopoles for a 132 kV line would generally be in the order of 6 m deep by 2 m radius but could be up to 10 m deep in some soil types.

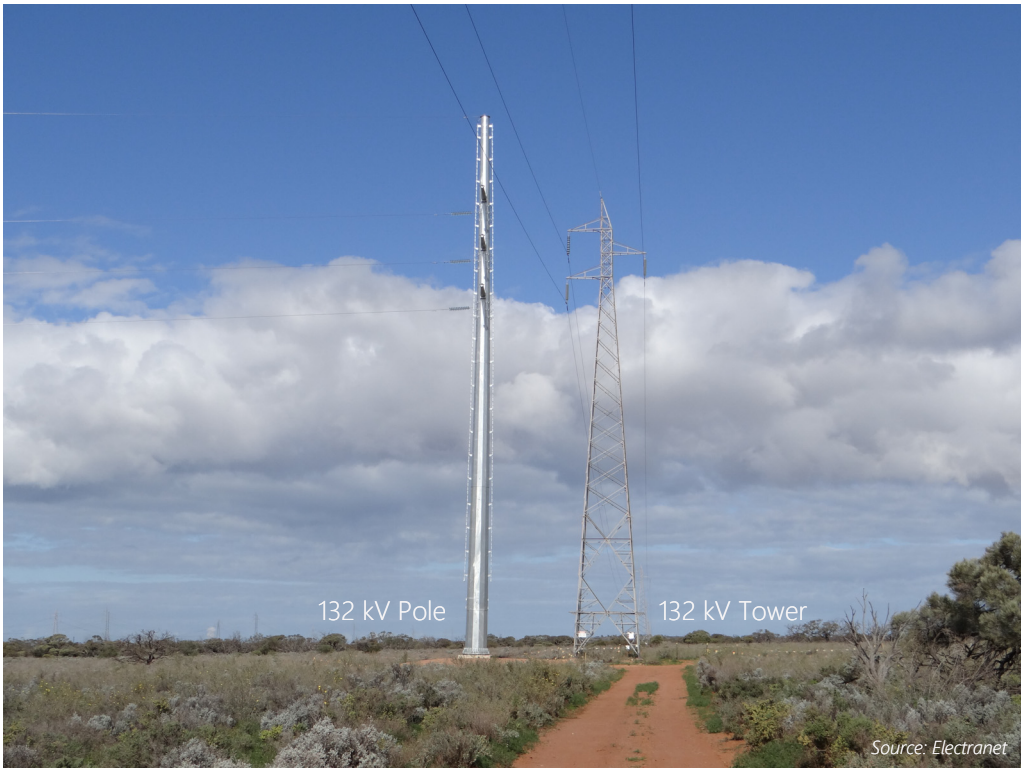
Plate 5.1: Lattice Towers



Source: ElectraNet

Figure 5.6: Schematics of Typical 275 kV Lattice Tower and Transmission Line Components

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE



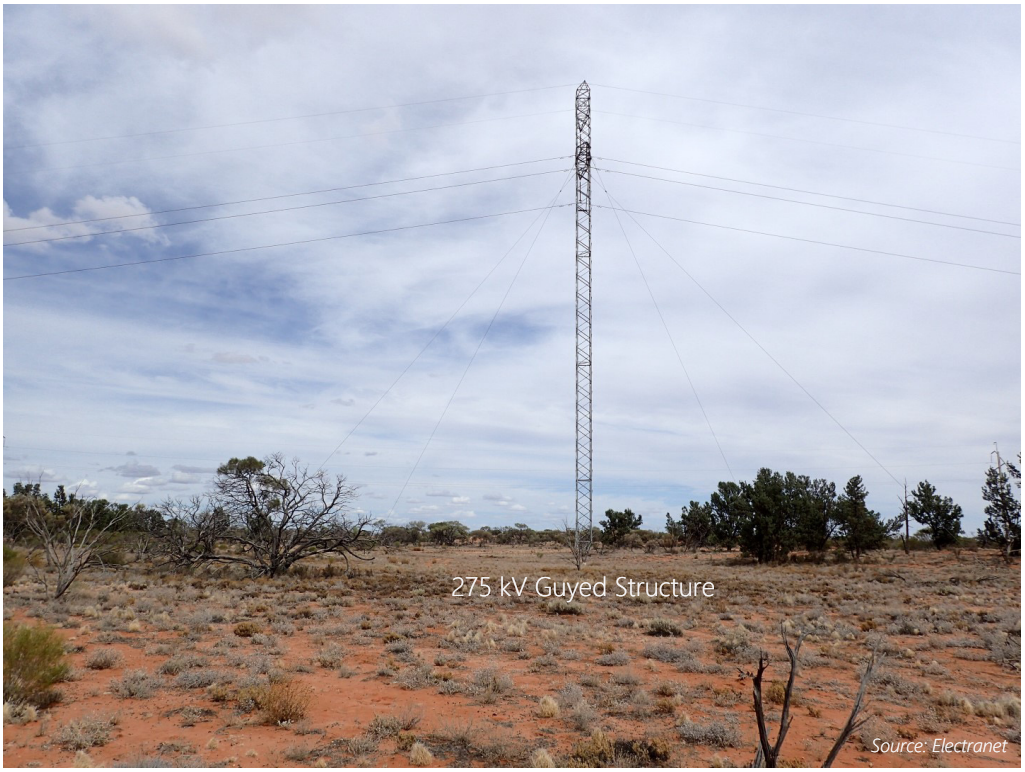
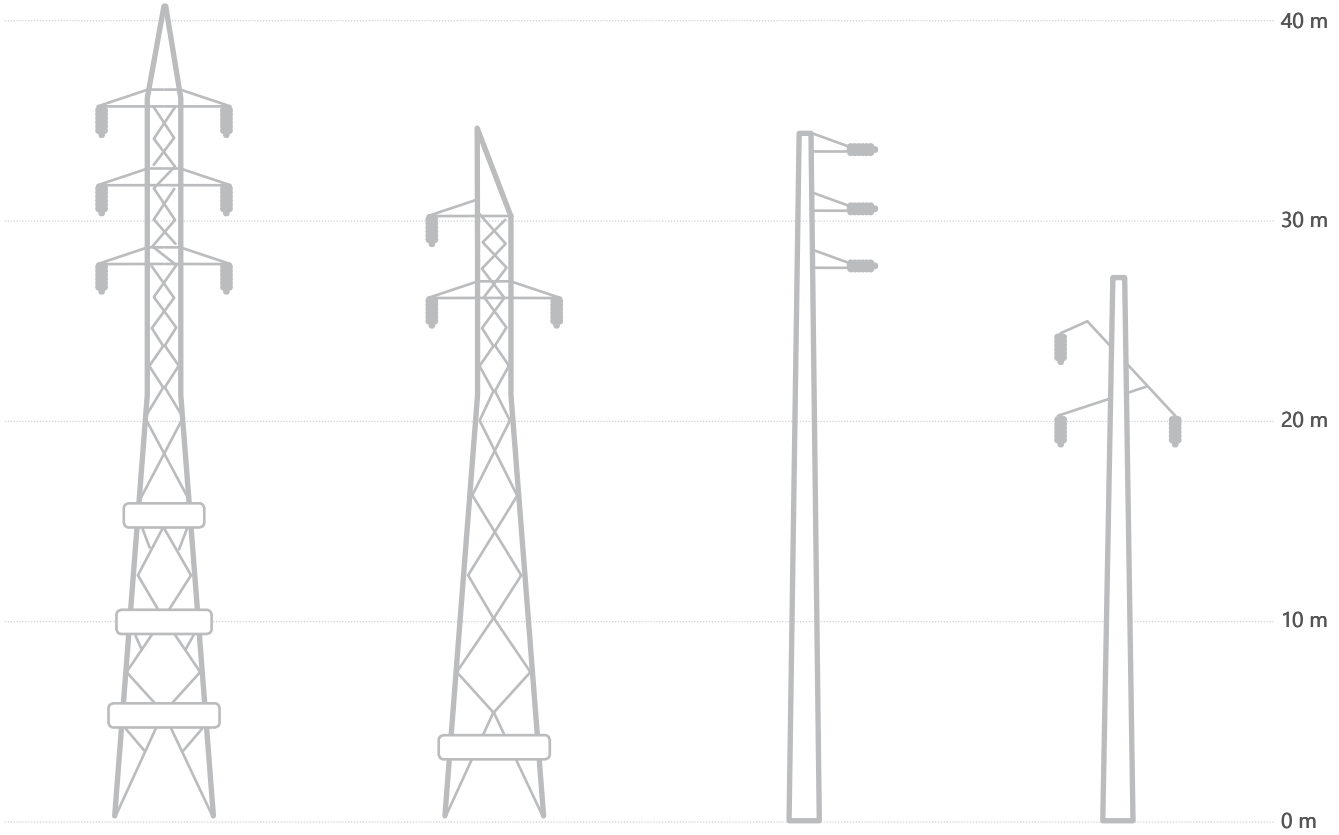


Plate 5.2: Example 132 kV Pole and Tower and 275 kV Guyed Structure

Plate 5.3: Typical 132 kV Monopole Line



Source: ElectraNet

Figure 5.7: Schematics of Typical 132 kV Tower Options

Plate 5.4: Typical Pole Footing

5.4.2 Structure Laydown Areas

At each structure location there will be a need for a cleared and flat laydown area to enable tower or pole footing construction and structure erection, including line stringing and tensioning. An example is illustrated in Plate 5.5. Depending upon terrain and structure type, the clearance areas can range from approximately 20 m x 20 m to 50 m x 50 m (as discussed in Section 5.5.2). Cleared sites will typically be left to naturally regenerate with original topsoil respread back over the area. Some sites may require gravel topping to allow for ongoing maintenance access or to protect the site from erosion and/or dust generation.

5.4.3 Conductors and Insulators

Conductors (or wires) for high-voltage transmission lines are typically made from aluminium alloy strands that are wound around a steel core to form a cable. These carry the electricity and are attached to the poles or towers with insulators. Transmission towers also carry an earth wire to reduce the likelihood of direct lightning strikes to the conductors (see Figure 5.6). Dampers are used on conductors to control wind-induced vibration and movement.

The proposed transmission lines will be single circuit lines, with three conductors on both the 132 kV and 275 kV.

5.4.4 Telecommunications

Telecommunications for operation of the transmission line are planned to be provided by an optical ground wire, which consists of an optical fibre core within the earth wire discussed above. A repeater optical / amplifier site, which would have a footprint of approximately 400 m^2 (for a solar array), may be required along the 132 kV section of transmission line. A buried optic fibre cable from the proposed transmission line to ElectraNet's Pimba substation along the one of the existing transmission lines (approximately 8 km) is planned to be installed which will allow connection to ElectraNet's existing telecommunications infrastructure and may avoid the requirement for a repeater / optical amplifier site.

During construction, telecommunications may be provided by a temporary radio network with radio masts in open or disturbed areas on or in closer proximity to the alignment.

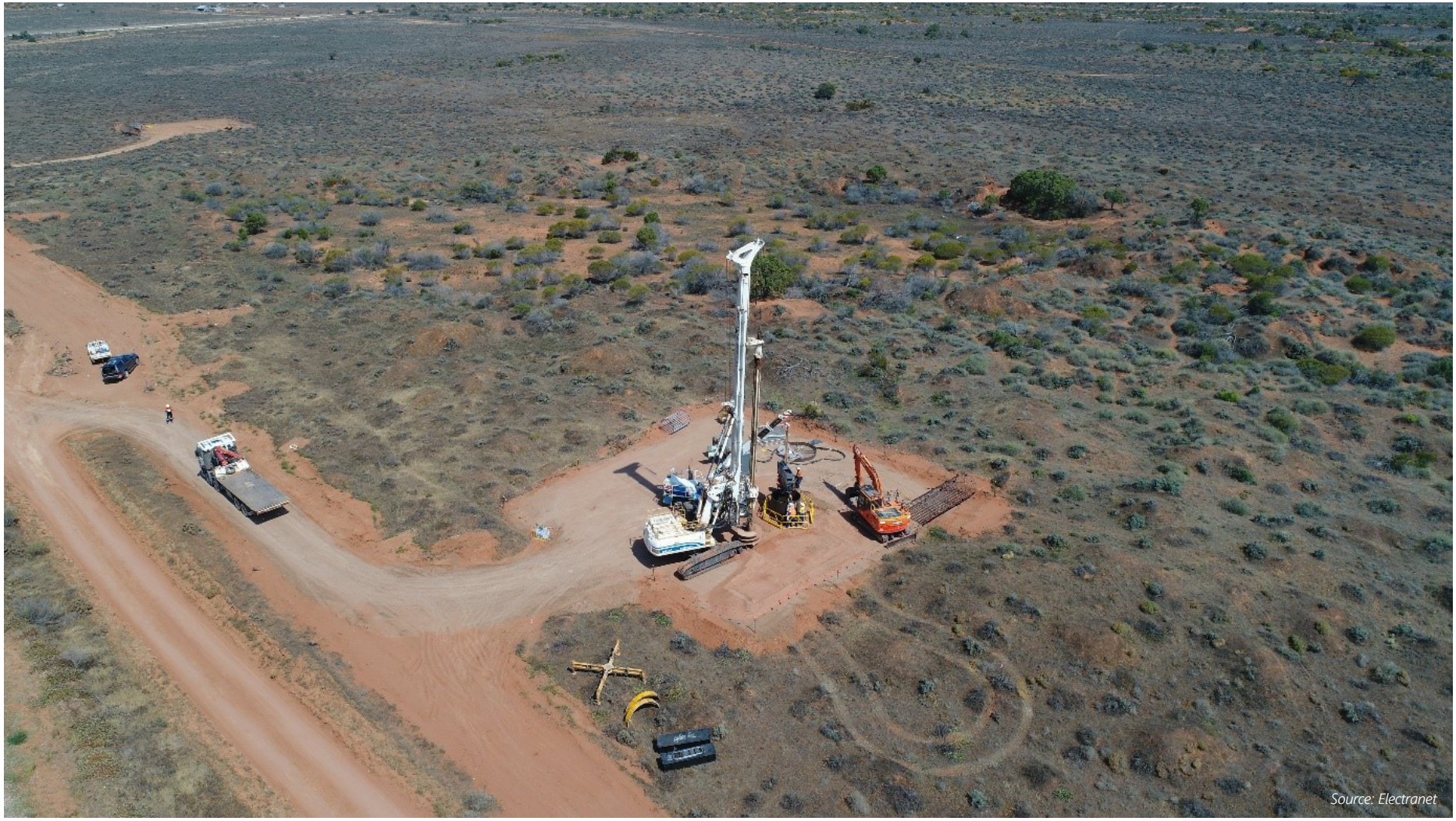


Plate 5.5: Indicative Pole Construction Area

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

5.4.5 Access Tracks

Access tracks will be required for both line construction and maintenance. A track to the base of each tower of approximately 5 m wide will be required. Greater track widths may be required in some areas (e.g. if a passing area or wider turning area is required, or where the track is established through very sandy dunes).

Existing roads and tracks will be used for access wherever possible (e.g. with short sections of new track constructed to access each tower). In areas where there is no existing access track or where use of nearby tracks is not permitted by the landowner, a new track generally parallel to the transmission line route would be constructed. New access tracks would be aligned to avoid sensitive features such as areas with higher erosion potential, steep watercourse banks, significant vegetation or habitats, or sites of cultural heritage sensitivity and for this reason may deviate from the transmission line alignment in some locations.

Where the alignment is adjacent to the existing ElectraNet line (i.e. south of Pimba), it is currently planned to utilise the existing ElectraNet access track along the 132 kV Davenport to Pimba line as far as possible, with a new track established from the existing track to each new tower location. Access to the remainder of the 132 kV alignment north of Pimba is expected to require a new track for much of its length, particularly where the new line does not parallel the existing lines. Existing tracks may need to be upgraded in some areas to allow construction access, which would be determined with the construction contractor during the detailed design phase.

Tracks are typically constructed by light grading. Capping with imported material is typically only required in limited areas where the surface cannot support construction traffic (e.g. sand dunes or boggy areas) or where all-weather access for ongoing maintenance is required. If required, material for capping would be obtained from appropriately authorised sources as discussed in Section 5.5.10.

Access track creek crossings are normally established at the natural surface level, with minimal earthworks undertaken. At some watercourses (e.g. where a narrow, defined channel is present), temporary or permanent crossings (e.g. using pipes or culverts) may be required to be installed to allow access for cranes and deliveries and ongoing maintenance access.

The final access track location will be determined by ElectraNet and the construction contractor in the detailed design phase, when final tower locations have been selected, cultural heritage clearances have been undertaken and agreement has been reached with landowners.

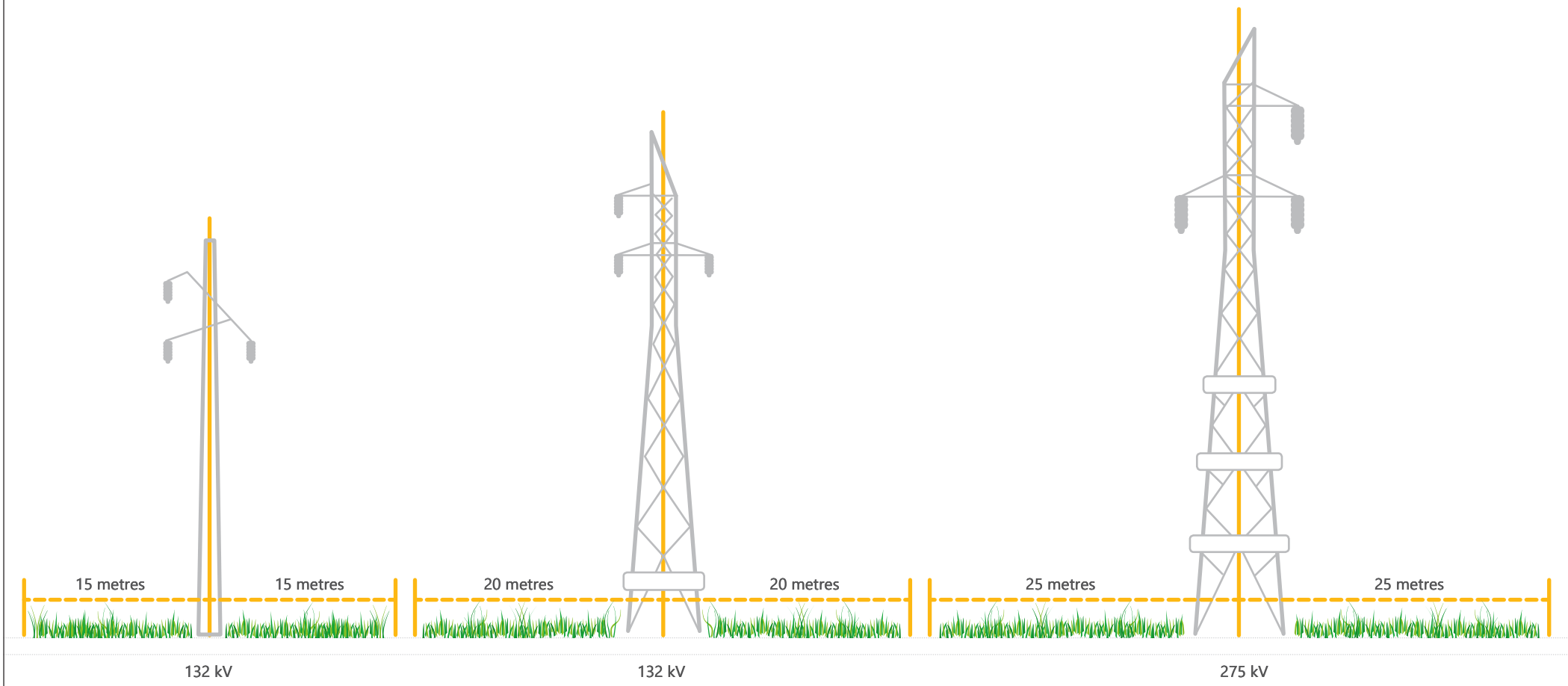
5.4.6 Easements

Appropriate tenure will be obtained for the land crossed by the transmission line, as noted in Section 2.2.2. This may include easements, licences or crossing agreements; for the majority of land on the alignment, it will consist of easements.

An easement is a property right that allows the proponent to build, own and maintain the transmission line. Easements are permanent and will be registered on the relevant land title and will remain part of the land and title regardless of changes in ownership.

The width of a typical easement varies between 40 m and 100 m, depending upon the voltage of the transmission line being erected overhead and the type of support structure proposed (see Figure 5.8).

An easement or Right of Way (ROW) provides a safety clearance margin between the high-voltage transmission lines and surrounding structures and vegetation, and provides a path for ground-based inspections and access to transmission towers for repairs and maintenance. Generally, the ROW will consist of native vegetation or plants, though in some instances, access tracks constitute a portion of the ROW.



Source: ElectraNet

Figure 5.8: Minimum Transmission Line Easement Widths

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

5.5 Construction

The following sections outline the typical construction activities for a transmission line. Construction typically proceeds in a linear fashion along the easement. It is likely that construction activities will proceed on several concurrent fronts.

5.5.1 Access Preparation

Access tracks are established using bulldozers and graders to clear any vegetation present and provide a trafficable surface. As discussed in Section 5.4.5, light grading is often suitable preparation, however some areas may need capping with imported material. In areas of stony 'gibber' soils, the surface stone cover may be left in place where feasible, with light grading or use of rollers implemented to remove larger rocks and create a trafficable surface. In sandy areas, bulldozers may be used to pull equipment and plant along the easement.

5.5.2 Clearance of Work Areas

Vegetation at tower locations will be cleared or rolled to allow tower installation and cleared vegetation stockpiled for use in rehabilitation where required. Large lattice towers generally require a cleared construction working area of approximately 50 m x 50 m. In more sensitive areas this can potentially be reduced to approximately 30 m x 30 m. Monopoles would typically require a construction working area approximately 40 m x 40 m, however this can potentially be reduced in specific identified cases to approximately 30 m x 30 m.

Additional cleared areas will be required at winch sites for stringing. Two areas of approximately 50 m x 50 m will be required at strain structure locations, indicatively every 3 km to 5 km but dependent upon terrain and number of direction changes.

During cable stringing, depending upon the construction method (such as helicopter stringing or land-based stringing), there may be a need to clear or roll a narrow path between structures to enable pulling of the draw wire. If this is required, such a track would most likely (depending up terrain) become the long-term maintenance access track. Wherever possible, vegetation clearance will be avoided for the stringing easement.

Vegetation assessments, including canopy height measurement, are used during the detailed engineering phase to design the line profile. Where possible, conductor heights will be set to avoid or minimise vegetation clearance both during construction and ongoing maintenance. Where vegetation clearance is unavoidable and to minimise the risk of power outages, damage to transmission lines or fire starts, vegetation management works are undertaken to make sure that clearance distances between vegetation and transmission lines are established and maintained in accordance with the *Electricity (Principles of Vegetation Clearance) Regulations 2010* (SA) (see Figure 5.9). As much of the open woodland and scrubland vegetation (where present on the alignment) is relatively low, slow growing and at mature height, it is possible that it can be spanned across with minimal clearance required. If this is not possible, some clearance or lopping of trees may be required under the conductors in some areas. This will be confirmed when LIDAR data is collected and detailed line design is undertaken.

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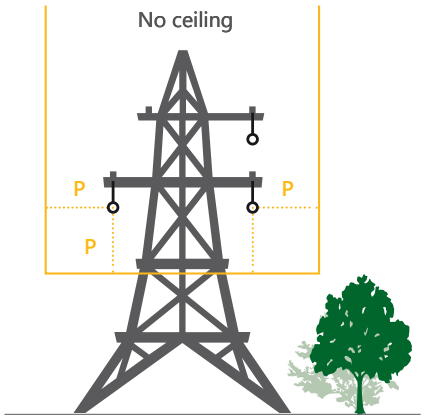
At the structure

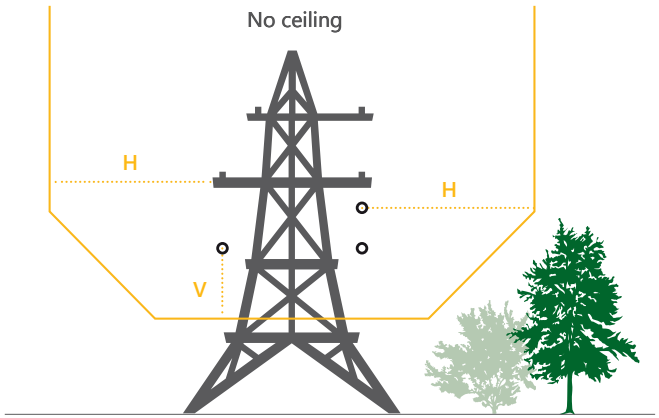


132 kV 'P' = 2.5 metres

275 kV 'P' = 4.5 metres

Clearance at structures is a constant for both 132 kV and 275 kV for all types of towers.
The clearance zone has no ceiling.

At mid span

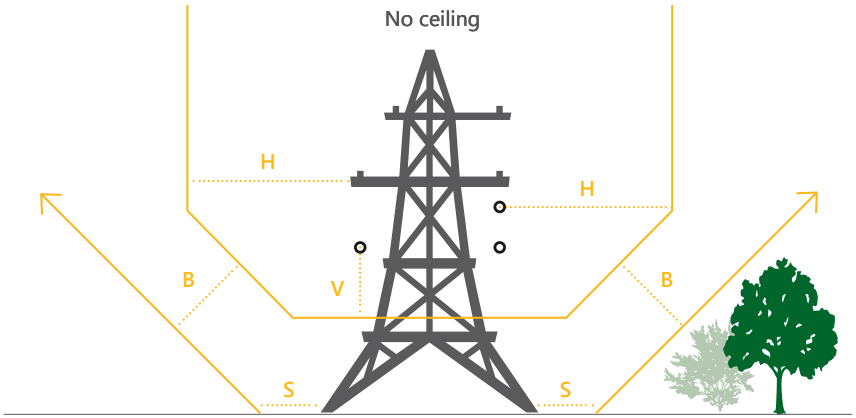


V = Vertical clearance, measured from the bottom of the conductor at mid span at 15˚C

H = Horizontal clearance at mid span

Clearances have increased in size to account for the sag and swing of the conductor.
A 45˚ element has also been included.
V and H are variable and depend on length of the span between towers.

Buffer zone at mid span



132 kV 'B' = 3 metres

275 kV 'B' = 3 metres

A buffer zone is an extension of the vegetation clearance zone, to allow for natural growth while still allowing the clearance zone to remain clear until the next trimming is due.
S is a variable factor which increases with the length of the span between towers.

Source: ElectraNet

Figure 5.9: Vegetation Clearance Profile

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

5.5.3 Stockpiles

The temporary stockpiling of topsoils and subsoils may be required during the construction phase of the Project, specifically for the establishment of lattice tower or monopole sites and for laydown areas along the linear corridor. As described in Section 5.5.2, each tower and conductor stringing site would nominally require approximately 50 m x 50 m of clearance. Assuming the average depth of the clearance is approximately 100 mm, each tower would require a temporary stockpile of around 250 m^3, with stockpiles limited to approximately 2 m in height, and approximately 15 m x 15 m in area, with the exact dimensions varying to fit within the available cleared area (i.e. no further land disturbance is required for the stockpiles). Stockpiles would be located outside of defined watercourses to reduce the potential for surface water erosion impacts to creeklines, and may be temporarily covered with cleared vegetation to reduce the potential for wind erosion.

Following the completion of construction activities, the stockpiled topsoil and subsoil would be respread over the cleared area with the cleared vegetation, and the sites left to naturally revegetate.

5.5.4 Foundations

Excavations for tower foundations are typically dug using equipment such as excavators or borers. Blasting or pile driving may sometimes be used in areas where it is dictated by the geology, however these are not expected to be extensively required. Soil from excavations for foundations is typically spread at the tower site if suitable, or it may be used off site (e.g. for capping or used by the landowner).

Concrete for the foundations is likely to be supplied by a batching truck travelling between movable concrete batching plants. The location of such plant along the route is not yet known and will be determined once the construction contractor is engaged.

5.5.5 Tower Assembly and Installation

Lattice towers are expected to be partially fabricated off site and transported to the tower locations in sections for final assembly and erection. Monopoles are delivered to site in sections. Mobile cranes are used to lift tower sections into place for final assembly (see Plate 5.6). Insulators and fittings would be attached to the tower and sheaves attached to the crossarms for stringing.

5.5.6 Cable Stringing

Conductors may be installed using land-based or helicopter stringing techniques. Land-based tension stringing using a drum and winch involves running steel draw wires out on the ground from a moving vehicle and lifting them into running blocks on the towers. Conductors are pulled well clear of the ground and vegetation under tension using a winch. Tension is maintained by braking apparatus located with the conductor drums (see Plate 5.6). The conductors are held in tension in the sheaves for up to two weeks for the wires bed in before final adjustment, cutting and dead-ending at tension positions on suspension towers.

Helicopter stringing (see Plate 5.7) involves pulling the draw wire from winch point to each tower and through to the next strain location. This method can save time and minimise ground impacts but generally has less favourable economics.

Plate 5.6: Indicative Pole Construction and Line Stringing

Plate 5.7: Helicopter Stringing

5.5.7 Commissioning

The commissioning phase involves a series of inspections to check aspects such as phases, line clearances, connections, joints, towers/poles, earthing, line sags and communications prior to energisation of the line.

5.5.8 Clean-up and Rehabilitation

Areas of temporary disturbance such as laydowns would be cleaned up and rehabilitated. Rehabilitation would involve removal of construction material and waste, surface contouring and scarifying where required, and respreading of topsoil and cleared vegetation to encourage natural recruitment of vegetation. Rehabilitated sites are monitored during operations for soil stability, presence of weeds and vegetation recruitment success and remedial measures undertaken where required, including active reseeding should this be required.

5.5.9 Laydown Areas

Several temporary laydown and storage areas, each of approximately 1 ha, will be required along the transmission line corridor. These areas would be used for temporary storage of materials and equipment. They may also form a mobile construction depot and include temporary offices and ablution facilities and moveable concrete batching plants.

Several larger temporary yards / "facilities areas" of up to 10 ha in area are also likely to be used during construction. These areas would typically house a construction camp, offices, water storage (e.g. tanks or turkeys nests), laydown areas, fuel storage, machinery and equipment storage and maintenance areas, tower fabrication areas and a concrete batching plant. One potential location near the southern end of the transmission line has been identified in consultation with landowners (see Figure 5.10) and one or more further locations are likely to be required towards the northern end of the transmission line, from the vicinity of Mount Gunson South Substation northwards. The final size and location of these larger temporary yards would be determined during detailed construction planning and landholder negotiations.

Temporary laydown and storage yards would typically be in areas with limited native vegetation and would be prepared by lightly grading to form a level surface. Imported material may be used to cap the surface if the natural soil does not provide a suitable substrate.

Following construction, these areas would be rehabilitated by removing construction material and waste, surface contouring where required and respreading topsoil and cleared vegetation.

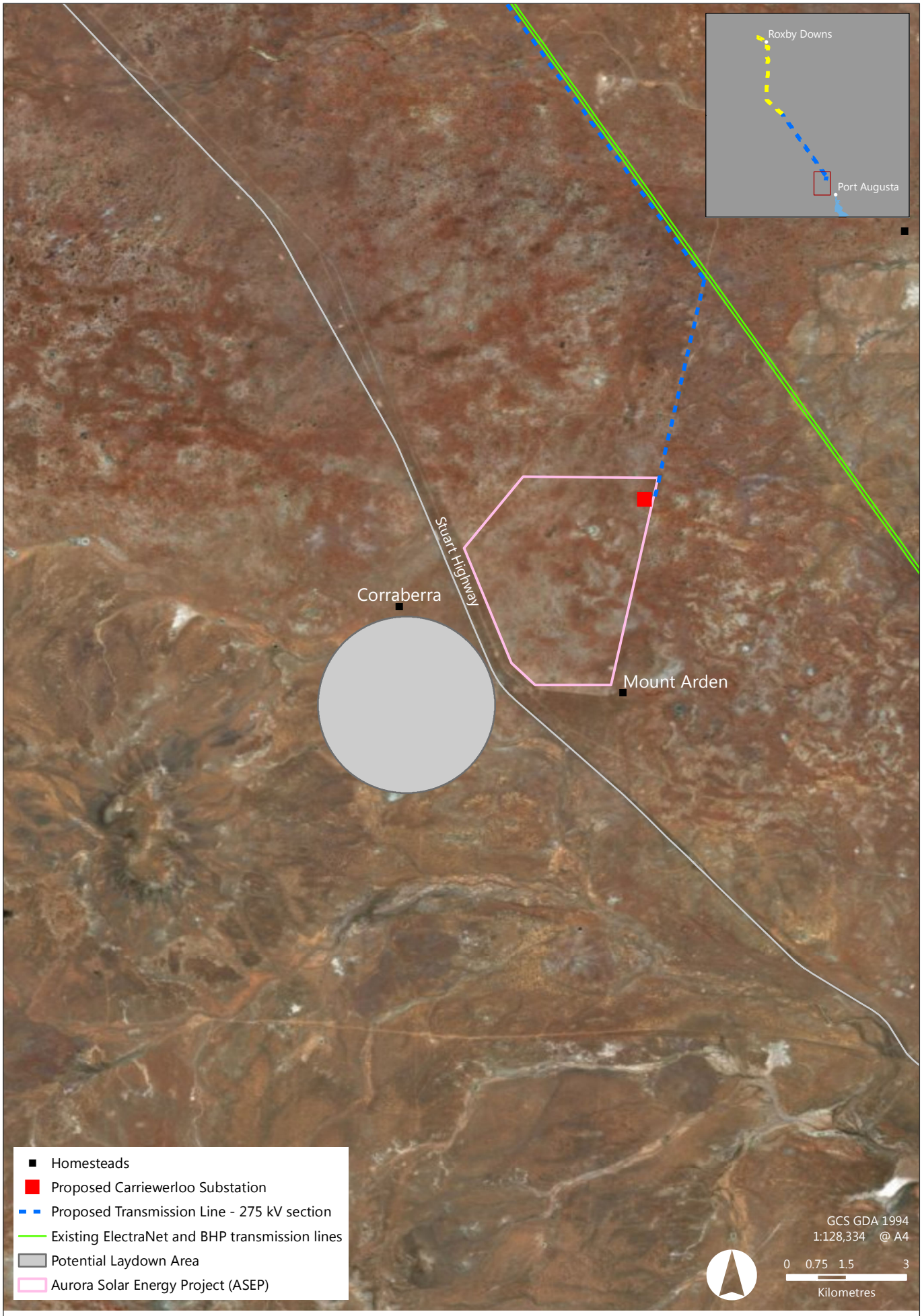


Figure 5.10: Location of Potential Laydown Area Near Southern End of Transmission Line

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

5.5.10 Water Supply During Construction

Construction would require up to approximately 65 ML of water in total, consisting of approximately 15 ML (an average of approximately 41,500 litres per day) of potable water for use in concrete manufacture and workforce ablutions and drinking water and 50 ML (an average of approximately 140,000 litres per day) of lower quality water to assist in compaction of the foundations at tower sites and for dust suppression of cleared areas along the easement.

The water is likely to be obtained from a range of sources, including existing and new groundwater wells and the South Australian potable water network (e.g. the existing Woomera pipeline and proposed SolarReserve water pipeline). Water may be stored in large, temporary aboveground storages (e.g. water tanks or turkeys nests), which would be removed after use or ownership transferred to the landowner.

5.5.11 Borrow Material

Approximately 20,000 m^3 of material including clay, crushed rock and aggregate would be required for construction. Borrow material and crushed rock (e.g. for concrete manufacture) would be obtained from a range of sources including commercial suppliers, existing approved borrow pits or new borrow pits with appropriate approvals in place (e.g. Extractive Minerals Leases) where required.

5.5.12 Transport

Infrastructure would be transported from a port (most likely Port Adelaide) and unloaded at laydown/assembly areas or transported directly to the easement. Standard trucks would generally be used, with most of the materials for the Project expected to be transported in semi-trailers, with no or very few oversize loads required. Following engagement of the construction contractor, Traffic Management Plan(s) will be prepared detailing aspects such as approximate numbers of loads, sizes of trucks, routes, timing and traffic management requirements.

Preliminary estimates of traffic movements for construction are provided in Table 5.1.

Table 5.1: Traffic Movement Estimates for Project Construction[A]

Item	Vehicle Type	Total Number of Loads	Comments
275 kV Section			
Towers	Semi-trailer	230[B]	1 load per tower
Conductors, insulators and hardware	Semi-trailer	32	
Concrete	Concrete truck	930	4 deliveries per tower
Construction equipment	Cranes, dozers, graders, excavators etc	10-20	Generally, remain on alignment
Light vehicles	4WD vehicles, light trucks	15 – 20 per day	
Other (including water, borrow material, camp supplies)	Truck (various)	Several per day	
132 kV Section			
Towers	Semi-trailer	185[B]	550 poles, 3 poles per semi
Conductors, insulators and hardware	Semi-trailer	45	
Concrete	Concrete truck	1000	Estimate 2 trucks per pole
Construction equipment	Cranes, dozers, graders, excavators etc	10 – 20	Generally, remain on alignment
Light vehicles	4WD vehicles, light trucks	15 – 20 per day	
Other e.g. water, borrow material, camp supplies	Truck (various)	Several per day	

A. Construction period will be approximately 9 months for 275 kV, 12 months for 132 kV
B. Deliveries of towers to site depots from Port Adelaide would typically involve 30 – 40 semi-trailer loads over several days for each shipment.

5.5.13 Construction Workforce, Accommodation and Hours

Depending on construction staging, it is likely that a peak workforce of approximately 200 people would be required for the construction of the line. The construction of each section (i.e. the 275 kV and the 132 kV sections) are expected to require a peak workforce of approximately 80 to 100 people each. Temporary facilities such as crib rooms and sanitary facilities would be provided at mobile construction depots and at some tower construction sites.

The workforce is expected to be accommodated at temporary accommodation camps, as there is limited accommodation along the alignment and availability of accommodation is expected to be low due to the large number of projects occurring in the region (particularly in Port Augusta).

Camps will be located at the temporary yards discussed in Section 5.5.9, and would include accommodation and office buildings, sewage treatment systems and possibly mobile reverse osmosis plants for water treatment.

Construction hours are typically 12-hour shifts, from 6am to 6pm seven days per week. Depending on construction scheduling, some work may need to occasionally be undertaken outside these hours.

5.6 Operation / Maintenance

Very little ongoing maintenance is likely to be required for the transmission line. Access tracks to the transmission line towers would be retained for inspection and maintenance activities, predominantly by light 4WD vehicles. Maintenance programs would typically involve two visual inspections per year for signs of unusual wear, corrosion or damage. Bird nest removal is undertaken where required, in accordance with permits obtained under the *National Parks and Wildlife Act 1972* (SA). Helicopter-based inspections would be undertaken annually. A more detailed inspection by vehicle would occur about every four years. Insulators would typically be replaced every 25 years.

Extensive vegetation maintenance on the easement during operations is not expected to be required as vegetation present is generally slow growing and at mature height (as discussed in Section 5.5.2).

5.7 Decommissioning

The design life of a transmission line, with appropriate maintenance, is approximately 40 to 50 years after which time options for its future use will be evaluated by ElectraNet in consultation with the State Government and other parties.

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6 SOIL AND LANDFORM

6.1 Existing Environment

6.1.1 Regional Context

The Project is located within the Stuart Shelf geological province, a relatively thin sequence of sedimentary rocks that lie above the Gawler Craton. The Gawler Craton is geologically stable, having not been substantially deformed or remobilised since Proterozoic times (Parker, 1993). The most significant sedimentary rocks of the Stuart Shelf include the Andamooka Limestone and the Tent Hill Formation.

The Project is situated within the Gawler Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion[1], and crosses three IBRA Subregions; Arcoona Plateau, Gawler Lakes and Roxby (see Table 6.1 and Figure 6.1). The Gawler Bioregion comprises one quarter of South Australia's Pastoral Rangelands, encompassing an area of 123,070 km^2 and is characterised by flat-topped to broadly rounded hills of the Gawler Range Volcanics and Proterozoic sediments, low plateaux on sandstone and quartzite with an undulating surface of aeolian sand or gibbers and rocky quartzite hills with colluvial footslopes, erosional and depositional plains and salt encrusted lake beds. Spinifex grasslands, open woodlands and chenopod shrubs occur on shallow loams, calcareous earths and hard red duplex soils.

Landforms across the Study Area comprise gently undulating calcareous plains with quartzite uplands and zones of salt lakes. Sand dunes overlie the calcareous plains in the central part of the Study Area.

Table 6.1: IBRA Subregions Traversed by the Transmission Line

IBRA Subregion	Description
Arcoona Plateau	Dissected stony tablelands and plains made up of a series of low plateaux on sandstone and quartzite with an undulating surface of aeolian sand or gibbers over red duplex soils, and rocky quartzite hills with colluvial footslopes. There is a cover of low chenopod shrubland, *Acacia victoriae* tall shrubland with a chenopod shrub understorey and fringing *Acacia papyrocarpa* woodland. Approximately 99% (1,077,028 ha) of the subregion is mapped as remnant native vegetation, of which 1% (710 ha) is formally conserved. Sub-region consists of a dissected sandstone plateau with a bold eastern escarpment. Surface is undulating to hilly and often gibber-covered, particularly in the east, and consists of crusty red duplex soils and red calcareous loams. Vegetation is generally chenopod shrublands.

[1] Bioregions and subregions are defined by the Interim Biogeographic Regionalisation for Australia (IBRA) Version 7.0. Bioregions are broad landscape units based on major geomorphic features.

IBRA Subregion	Description
Gawler Lakes	An undulating upland plain underlain by quartzite and sandstone, with shallow loamy soils. Encompasses the Woomera plateau, which is characterised by the absence of trees and tall shrubs, except on floodplains, where mulga (*Acacia aneura*), bullock bush (*Alectryon oleifolius ssp. canescens*), occasional red gums (*Eucalyptus camaldulensis*) and other species may be found. The gibber-covered areas are either bare or carry a scattered growth of samphire (*Tecticornia* sp.) and bindyi (*Sclerolaena* sp.). The depositional plains to the south and southwest of the plateau are covered with deep calcareous earths characteristically carrying an open myall (*Acacia papyrocarpa*) woodland with a bluebush (*Maireana sedifolia*) understorey, or red aeolian sand sheets and dunes with open mulga shrubland or a low woodland of *Casuarina pauper* or *Callitris glaucophylla*. Approximately 62% (1,271,089 ha) of the subregion is mapped as remnant native vegetation, of which 2% (30,615 ha) is formally conserved. Undulating plains are overlain with sand sheets and dunes, with occasional silcrete-capped rises with brown calcareous earths, crusty loamy soils with red clayey subsoils, Sand soils, brown and red, shallow dense loams.
Roxby	Generally undulating terrain with mesas and buttes and some seasonally swampy saline areas. Dunefields cover calcareous plains and are vegetated with native pine and mulga woodland over hopbush, woollybutt and kerosene grass. Also present are swales of mulga woodland over sandhill wattle, hopbush and grasses; myall woodland plains over pearl bluebush and limestone copperburr, flats of saltbush, starbush and sea-heath and swamps of tea-tree, canegrass or lignum. Approximately 98% (1,375,681 ha) of the subregion is mapped as remnant native vegetation, of which none is formally conserved. Brown calcareous earths cover variable stone and gravel mantle. Some low silcrete-capped hills are present as well as evaporite deposits of gypsum and halite. And sand silt and clay deposits in lowlands

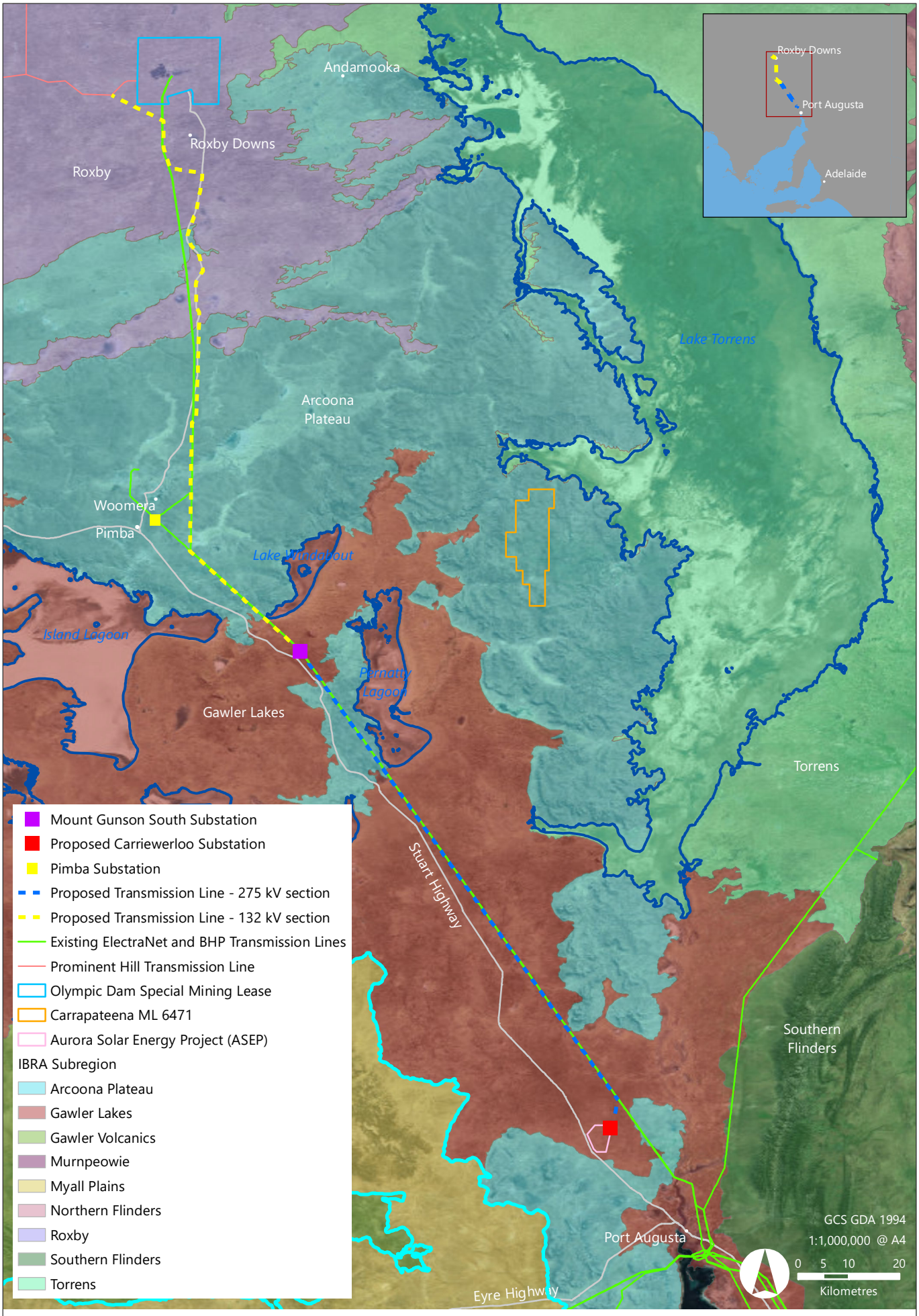

Figure 6.1: IBRA Subregions

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

6.1.2 Climate

The Project lies in an arid to semi-arid region, subject to hot summers and cool to mild winters. Temperatures are consistently higher in the north, with average monthly summer maximums reaching 37°C at Roxby Downs, compared to 34°C at both Woomera and Port Augusta (BoM, 2018, see Table 6.2).

Rainfall in the Study Area is low, with no clear seasonal pattern. Rainfall is unpredictable and sporadic throughout the year, often occurring in intense short bursts. Average annual rainfall at Roxby Downs, Woomera and Port Augusta is 150 mm, 184 mm and 220 mm respectively. The average number of rain days per year is between 22 (Roxby Downs) and 35 (Port Augusta), though this can vary considerably from year-to-year.

Table 6.2: Climate Records for Weather Stations in Proximity to the Proposed Transmission Line

	J	F	M	A	M	J	J	A	S	O	N	D
Roxby (Olympic Dam Aerodrome) Station #016096 (1997-2017)												
Mean Daily Max (°C)	37.1	35.9	32.2	27.1	22.4	18.5	18.6	20.9	25.3	28.6	32.2	34.5
Mean Daily Min (°C)	21.2	20.3	17.1	12.7	8.3	5.2	4.2	5.4	9.3	12.6	16.5	18.8
Mean monthly rainfall (mm)	13.8	19.0	6.8	18.7	9.3	16.4	6.7	9.4	9.4	11.7	14.0	17.2
Woomera (Aerodrome) Station #016001 (1949-2017)												
Mean Daily Max (°C)	34.6	33.8	30.5	25.5	20.7	17.4	17.0	19.0	22.7	26.4	29.9	32.4
Mean Daily Min (°C)	19.6	19.4	16.9	13.1	9.5	6.7	5.8	6.8	9.5	12.4	15.5	17.7
Mean monthly rainfall (mm)	16.1	19.6	13.2	12.4	18.1	16.1	14.5	13.3	14.5	15.1	16.4	14.4
Port Augusta (Aerodrome) Station #018201 (2001-2017)												
Mean Daily Max (°C)	34.2	33.2	30.6	26.6	21.7	18.0	17.8	20.0	24.0	27.2	30.5	32.3
Mean Daily Min (°C)	19.5	18.8	16.6	13.0	8.8	6.0	4.6	5.3	8.4	11.7	15.5	17.2
Mean monthly rainfall (mm)	14.2	17.1	15.5	22.4	17.1	24.5	16.7	15.4	18.6	16.0	20.2	25.7

6.1.3 Topography

The majority of the transmission corridor comprises sand sheets and clay plains with low topographic relief. Around the Pimba area, between Mount Gunson and Purple Downs, the Arcoona Plateau presents an undulating tableland with maximum elevations of 194 m. The highest point in the vicinity of the transmission corridor is an unnamed hill in the Arcoona area (194 m AHD), located approximately 45 km south east of Pimba. Topography across the transmission corridor is shown in Figure 6.2 (275 kV section) and Figure 6.3 (132 kV section).

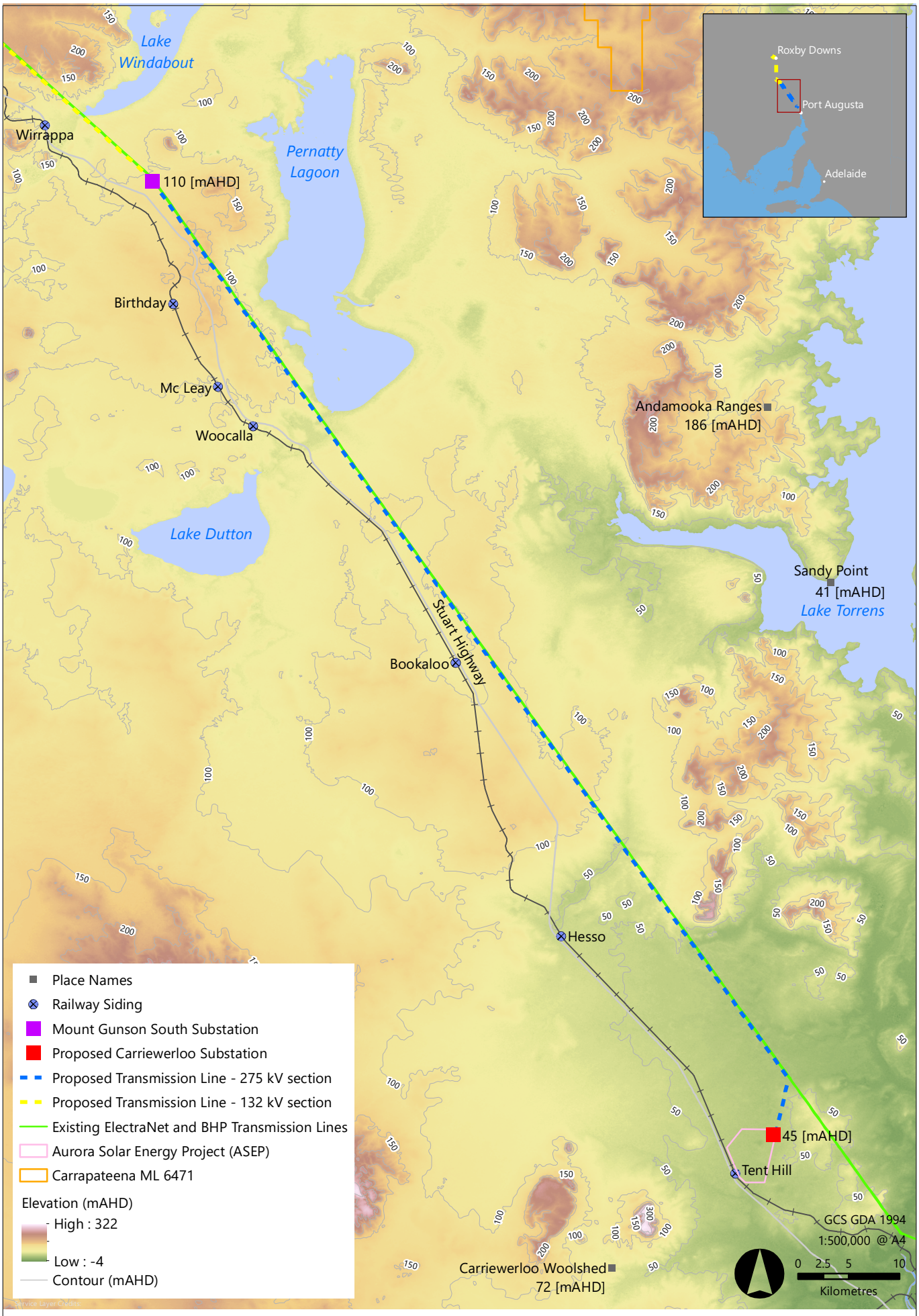

Figure 6.2: Topography of the Proposed Transmission Line 275 kV section

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

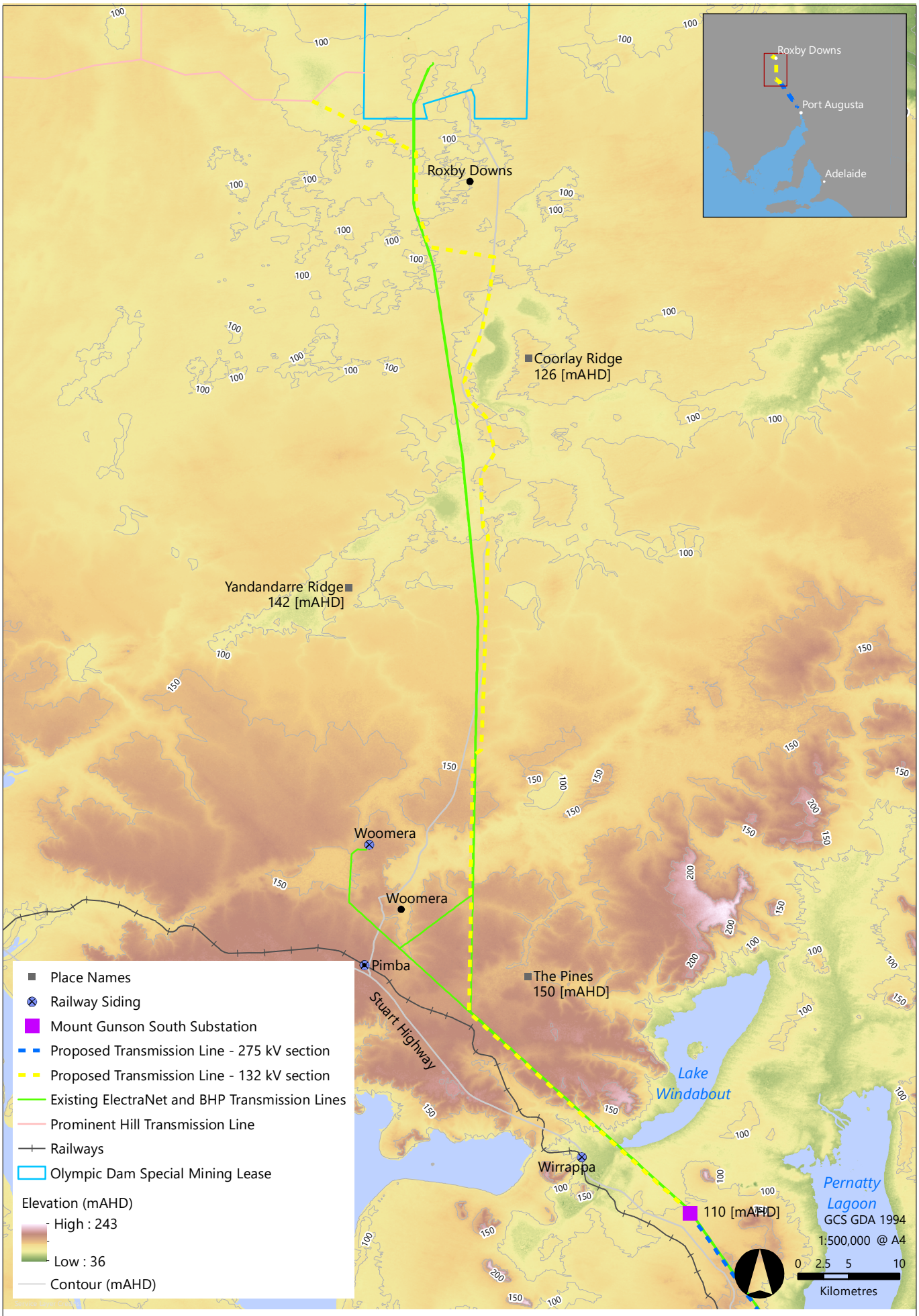

Figure 6.3: Topography of the Proposed Transmission Line 132 kV section

6.1.4 Land Systems

The proposed transmission line traverses several land systems (see Figure 6.4, Figure 6.5, Plate 6.1 and Table 6.3). Land systems are an area, or group of areas, throughout which there is a recurring pattern of geology, topography, soils and vegetation, based on the SA Land Systems data that was developed by the SA Department for Environment and Water (DEW) as part of land system mapping of the pastoral areas of South Australia (Naturemaps, 2018). They provide a finer level of detail of environmental description than IBRA Subregions.

From Roxby Downs south to Pimba these land systems typically comprise dunefields and plains as well as undulating tablelands. The area between Pimba and Port Augusta is predominantly made up of sand sheets and plains with low topographic relief.

Table 6.3: Land Systems Present Across the Project Area

Land System	Description	Coverage (% transmission line length)
Arcoona	Arcoona tablelands. Broad, gently undulating gibber plateau, grading to steep marginal slopes in the south. Vegetation includes bladder saltbush, neverfail, plover daisy and glasswort; escarpments of bladder saltbush, glasswort and woolly bluebush; swamps of blackbush, nitre goosefoot, cottonbush or canegrass and watercourses of dead finish	34.5% (81.3 km)
Bowen	Stony rises of bladder saltbush low shrubland with slender glasswort; plains and rises of pearl bluebush shrubland with brilliant hopbush, saltbush and spiny goosefoot; salt lakes fringed with samphire, bladder saltbush and star bush	1% (3.1 km)
Hesso	Extensive sand sheets with calcareous soils. Plains of myall, sugarwood woodland over pearl bluebush +/- bladder saltbush; and plains and rises of mulga and myall woodland with pin bush wattle, pearl bluebush and spiny fan flower	27% (63.5 km)
Roxby	Extensive dunefield over undulating calcareous plains, and low gibber (rock) capped rises. Dunes of native pine and mulga woodland over hopbush, woolly butt and kerosene grass; swales of mulga woodland over sandhill wattle, hopbush and grasses; and myall woodland plains over pearl bluebush and limestone copperburr; flats of saltbush, star bush and sea-heath with swamps of tea-tree, canegrass or lignum	35% (83.6 km)
Torrens	Salt lake shoreline. Salt crusted lake bed; flats and lake fringes of bladder saltbush, starbush or samphire; and lunettes of sandhill wattle and narrow-leaf hopbush over grasses	1% (2.3 km)
Yorkey	Saline sand plain. Dunes of mulga, myall or northern native pine over narrow-leaf hopbush and blackbush; swales of blackbush, slender glasswort and bladder saltbush; sandy flats of myall open woodland over blackbush, bladder and bitter saltbushes; and salt pans and fringing samphire flats	1% (2.5 km)

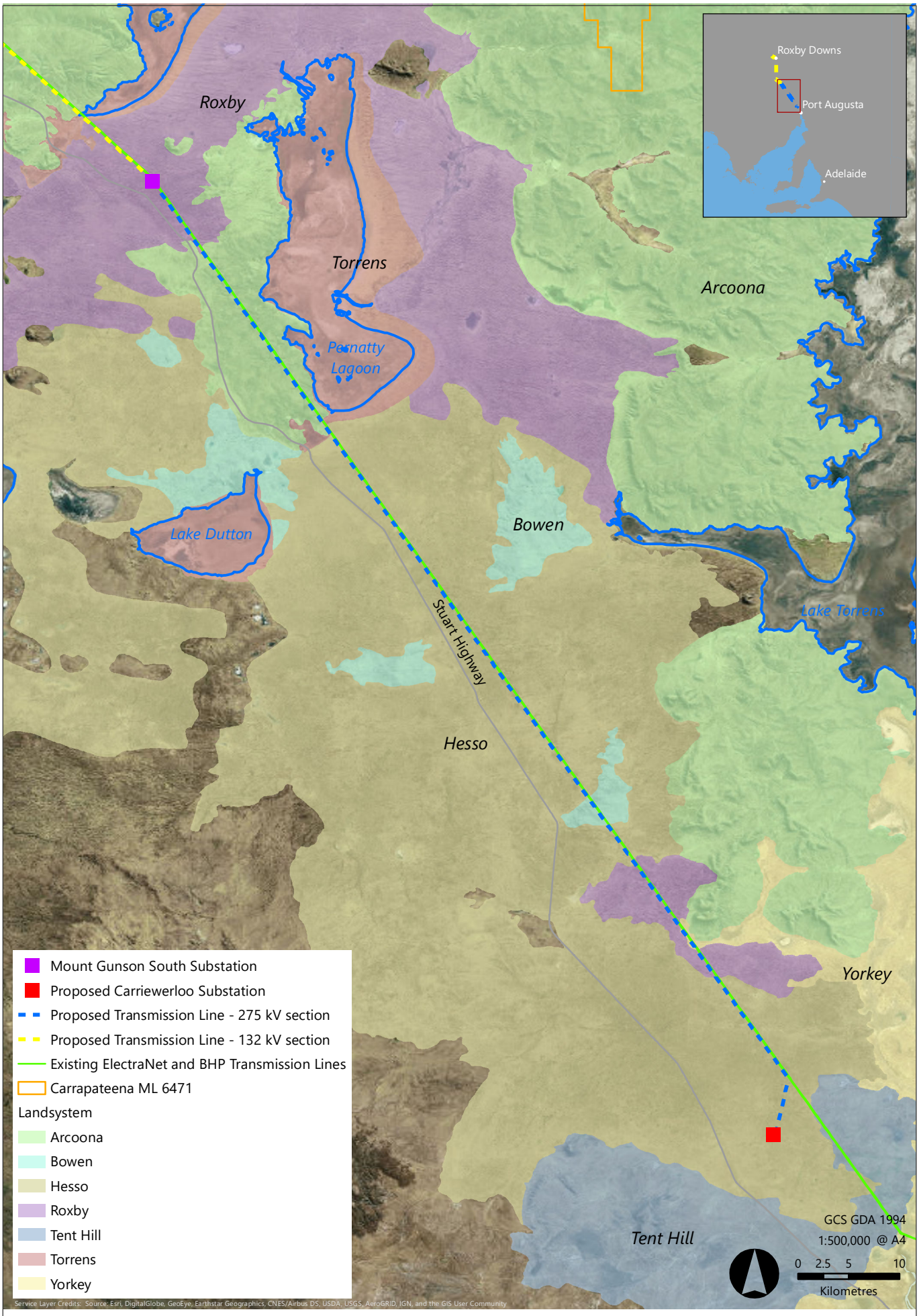

Figure 6.4: Land Systems of the Proposed Transmission Line 275 kV section

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

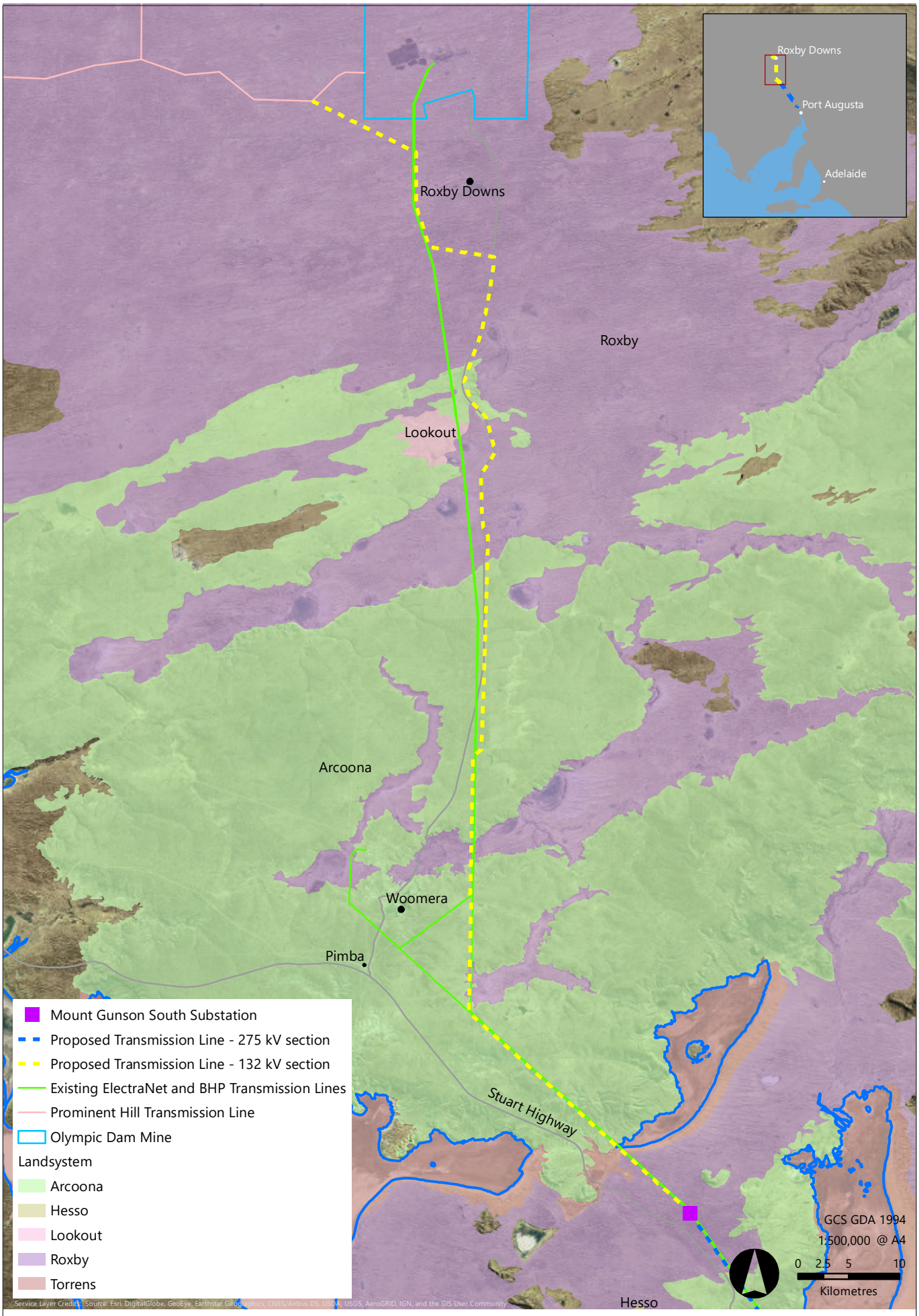

Figure 6.5: Land Systems of the Proposed Transmission Line 132 kV section

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

Plate 6.1: Key Land Systems within the Project Area

6.1.5 Soils

Soils along the proposed transmission line are varied and include sands on dunes and plains, shallow duplex soils overlying Arcoona Quartzite or Bulldog Shale, calcareous clays, silts and sands on salt lakes and alluvial sands with some clays and silts. Soil units along the transmission alignment are described in Table 6.4.

These descriptions are based primarily on information presented for the Olympic Dam southern infrastructure corridor (which aligns with the Study Area) in the Olympic Dam Expansion EIS (BHP Billiton, 2009). The BHP Billiton (2009) descriptions were informed by desktop assessment and soil sampling along the corridor. Additional geotechnical assessment is planned to be undertaken for the proposed transmission line in the detailed design phase.

Table 6.4: Soil Unit Descriptions

Soil Unit	Coverage in Study Area	General Description	General Soil Characteristics	Soil Landscape[1]	Land System
Sand dunes with interdunal clay pans	From Olympic Dam to approximately 15 km south of Purple Downs pastoral station	Red to reddish brown sand dunes Interdunal clayey soils with gibber surface rock and little vegetation Clay pans generally have no surface rock and are devoid of vegetation	Sands: highly permeable, alkaline Clays: expansive and low permeability when wet, cracking under low moisture conditions, alkaline, forms a hard surface skin	Brown calcareous earths (Gc)	Roxby
Shallow soils overlying Arcoona Quartzite and Bulldog Shale	South of Purple Downs to Lake Windabout	Thin fine-grained topsoil (~100 mm) with gibber surface rocks over heavy clays	Highly expansive clays, low permeability when wet, slightly alkaline Shrink-swell movements of the clayey soils have formed distinct mounds and depressions called gilgai	Crusty loamy soils with red clayey subsoils (Dr1)	Arcoona
Salt lakes and deposits	Found predominantly to the north of Port Augusta e.g. Lake Windabout, Ironstone Lagoon	Salt crust overlying, clays, silts and quartz sands, or grey, plastic muds	Calcareous, neutral to alkaline	Lakes	Torrens (north of Port Augusta)

Soil Unit	Coverage in Study Area	General Description	General Soil Characteristics	Soil Landscape[1]	Land System
Quaternary sandplains and sand dunes	Between Lake Windabout and approximately 20 km north of Port Augusta. Also present to the east of Woomera	Red sandy soils with little or no fines and little or no surface rock	High permeability, low fertility, alkaline	Brown calcareous earths (Gc)	Hesso
Shallow soils overlying Pernatty Grit	Generally found to the west of Pernatty Lagoon	Red sandy topsoil up to 200 mm thick with gibber surface rock, over clay and clay loam	Highly permeable sands. Highly plastic and expansive clays, low permeability when wet, slightly acid to alkaline	Crusty loamy soils with red clayey subsoils (Dr1)	Arcoona
Quaternary soils of alluvial plains	Found between Port Augusta and Whyalla	Alluvial sands with some clays and silts up to 500 mm thick, over clay	Slightly acidic to alkaline	Brown calcareous earths (Gc)	Hesso

[1] As described in the *Atlas of Australian Soils* (CSIRO, 1960 and 1968, cited in BHP Billiton, 2009)

Erosion Potential

Erosion potential (the degree to which soils are prone to erosion) is dependent on the susceptibility of the disturbed soil type to wind velocity, rainfall volume and intensity, and landscape features such as slope and vegetation coverage.

The erosion potential across the Project Area has previously been mapped for the Study Area (BHP Billiton, 2009) based on laboratory testing and field observations of soil properties, landform and erosion features. Erosion potential was classified as low, medium, high or very high for each soil unit in the Study Area (see Figure 6.6 and Table 6.5). The erosion potential is predominantly low to medium along the proposed transmission line. Some areas of high to very high erosion potential have been identified, predominantly near salt lakes, some dunefields and some areas of undulating terrain where removal of surface gravels (gibber) can lead to loss of surface soils.

Table 6.5: Erosion Potential of Soil Units

Soil Unit	Erosion Potential	Description
Sand dunes with interdunal clay pans	Low to high	Dunes highly susceptible to wind erosion. Bare clay pans subject to scalding from surface water.
Shallow soils overlying Arcoona Quartzite and Bulldog Shale	Low	Removal of surface gravels may lead to some minor loss of surface soils.
Salt lakes and deposits	High to very high	Susceptible to gullying and wind erosion when surface cover disturbed.
Quaternary sandplains and sand dunes	Medium to high	Minor gullying associated with drainage features Highly susceptible to wind erosion where surface cover disturbed.
Shallow soils overlying Pernatty Grit	Low	Removal of surface gravels may lead to some minor loss of surface soils.
Quaternary soils of alluvial plains	Low (high to very high at stream crossing)	Stream channels highly susceptible to stream bank erosion. Plains may be susceptible to sheet erosion.

Source: BHP Billiton (2009)

Acid Sulphate Soils

Inland acid sulphate soils form in instances where there is a source of sulphate, iron and organic matter, all of which occur in inland salt lakes. They occur in the form of monosulphides (black ooze) in near-surface sediments (<10 mm) of salt lakes, which if disturbed, can react rapidly to form acid. Previous investigations undertaken by BHP within the Project Area, found only one site (at the inlet to Lake Windabout) with very thin monosulfide layers within the top 5 cm of surficial sediments (BHP Billiton, 2009). There are several salt lakes adjacent to the proposed alignment, and the route traverses low lying areas around Lake Windabout and Pernatty Lagoon where acid sulphate soils potential may be greater.

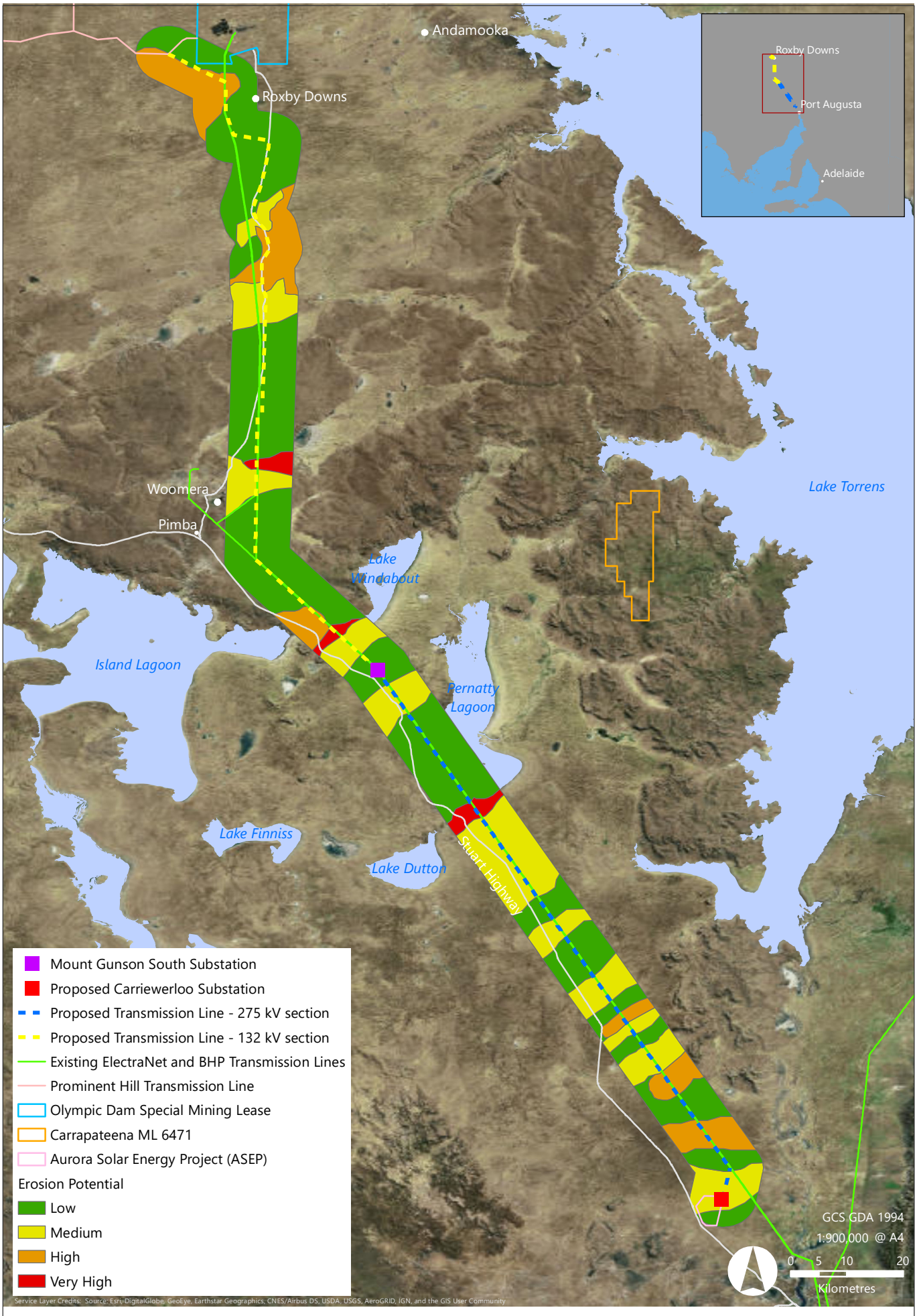

Figure 6.6: Erosion Potential for the Study Area

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

6.2 Impact Assessment

6.2.1 Description of Effects

This section describes the interaction of the Project (Section 5) with the baseline soil environment (Section 6.1.5).

The effects on soil from Project activities, which may subsequently have an impact on receptors, are presented in Table 6.6. These effects are discussed further below. Where the effects impact on ecology and local community (land use) receptors, the impacts are discussed in further detail in the relevant chapters.

The structure of the soil and underlying geology will also influence the installation method and depth of the footings for the transmission structures. Geotechnical investigations will be undertaken to inform the detailed design.

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised below in Section 6.4.

Table 6.6: Soil Potential Effects

Source	Potential Effect	Receptors	ID
Runoff from stockpiles and disturbed surfaces*	Erosion of soils and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water	Aquatic Ecology Terrestrial Ecology Local Communities	SW04 SW05 SW06
Excavation and earthworks	Excavation and earthworks disturb acid sulphate soils leading to generation of acid leachate	Aquatic Ecology Terrestrial Ecology Local Communities	SW07 SW08 SW09
Accidental spills**	Contaminates land (secondary pathways include surface water and groundwater)	Flora Fauna Third-party Users	L01 L21 L22

*Sedimentation effect further discussed in Surface Water (Section 7.2.1)
** Secondary pathways include surface water and groundwater. These unplanned events are discussed in more detail under the primary receptors Land Use (Section 15.3) and Ecology (Section 11.3).

Erosion Potential

Construction activities such as vegetation clearance, excavation and earthworks have the potential to lead to the erosion of soils if exposed to wind or water flows. Clearance, excavation and earthworks will be required for the construction of tower footings, lay down areas, temporary stringing easements, new access tracks, and temporary site facilities (including construction camp).

As described in Section 6.1.5, erosion potential is predominantly low to medium along the transmission line, with areas of higher erosion potential limited to areas in the vicinity of salt lakes, some dunefields and some areas of undulating terrain where removal of surface gravels (gibber) and channelling of overland flows can lead to loss of surface soils.

The areas of disturbance along the alignment have a relatively small and discrete footprint and are sparsely distributed, and groundcover will be retained where possible (e.g. for the stringing easement, if required). The most continuous disturbance will be the access track along the length of the transmission line which will run through some areas more susceptible to erosion (see Figure 6.6). Total disturbance for the Project is conservatively estimated to be 470 ha (refer to discussion in Section 11.2.1). Existing tracks (including the track along the ElectraNet 132 kV line) will be used as far as possible which is likely to significantly reduce this disturbance estimate.

Transmission towers, poles, laydown areas and tracks will be located and constructed to minimise erosion potential. Salt lakes and steeper slopes will be avoided and interdune corridors preferentially used for access as far as practicable. Sediment and erosion control measures will be installed prior to construction where appropriate (e.g. where earthworks are being undertaken in areas of high erosion risk or near watercourses or ephemeral lakes). Drainage features or structures will be installed on the access track where appropriate to prevent erosion during operations and remedial action will be implemented where required. With controls in place, the likelihood for significant erosion to occur will be reduced.

Note: The subsequent potential effect on surface water of sediment transport to watercourses is discussed further under Surface Water in Section 7.2.

Disturbance of Acid Sulphate Soils during Excavation and Earthworks

As discussed in Section 6.1.5, it is possible that some soils within the Project Area, particularly around salt lakes, have the potential to generate acid sulphate soils if disturbed.

Oxidation of potential acid sulphate soils (PASS) material can result in generation of actual acid sulphate soils (AASS), which can release sulphuric acid and iron into the soil and groundwater. This in turn can release nutrients and heavy metals stored within the soil matrix. Once mobilised in this way, the acid, metals and nutrients can seep into waterways, impacting aquatic fauna and vegetation and degrading structures such as concrete, steel pipes and structures.

Previous investigations undertaken by BHP at such sites within the Project Area, found only one site (at the inlet to Lake Windabout) with very thin monosulfide layers within the top 5 cm of surficial sediments (BHP Billiton, 2009). The siting of the transmission structures will avoid this inlet. Even if disturbed, the amount of acid produced by oxidation from the small amount of monosulphides would be minimal (BHP Billiton, 2009), with negligible potential for off-site effects, particularly given that lakes such as Lake Windabout also form a sink for surface water and groundwater flows (BHP Billiton, 2009). Standard practices such as minimising disturbances and lime dosing if required would further limit the potential effect.

Accidental Spills

Accidental spills from the transport, storage and handling of hydrocarbons and chemicals can lead to local contamination of soil. Such an event could have potential secondary effects via surface water or groundwater in regard to land use or habitat for native flora and fauna. Appropriate controls on transport, storage and handling would be implemented.

The presence of accommodation camps and associated waste-water systems/ablution facilities, as well as portable toilets for mobile works has the potential to lead to contamination of soils (and subsequently surface waters) via release of sewage effluent. Appropriate design, siting and management will be implemented, and this is not anticipated to occur.

6.2.2 Effect S-P-R Linkage

The information provided in Table 6.7 identifies the potential impacts related to soil at identified receptors using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor.

Table 6.7: S-P-R Linkage Summary for Soil Effects

Soil Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Erosion of soils and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water impacting on the abundance and/or diversity of aquatic ecology.	Yes	Significant rainfall events may erode disturbed areas and stockpiles resulting in an increase in sediment loads entering local surface water catchments. This could possibly result in a small and localised increase above high background levels and result in localised change in the abundance and diversity of aquatic invertebrates in ephemeral lakes. Note: Impact significance assessment is contained in Section 11.2 (Ecology).	SW04
Erosion of soils and runoff from stockpiles and disturbed surfaces leads to alteration of land surface and increased sedimentation impacting on the abundance and/or diversity of terrestrial ecology	Yes	Significant rainfall events may erode disturbed areas and stockpiles resulting in altered land surfaces and increased sediment loads. This could possibly result in localised alteration to habitat suitability for terrestrial flora and fauna, and a small, localised increase in sediment loads above high background levels which could result in very localised changes in the abundance and diversity of terrestrial species. Note: Impact significance assessment is contained in Section 11.2 (Ecology). Unplanned event is discussed below in Section 6.3 and in Section 11.3 (Ecology).	SW05

Soil Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Erosion of soils and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water impacting on the local community	No	During construction (and to a lesser extent operation) the disturbance of land will result in the potential for discharge of sediments during rainfall events. Given the high natural turbidity, small contribution from the Project Area to surface water catchments, distance to dams or other surface water features used by the community (in addition to the short construction period and the rare occurrence of water volumes suitable for use) the Project is not anticipated to impact surface water used by the local community.	SW06
Excavation and earthworks disturb acid sulphate soils leading to generation of acid leachate impacting on the abundance and/or diversity of aquatic ecology, terrestrial ecology and or impacting local communities	No	Detailed design will ensure that areas of potential acid sulphate soils (PASS) will be avoided. If disturbed, literature indicates that the amount of acid produced by oxidation from the small amount of monosulphides would be minimal (BHP Billiton, 2009), with negligible potential for off-site effects, particularly given that lakes such as Lake Windabout also form a sink for surface water and groundwater flows.	SW07 SW08 SW09
Accidental spills contaminate land (secondary pathways include surface water and groundwater) impacting native flora, fauna and third-party users	No	Hydrocarbons and chemicals will be stored within appropriate containers relevant to the material being stored. An impact can only occur as a result of an unplanned event that results in the uncontrolled release of hydrocarbons or chemicals. Unplanned event is discussed below and in Sections 11.3 (Ecology) and 15.3 (Land Use).	L01 L21 L22

6.2.3 Impact Significance Assessment

This section discusses the significance of potential impacts where a linkage has been identified between the soil effects of the Project and receptors. An impact assessment using the OZ Minerals Impact Assessment Framework has been carried out for each of these potential impacts. These impact assessments are presented in Appendix I. Supporting discussion is provided below.

In accordance with the Impact Assessment Framework, only those potential impacts that have been identified as having an S-P-R linkage (or are found to be "material") have had an impact significance assessment carried out. Potential impacts where there is no identified S-P-R linkage are discussed above in Table 6.7.

Erosion and Runoff

Erosion and runoff from stockpiles and disturbed surfaces may lead to increased sedimentation of surface water and alteration of the land surface. The effect is discussed further in Surface Water Chapter (Section 7.2) and associated impacts to aquatic and terrestrial ecology are covered in the Ecology Chapter (Section 11.2), including an impact significance assessment. Based on the assessment discussed in Section 11.2, the impacts are not significant and are assessed to be low.

6.3 Unplanned Events

Erosion and Sedimentation

Construction outside of design parameters and/or inappropriate application of construction methodologies may lead to potential increase in erosion and sedimentation effects and unplanned indirect impacts to terrestrial and aquatic ecology. Risks to terrestrial ecology from erosion and sedimentation arising from construction activities are assessed in Section 11.3 and have been assessed as low.

Unexpected Disturbance of Acid Sulphate Soils

Uncovering acid sulphate soils that has not been previously identified has the potential to impact aquatic ecology. In the event that unexpected disturbance of acid sulphate soils does occur, management in accordance with relevant guidelines would be undertaken as directed by the Construction Environment Management Plan (CEMP). The risk from unexpected disturbance of acid sulphate soils is assessed in Section 11.3 and has been assessed as low.

Accidental Spills

The risk of soil contamination during construction will be minimised by storage and handling of fuel and chemicals in accordance with relevant standards and guidelines and the implementation of procedures to contain and clean up spills should they occur. Infield refuelling of vehicles would be undertaken only within cleared laydown areas and is expected to be required infrequently. The risk posed by accidental spills during construction or operation is assessed in Sections 11.3 (Ecology) and 15.3 (Land Use) and has been assessed as low.

Further discussion on accidental spills is provided in Sections 7.3 (Surface Water), 8.3 (Groundwater), 11.3 (Ecology) and 15.3 (Land Use).

6.4 Summary of Control and Mitigation Strategies

Table 6.8: Summary of Design Controls

Design Controls	Impact ID
Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards.	L01, L21, L22
Siting of tracks and transmission structures to minimise erosion potential.	SW04, SW05, SW06
Siting of the transmission structures and access track to avoid disturbing identified areas of potential acid sulphate soils as far as possible e.g. Lake Windabout inlet.	SW07, SW08, SW09
Restricting area of disturbance to the minimum necessary.	SW04, SW05, SW06
Existing tracks incorporated into the design as far as possible.	SW04, SW05, SW06
Installation of drainage features or structures where appropriate.	SW04, SW05, SW06

Table 6.9: Summary of Management Controls

Management Controls	Impact ID
Ensure compliance with the land disturbance approval process	SW04, SW05, SW06
Geotechnical investigations undertaken as part of structure foundation design.	SW07, SW08, SW09
Install temporary sediment and erosion controls (e.g. berms, drainage controls, sediment fencing).	SW04, SW05
Access tracks constructed in accordance with industry standards.	SW04, SW05, SW06
Land system and site-specific soil management measures detailed in CEMP.	SW04, SW05, SW06, SW07, SW08, SW09
Any disturbed acid sulphate soil managed in accordance with industry standards (e.g. appropriate soil handling methods and lime dosing rates) as detailed in the CEMP.	SW07, SW08, SW09
Stockpiling of topsoil and cleared vegetation for re-spreading over areas of temporary disturbance.	SW04, SW05, SW06
Rehabilitation procedures.	SW04, SW05, SW06
Spill and emergency response procedures.	L01, L21, L22
Equipment maintenance to prevent spills.	L01, L21, L22
Licensed chemical and waste transporters.	L01, L21, L22
Wastewater managed in accordance with health regulations and Environment Protection (Water Quality) Policy.	L01, L21, L22

7 SURFACE WATER

7.1 Existing Environment

7.1.1 Regional Context

The Project is located in an arid to semi-arid environment. Surface waters in the region are scarce and largely ephemeral, with creek flows occurring for short periods following only significant rainfall events. Rainfall in the region is low but when rain does fall, it is often intense and of short duration and often leads to flooding. Flooding can range from short term surface ponding to widespread flooding leading to Lake Torrens or other terminal surface water features being filled. Rainfall sufficient to create widespread ponding of surface water is not a common occurrence (BHP Billiton, 2009). Ephemeral surface water features, such as Lake Torrens (which has filled only once in the last 100 years (BoM, 2012)), are generally dry salt lakes.

Although scarce, surface waters in the region are of value to pastoralists and native fauna. Following rainfall events, pastoralists may utilise surface waters from dams, providing supply for up to two years (Kinhill-Stearns Roger, 1982, cited in BHP Billiton, 2009). Water ponded in clay pans following storm events provide an important source of water for sheep, cattle and native fauna. However, the high evaporation rates and sporadic nature of rainfall in the region mean surface water is only used opportunistically in the region.

There are no surface water features of formal conservation significance (e.g. Great Artesian Basin (GAB) springs, Ramsar listed wetlands) within the Project Area. The Project Area is not located within an area where the water resource is prescribed under the NRM Act and is not within a water protection area.

7.1.2 Surface Water Features

This section describes existing surface water features in the Project Area, using land system mapping as a basis for characterising drainage patterns. Surface water features in the region are shown in Figure 7.1 and Figure 7.2.

The proposed transmission line alignment traverses six land systems (see Section 6.1), with the Roxby, Arcoona, and Hesso land systems covering the majority (97%) of the alignment. Surface water features and drainage patterns in these land systems are described in detail in Table 7.1.

Broadly, surface drainage in the Project Area is characterised by:

- Extensive flat plains with highly permeable sandy soils in the Hesso land system in the southern section of the proposed alignment (south of Pernatty Lagoon to Port Augusta), which allow rapid infiltration of surface waters. Surface ponding occurs only after significant storm events, however the flat terrain can lead to widespread ponding when such events occur.

- Well defined drainage lines and catchments that have formed several large terminal salt lakes and ephemeral lagoons in the Arcoona land system (which occurs predominantly in the northern section of the proposed alignment). Stone-free areas with cracking clay (gilgai) are an important component of this land system and accept much of the runoff during smaller rainfall events.
- Terminal drainage in many small enclosed catchments between dunes in the Roxby land system. Typically, each catchment includes bounding dunes, an interdune swale and a lower depression within the swale (often a claypan). No defined watercourses are present and surface waters from the small catchments rarely flow into the neighbouring catchments.

The very short sections of the Bowen and Yorkey land systems crossed by the transmission line near the southern end of the alignment are effectively small transitional areas between the Hesso, Arcoona and Roxby land systems and do not introduce any significant additional drainage characteristics. The Torrens land system, which is intercepted where the proposed alignment passes close to Pernatty Lagoon and where it crosses the tail of Lake Windabout, is characterised by the flat beds of the salt lakes and adjacent fringing samphire flats.

Table 7.1: Surface Water Features for Major Land Systems on the Transmission Line

Land System	Surface Water Features
Roxby	The Roxby land system covers 83.6 km of the proposed alignment, predominantly north of Purple Downs. The Roxby land system is characterised by expansive east–west trending dunes that form small, enclosed catchments (10 ha – 300 ha in size). Swales and claypans within interdunal corridors are bound by dune crests. Water infiltrates through sand ridges and drains into the swale and clay pan after being redirected by a thick layer of clayey soil beneath the sand dunes. The less permeable clayey soils of the swales and clay pans collect water in low depressions after significant rainfall. Stormwater within the swales and clay pans infiltrates the surface cracks of the clay soils, causing them to swell. In most instances the swelling of the clay soils reduces infiltration significantly, leading to surface water ponding. Depending on the rainfall event, surface water may stay in the swales and clay pans from a few days to a few weeks, but only rainfall events of a significant intensity and duration result in ponding for more than one month. The ponded water in this land system is generally fresh and of high quality. There are no defined watercourses in the Project Area within the Roxby land system and surface waters from the small catchments very rarely flow into the neighbouring catchments.
Arcoona	Approximately 81.3 km of the proposed alignment lies within the Arcoona land system predominantly between Pernatty Lagoon and Purple Downs. The Arcoona land system has a dendritic drainage pattern radiating from main tablelands, and well-defined catchments that have formed several large terminal salt lakes and ephemeral lagoons. The normal condition for watercourses that drain the plateau is dry, with flow occurring for short periods following only significant rainfall events. Drainage lines are generally broad and poorly defined. Gully erosion, while not extensive, is evident in areas where stormwater flows are concentrated, such as near roadside drains and culverts.

Land System	Surface Water Features
	An ecologically important wetland complex, the Arcoona Lakes, lies between Woomera and Roxby Downs. This complex comprises 11 waterbodies (50 ha – 600 ha) and other smaller swamps between Roxby Downs and Woomera on the Arcoona Tableland. These ephemeral lakes fill and remain inundated only after very high rainfall events (typically every 15 – 20 years). Local catchment characteristics shape the diverse hydrology and water chemistry of the lakes; some are large, shallow and highly saline, while others provide deeper freshwater habitats which remain for several years after filling. The ecology of the Arcoona Lakes is discussed further in Chapter 11.
Hesso	The flat sandy plains of the Hesso system constitute approximately 63.5 km of the proposed alignment between Port Augusta through to just south of Pernatty Lagoon. This system is characterised by extensive flat sandy plains Infiltration is relatively high, and surface ponding occurs only after significant storm events. However, given the flat terrain, surface ponding is widespread when such events occur. Surface water is good quality, generally infiltrating to the groundwater before significant changes in salinity levels can occur.

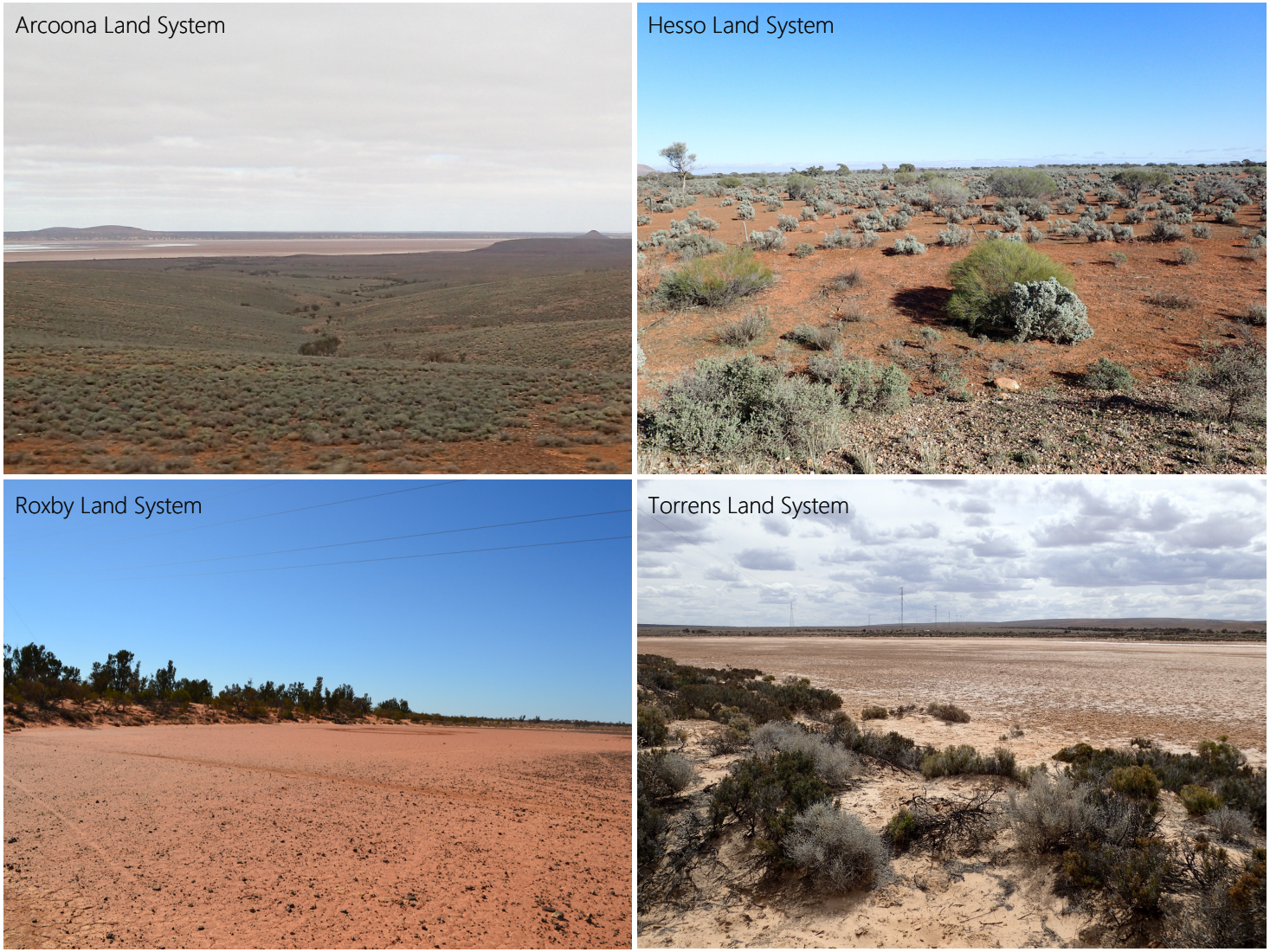

Plate 7.1: Typical Drainage Features of Key Land Systems within the Project Area

The proposed alignment crosses a number of minor ephemeral watercourses, predominantly in the Arcoona land system, which are generally broad and poorly defined. Watercourses on the proposed alignment identified in DEW mapping (DEW, 2015a) are listed in Table 7.1.

Table 7.2: Watercourses in the Project Area (source: DEW, 2015a)

Watercourse (South to North)	Description	Watercourse Crossed by Proposed Alignment
Mason Creek	Minor ephemeral drainage line	Mason Creek drains to Lake Windabout where it is crossed by the proposed transmission line
Wirrawirralu Creek	Minor ephemeral drainage lines	Crossed east of Woomera
Sanders Creek	Minor ephemeral drainage lines	Connects with unnamed watercourse, which is crossed by proposed transmission line
Unnamed watercourses	There are 121 minor ephemeral drainage lines within the Project Area	72 minor ephemeral drainage lines are crossed by the proposed transmission line

There are several salt lakes and ephemeral lagoons in the vicinity of the proposed alignment in the Arcoona and Roxby land systems. The alignment crosses Lake Windabout at its narrow western end (at the same location the existing transmission lines cross the lake). Pernatty Lagoon is approximately 1 km from the proposed alignment, and several of the ephemeral lagoons that form the Arcoona Lakes, including Coorlay Lagoon and Lake Mary, are within 2 km of the alignment. Coorlay Lagoon is approximately 300 m from the proposed alignment along the Olympic Dam Highway at its closest point. The proposed alignment is outside the catchment of Lake Torrens, which is approximately 30 km to the east.

Table 7.3 provides an overview of the ephemeral surface water bodies in the vicinity of the Project Area, identified in DEW mapping (2015b). Plate 7.2 shows the crossing point at Lake Windabout.

Table 7.3: Salt Lakes and Ephemeral Lagoons near the Project Area

Surface Water Features (South to North)	Description	Proximity to Proposed Transmission Line
Monalena or Ironstone Lagoon	Ephemeral lagoon immediately south-west of Pernatty Lagoon. Surface area 320 ha.	0.3 km
Pernatty Lagoon	Ephemeral salt lake, fringed by sand dunes. The largest creeks terminating at Pernatty Lagoon are Elizabeth Creek, which terminates at the northern end of the lagoon, and Pernatty Creek and Yeltacowie Creek that terminate at the south-eastern end of the lagoon. Surface area 209 km^2 and a catchment 1,730 km^2.	1 km
Lake Windabout	Ephemeral salt lake fringed by sand dunes to the south-east and stony tableland to the north-west. Deep Creek, Springs Creek and numerous small creeks, predominantly from the tableland to the west. Surface area 70 km^2.	Transmission line crosses western end (approx. 300 m)
Red Lake	Ephemeral lagoon adjacent to Lake Richardson. Surface area 100 ha.	1.7 km
Lake Richardson	Ephemeral lagoon in the Arcoona Lakes complex. Surface area 582 ha.	5.3 km
Mirage Lagoon (Lake Bessie)	Ephemeral lagoon in the Arcoona Lakes complex. Surface area 258 ha.	2.0 km
Lake Mary	Ephemeral lagoon in the Arcoona Lakes complex. Surface area 159 ha.	0.9 km
Red Swamp	Ephemeral lagoon in the Arcoona Lakes complex. Surface area 250 ha.	2.6 km
Purple Lake	Ephemeral lagoon in the Arcoona Lakes complex. Surface area 53 ha.	2.6 km
Purple Swamp	Ephemeral lagoon in the Arcoona Lakes complex. Surface area 50 ha.	2.5 km
Coorlay Lagoon	Ephemeral lagoon in the Arcoona Lakes complex. Surface area 420 ha.	0.8 km
Lake Blanche	Ephemeral lagoon in Roxby land system, 5 km west of Olympic Dam. Surface area 130 ha.	2.3 km

Source: DEW, 2015b

Plate 7.2: Crossing Point at Lake Windabout

7.1.3 Water Quality

The water quality in ephemeral systems is inherently variable. Following rainfall events, water flowing in watercourses is likely to be fresh, highly turbid and slightly alkaline (BHP Billiton, 2009). Water quality sampling for the nearby Carrapateena Project undertaken by OZ Minerals supports this, with a median background concentration of total suspended solids of 120 mg/L recorded in surface waters.

Turbidity in surface waters generally decreases slowly after flow ceases and water pools, as suspended sediment settles out of the water column.

In the clay pans of the Roxby land system, pooled water (when present) is generally fresh and of high quality. As water enters the cracked surface of the clays, the clay expands, reducing infiltration essentially forming a seal to hold the pooled water. Salinity may increase over time due to evapoconcentration effects. Further south in the Arcoona land system, salinity is highly variable, fluctuating from fresh during rain events, to highly saline as a result of evapoconcentration.

7.1.4 Surface Water Use

Low and irregular rainfall and high evaporation affect the quantity and quality of surface water available in and around the Project Area. Existing resources are limited and often have high salinity levels and are therefore of limited use. Water supply and quality have been identified as critical issues in the Far North and are potential constraints to the economic development of the region (RDAFN, 2013).

In addition to groundwater bore abstraction, many of the stock-water supplies in the region are sourced from dams that capture surface water runoff. Domestic water supplies may be sourced from either rainfall capture or via extraction from the Port Augusta-Woomera pipeline.

Port Augusta, Woomera and Pimba are supplied by reticulated water from the River Murray via the Morgan-Whyalla pipeline. Woomera and Pimba access this water via the Port Augusta-Woomera pipeline (SA Water, 2018). Roxby Downs sources its water from groundwater wells within the Great Artesian Basin, following treatment at Olympic Dam. Other communities rely on a mix of community-maintained bores and rain water. Dams, tanks and bores support stock on pastoral leases.

Regional surface water users are summarised in Table 7.4.

Table 7.4: Surface Water Users

Subject	Summary
Community	There are no permanent surface water bodies in the Project Area. Numerous ephemeral lagoons and salt lakes in the area are intermittently inundated with fresh water following large rainfall events, but these do not provide a source of surface water for the local community. Port Augusta, Woomera and Pimba, are supplied by reticulated water from the River Murray via the Morgan-Whyalla pipeline, and Roxby Downs is supplied by desalinated groundwater. Pastoral dwellings capture small amounts of runoff in rainwater tanks for domestic use. On the rare occasion (approximately every 15 – 20 years) when ephemeral surface water features contain water after storm events, they attract birdlife, which makes the lakes a tourist destination.
Pastoral Industry	Pastoral properties in the region generally source water from local dams that capture surface water runoff or from groundwater bores that abstract from perched aquifer systems. Surface water ponded in clay pans following storm events provide a source of water for stock, though its use is opportunistic due to the high evaporation rates and sporadic nature of rainfall in the region.
Native fauna	Water ponded in clay pans following storm events provide an important source of water for native fauna. However, the high evaporation rates and sporadic nature of rainfall in the region mean that surface water is only used opportunistically in the region. Following large rainfall events (every 15 – 20 years), salt lakes in the area are intermittently inundated and provide habitat for migratory waders and other fauna. In prime conditions, the inland lakes are considered to be of high ecological value (EBS, 2018). See Section 11.1.4 for more detail regarding habitat value of the ephemeral water bodies and Arcoona Lakes.

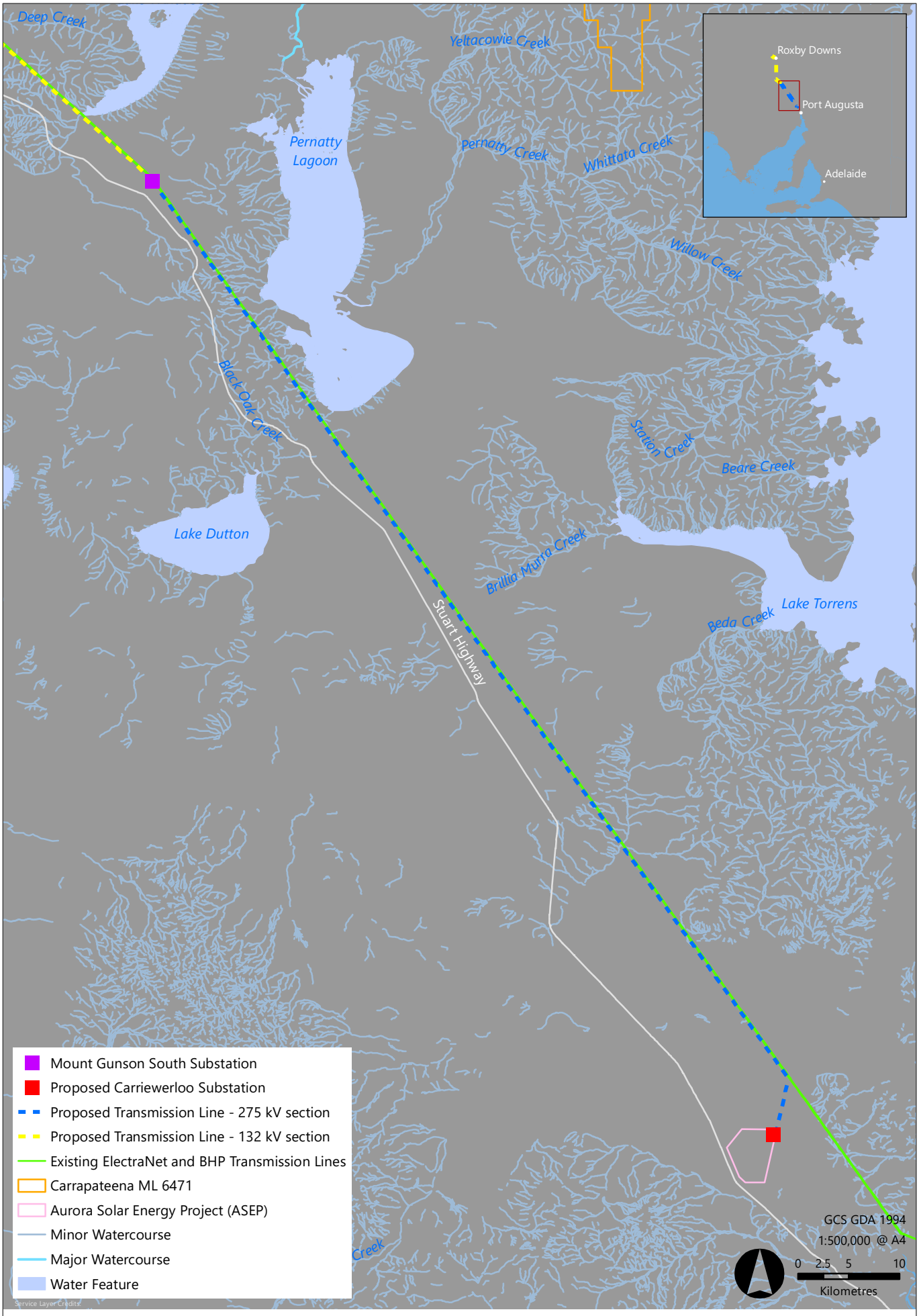

Figure 7.1: Surface Water Features near the Project Area (275 kV section)

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

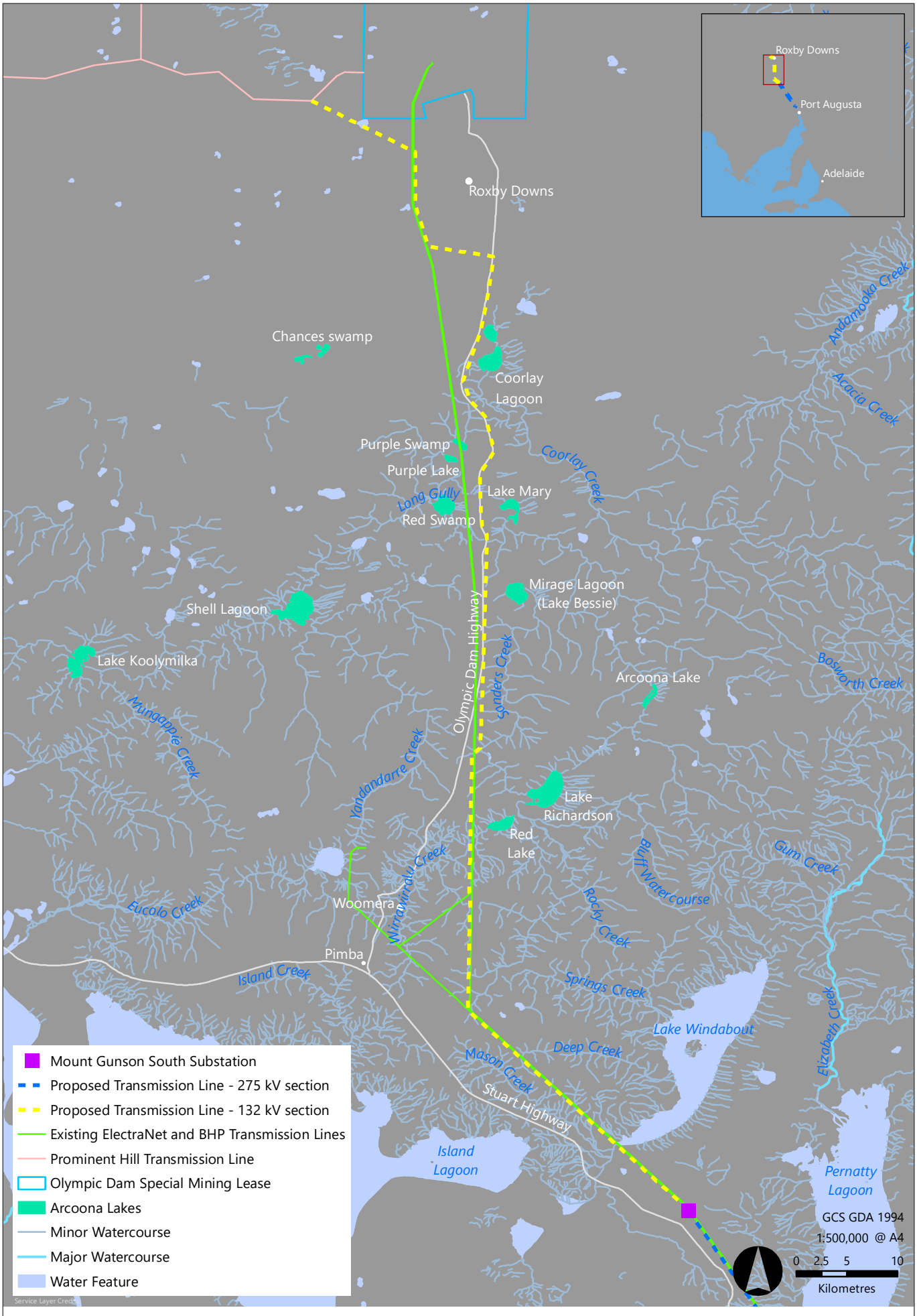

Figure 7.2: Surface Water Features near the Project Area (132 kV section)

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

7.2 Impact Assessment

7.2.1 Description of Effects

This section describes the interaction of the Project (Section 5) with the baseline surface water environment (Section 7.1).

The activities that potentially alter surface water quantity or quality which may subsequently have an impact on receptors are presented in Table 7.5. These effects are discussed further below.

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised below in Section 7.4.

Table 7.5: Surface Water Potential Effects

Source	Potential Effect	Receptors	ID
Placement of Infrastructure*	Placement of transmission line infrastructure alters surface water flows	Aquatic Ecology Terrestrial Ecology Local Communities	SW01 SW02 SW03
Runoff from disturbed surface areas*	Erosion of soils and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface waters	Aquatic Ecology Terrestrial Ecology Local Communities	SW04 SW05 SW06
Accidental spills*	Contaminates surface water (Other pathways include soils and groundwater)	Flora Fauna Third-party Users	L01 L21 L22

*Other pathways for accidental spills include soils and groundwater. These unplanned events are discussed in more detail under the primary receptors Land Use (Section 15.3) and Ecology (Section 11.3).

Disturbance of Surface Water Flows

Activities involving earthworks and installation of infrastructure have the potential to alter surface water flows, which can impact vegetation, fauna and pastoral operations that reliant on surface water.

The Project will have a negligible effect on surface water flows. The natural topography of the Project Area will be maintained, and the presence of towers or poles will not provide any significant impediment to surface water flows or alter catchment areas. Towers or poles will not be in watercourses. Access tracks will be constructed at the natural surface level and channel flows will be maintained at watercourse crossings (e.g. by construction at natural surface level or using pipes or culverts if required). There will not be a significant change in runoff from the Project Area as impervious surfaces are not proposed to be introduced and the contribution from any less permeable areas (e.g. capped or compacted areas of access tracks) will be negligible. Any effects on surface water flows during the construction period would be very minor, localised and short term. During construction, stockpiles will be managed to minimise impediment to flow, particularly near drainage lines.

Erosion and Sedimentation

Construction activities such as vegetation clearance, excavation and earthworks have the potential to generate suspended solids in surface water run-off during rainfall events. As discussed in Section 6.2.1

there is potential for erosion and sediment transport during rainfall events from stockpiles and disturbed areas events in the construction phase and predominantly from the access track during operation. Controls such as appropriate location of structures and access tracks, sediment and erosion controls, drainage features and remedial action (where required) limit the potential for significant erosion to occur.

Surface water flows only occur following significant rainfall events, which occur infrequently. During flow events, surface water is typically characterised by high total suspended solids. Sediment transport from disturbed areas associated with the Project could have a small and localised effect on total sediment loads during flow events. Any effect on turbidity and sedimentation in ephemeral lakes, where inflows following rainfall are naturally highly turbid and are typically fed by large catchments, would be small, localised and short term. The distances to most ephemeral lakes further reduces the potential effect. Similarly, any increase in sedimentation in areas of predominantly terrestrial vegetation that receive runoff (e.g. claypans, swamps or riparian vegetation) would be a relatively small and localised effect. Increased sedimentation in pastoral dams would be negligible, given the low numbers of dams in proximity to the alignment (two dams within 1 km) and the small proportion of their total catchments that the Project Area represents.

Accidental Spills

Accidental spills from the transport, storage and handling of hydrocarbons and chemicals can lead to local contamination of soil, which could have potential secondary effects via surface water (or groundwater) in regard to land use or habitat for native flora and fauna.

The presence of accommodation camps and associated waste-water systems, as well as portable toilets for mobile works has the potential to lead to contamination of soils (and subsequently surface waters) via release of sewage effluent. Appropriate design, siting and management of this infrastructure will be implemented and no contamination of soils and surface waters is anticipated to occur.

This effect is discussed under Soils and Landform in Section 6.2.1.

7.2.2 Effect S-P-R Linkage

The information provided in Table 7.6 identifies the potential impacts to surface water pathways at identified receptors using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor.

Table 7.6: S-P-R Linkage Summary for Surface Water Effects

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Placement of transmission line infrastructure alters surface water flows impacting on the abundance and/or diversity of aquatic ecology.	No	The Project will have a negligible effect on surface water flows as it will not provide any significant impediment to surface water flows or alter catchment areas. The Project Area also represents a very small proportion of the catchment of surface water features in the area.	SW01

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Placement of transmission line infrastructure alters surface water flows impacting on the abundance and/or diversity of terrestrial ecology.	No	The Project will have a negligible effect on surface water flows as it will not provide any significant impediment to surface water flows, or alter catchment areas. Unplanned event is discussed in Section 11.3.	SW02
Placement of transmission line infrastructure alters surface water flows impacting on local communities.	No	The Project will have a negligible effect on surface water flows as it will not provide any significant impediment to surface water flows, or alter catchment areas.	SW03
Erosion of soils and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water impacting on the abundance and/or diversity of aquatic ecology.	Yes	Significant rainfall events may erode disturbed areas and stockpiles resulting in an increase in sediment loads entering local surface water catchments. This could possibly result in a small and localised increase above high background levels and result in very localised change in the abundance and diversity of aquatic invertebrates in ephemeral lakes. Note: Impact significance assessment is contained in Section 11.2.	SW04
Runoff from stockpiles and disturbed surfaces leads to erosion of the land surface and increased sedimentation impacting on the abundance and/or diversity of terrestrial ecology.	Yes	Significant rainfall events may erode disturbed areas and stockpiles resulting in altered land surfaces and increased sediment loads. This could possibly result in localised alteration to habitat suitability for terrestrial flora and fauna, and a small, localised increase in sediment loads above high background levels which could result in very localised changes in the abundance and diversity of terrestrial species. Note: Impact significance assessment is contained in Section 11.2. Unplanned event is discussed below in Section 7.3 and in Section 11.3.	SW05
Erosion of soils and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water impacting on the local community.	No	During construction (and to a lesser extent operation) the disturbance of land will result in the potential for discharge of sediments during rainfall events. Given the high natural turbidity, small contribution from the Project Area to surface water catchments, distance to dams or other surface water features used by the community (in addition to the short construction period and the rare occurrence of water volumes suitable for use) the Project is not anticipated to impact surface water used by the local community.	SW06
Accidental spills contaminate land (secondary pathways	No	Hydrocarbons and chemicals will be stored within appropriate containers relevant to the material being stored. An impact can only	L01 L21

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
include surface water and groundwater) impacting native flora, fauna and third-party users.		occur as a result of an unplanned event that results in the uncontrolled release of hydrocarbons or chemicals. Unplanned event is discussed below and in Sections 11.3 and 15.3.	L22

7.2.3 Impact Significance Assessment

This section discusses the significance of potential impacts where a linkage has been identified between the surface water effects of the Project and receptors. An impact assessment using the OZ Minerals Impact Assessment Framework (IAF) has been carried out for each of these potential impacts. These impact assessments are presented in Appendix I. Supporting discussion is provided below.

In accordance with the Impact Assessment Framework, only those potential impacts that have been identified as having an S-P-R linkage (or are found to be "material") have had an impact significance assessment carried out. Potential impacts where there is no identified S-P-R linkage are discussed above in Table 7.6.

Erosion and Sedimentation

The IAF process has identified linkages for two potential impacts rated to erosion and sedimentation. Potential impacts to aquatic and terrestrial ecology receptors are covered in the Ecology Chapter (Section 11.2). Based on the assessment discussed in Section 11.2, the impacts are not significant and are assessed to be low.

7.3 Unplanned Events

Accidental Spills

Accidental spills from the transport, storage and handling of hydrocarbons and chemicals can lead to a decrease in surface water quality, when present. A change in surface water quality has the potential to impact on ecological receptors, as well as pastoralists or other members of the community that may use the water. The impacts will not occur without an unplanned event occurring.

The risk of surface water contamination during construction will be minimised by storage and handling of fuel and chemicals in accordance with relevant standards and guidelines and the implementation of procedures to contain and clean up spills should they occur. The risk posed by accidental spills during construction or operation is assessed in Sections 11.3 and 15.3 and has been assessed as low.

Placement of Infrastructure

Placement of infrastructure outside of design parameters and/or inappropriate application of construction methodologies may lead to unplanned alterations of surface water flows. This event could result in impacts to terrestrial ecology. Effects and impacts to terrestrial ecology have been covered in Chapter 11. The risk to terrestrial ecology from unplanned alterations to surface water flows is assessed in Section 11.3 and has been assessed as low.

Erosion and Sedimentation

Construction outside of design parameters and/or inappropriate application of construction methodologies may lead to unplanned erosion and sedimentation effects, potentially impacting terrestrial ecology. The risk to terrestrial ecology from erosion and sedimentation is assessed in Section 11.3 and has been assessed as low.

7.4 Summary of Control and Mitigation Strategies

Discussion around control and mitigation is incorporated into the Impact Assessment in Section 7.2. A Soil Erosion and Drainage Management Plan (SEDMP) will be developed which will detail measures to manage erosion and sedimentation.

Table 7.7: Summary of Design Controls

Design Controls	Impact ID
Siting of tracks and transmission structures to minimise erosion potential.	SW04, SW05, SW06
Siting of Project infrastructure to minimise disturbance to ephemeral drainage lines.	SW01, SW02, SW03, SW04, SW05
Existing tracks incorporated into the design as far as possible.	SW04, SW05, SW06
Design drainage features or structures to appropriate standards where considered necessary.	SW03, SW04, SW05, SW06
Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards.	L01, L21, L22

Table 7.8: Summary of Management Controls

Management Controls	Impact ID
Land disturbance approval process.	SW01, SW02, SW03, SW04, SW05, SW06
Temporary sediment and erosion controls (e.g. berms, drainage controls, sediment fencing).	SW04, SW05, SW06
Locate soil stockpiles out of potential flow paths.	SW01, SW02, SW03, SW04, SW05, SW06
Locate camps and mobile facilities away from watercourses and lakes.	L01, L21, L22
Access tracks will be constructed in accordance with industry standards.	SW01, SW02, SW03, SW04, SW05
Rehabilitation procedures.	SW04, SW05, SW06
Spill and emergency response procedures.	L01, L21, L22
Equipment maintenance to prevent spills.	L01, L21, L22
Licensed chemical and waste transporters.	L01, L21, L22
Wastewater managed in accordance with health regulations and *Environment Protection (Water Quality) Policy 2015*.	L01, L21, L22

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8 GROUNDWATER

8.1 Existing Environment

8.1.1 Regional Context

The Project Area lies within the Stuart Shelf geological province, a relatively thin sequence of sedimentary rocks that overlays the Gawler Craton. The most significant groundwater systems of the Stuart Shelf include the Andamooka Limestone Aquifer and the Tent Hill Aquifer, which comprises the lower, fractured (i.e. permeable) zone of the Arcoona Quartzite and the Corraberra Sandstone. Other deeper aquifers present within the region of the Project Area include the Whyalla Sandstone Aquifer and Pandurra Formation Aquifer, when permeabilities are sufficient to allow transmission of important quantities of groundwater. The Woomera Shale Aquitard separates the Tent Hill Aquifer from the Whyalla Sandstone Aquifer and Pandurra Formation.

Where it is saturated, the Andamooka Limestone Aquifer is the shallowest of the aquifers in the Stuart Shelf. It covers an area of approximately 14,500 km^2 extending from around 50 km south and 80 km north-west of Olympic Dam, to around 35 km north of the top of Lake Torrens. At the northern extent of the Project Area in the vicinity of Olympic Dam, the Andamooka Limestone Aquifer water table is approximately 50 m below ground. South of Olympic Dam, the base of the Andamooka Limestone becomes shallower and the aquifer becomes unsaturated (i.e. it does not contain water).

The Tent Hill Aquifer is extensive and forms the most important aquifer over the southern portion of the Stuart Shelf, where the Andamooka Limestone Aquifer is either very thin or absent. The upper portion of the Tent Hill Aquifer (i.e. the unfractured Arcoona Quartzite) forms a confining aquitard to the Tent Hill Aquifer, and restricts vertical movement of groundwater between the Andamooka Limestone Aquifer and the Tent Hill Aquifer. At Olympic Dam the Tent Hill Aquifer is typically 160 – 200 m below ground level.

Regional groundwater flow is predominantly from the west to east towards Lake Torrens, where evaporative discharge occurs (BHP Billiton, 2009; OZ Minerals, 2017).

Perched groundwater can be present in shallow alluvial sediments within the Stuart Shelf, and have been primarily found to align with ephemeral creek features. These perched groundwater systems are conceptualised to be recharged from rainfall and creek flow events and are considered to be disconnected from the regional aquifer systems (OZ Minerals, 2017). Perched groundwater can, however, form as a result of density driven forces between groundwater found in the regional aquifers (saline to hyper saline) and that recharging the shallow alluvial sediments (fresh to saline). An alternative conceptualisation of this water density perching of shallow groundwater is considered in OZ Minerals (2017). Groundwater recharge over much of the Stuart Shelf area is very low (in the order of 0.1 mm/yr, BRS, 2001) due to low rainfall infiltration (estimated at 0.1 to 0.2 mm/yr (Kellett *et al.*, 1999)) and high evaporation rates (greater than 3,000 mm/yr (OZ Minerals, 2017)), and is likely to vary considerably

across the region with some areas capable of accumulating rainfall runoff experiencing higher infiltration rates (such as sand dunes and where aquifers outcrop/subcrop). It is expected most of the groundwater recharge occurs following significant rainfall events.

There are no known groundwater springs in the Study Area. Groundwater discharge at surface is considered to occur, to some extent, at groundwater termini features such as salt (playa) lakes located within the Study Area (OZ Minerals, 2017).

8.1.2 Groundwater Quality and Depth

Groundwater is generally of poor to marginal quality. Shallow groundwater is generally saline to hypersaline, ranging between 14,000 mg/L and 100,000 mg/L along the alignment and up to 200,000 mg/L near ephemeral salt lakes (SARIG, 2018; BHP Billiton, 2009; Watt *et al.*, 2012). Salinity of perched groundwater can be lower.

Reported salinity for groundwater wells in the Study Area ranges from 6,526 mg/L to 42,070 mg/L (WaterConnect, 2018). Groundwater investigations carried out for the Carrapateena mining lease located 43 km east of the transmission line indicated salinity values across the wells tested ranging from 25,440 mg/L to 166,800 mg/L (OZ Minerals, 2017).

Depth to shallow groundwater varies along the alignment. It is shallower in proximity to salt lakes (in the order of 5 m below ground level), however is generally in the order of 10 – 20 m or more, particularly on higher topography (SARIG, 2018; OZ Minerals, 2017) (see Figure 8.1).

8.1.3 Groundwater Use

Groundwater can be an important water supply for many arid regions in South Australia. It often forms an important resource for domestic and stock water supplies, and can form an important source of water that sustains ecosystems.

In the broader region, the lack of reticulated water and reliable permanent surface water resources makes locally supplied groundwater resources the main source of water (Watt *et al.,* 2012). However, across the majority of the Project Area, there is limited third-party demand on regional groundwater resources, most likely due to high salinity conditions, although most pastoral stations still use limited volumes of groundwater, where present in sufficient volumes and at sufficient quality.

There are no known groundwater springs in the Study Area. There are no known groundwater dependent ecosystems recognised in the Study Area (see Chapter 11) and reliance of flora and fauna on groundwater is likely to be very limited due to the depth and salinity.

A summary of groundwater users in the Study Area is presented in Table 8.1.

There are 55 groundwater wells located within 5 km of the proposed alignment. Of these 55 wells, 26 are for exploratory purposes, three for investigative purposes, five for industrial purposes and the remaining 21 classified as unknown. Furthermore, all but three wells were installed in 1987 or later and appear to be not operational. These wells are shown in Figure 8.2.

Table 8.1: Groundwater User Summary

Subject	Summary
Beneficial Use	The saline composition of the groundwater within regional aquifers means that it has limited beneficial use without treatment, apart from mining and industrial applications.
Community	Roxby Downs sources its water from groundwater wells within the Great Artesian Basin, following treatment at Olympic Dam. Port Augusta, Woomera and Pimba are supplied by reticulated water from the River Murray via the Morgan-Whyalla pipeline. Woomera and Pimba access this water via the Port Augusta-Woomera pipeline (SA Water, 2018). Other communities rely on community-maintained bores and rain water. Dams, tanks and bores support stock on pastoral leases.
Pastoral Industry	Whilst there are some stockwater supplies sourced from localised perched groundwater systems, most supplies are sourced from dams that capture surface water runoff (see Section 7.1.4) because on a regional scale, groundwater salinity concentrations greatly exceed what might be tolerated by stock. The groundwater found within the shallow alluvial sediments are known to be localised and finite in extent, meaning these water sources are not generally relied upon by pastoral lease owners. Domestic water supplies may be sourced from either rainfall capture or low salinity (less than 2,000 mg/L) groundwater supplies that are associated with perched groundwater flow systems. However, most groundwater wells in the Study Area do not fall within this range, reporting groundwater salinities of 6,526 mg/L to 42,070 mg/L (WaterConnect, 2018). Consultation with the leaseholders in the area has identified that many of the stations receive their water supply to their houses from the Woomera pipeline where available, or capture rainwater or surface water (OZ Minerals, 2017). Figure 8.2 shows groundwater wells in the Project Area (Water Connect, 2018). However, several of the wells identified on the plan are non-operational or have been decommissioned.
Mineral and Petroleum Industries	There are a number of mineral exploration and mineral production tenements surrounding the Project Area. Water for exploratory drilling operations and accommodation supplies is typically sourced from groundwater or mineral exploration wells and then treated to become potable. In some cases, station dams are utilised through negotiations with pastoral leaseholders. It is assumed that companies that hold exploration licences on adjoining tenements will want to continue to source groundwater to meet their exploration demands. As with mineral exploration, petroleum/gas and geothermal energy exploration activities require access to water supplies to assist in drilling operations and provide potable accommodation supplies.

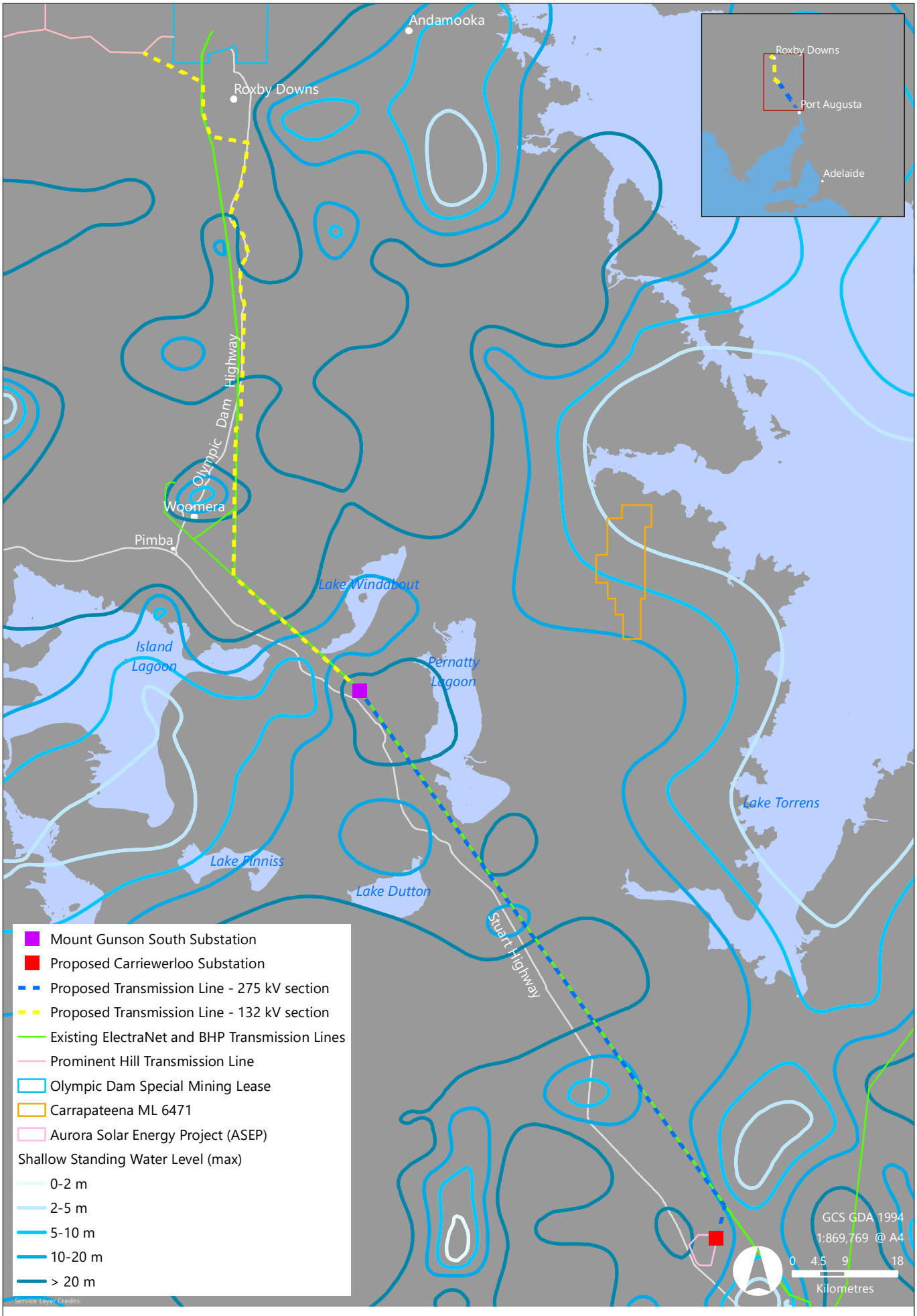


Figure 8.1: Shallow Groundwater Levels across the Transmission Line

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

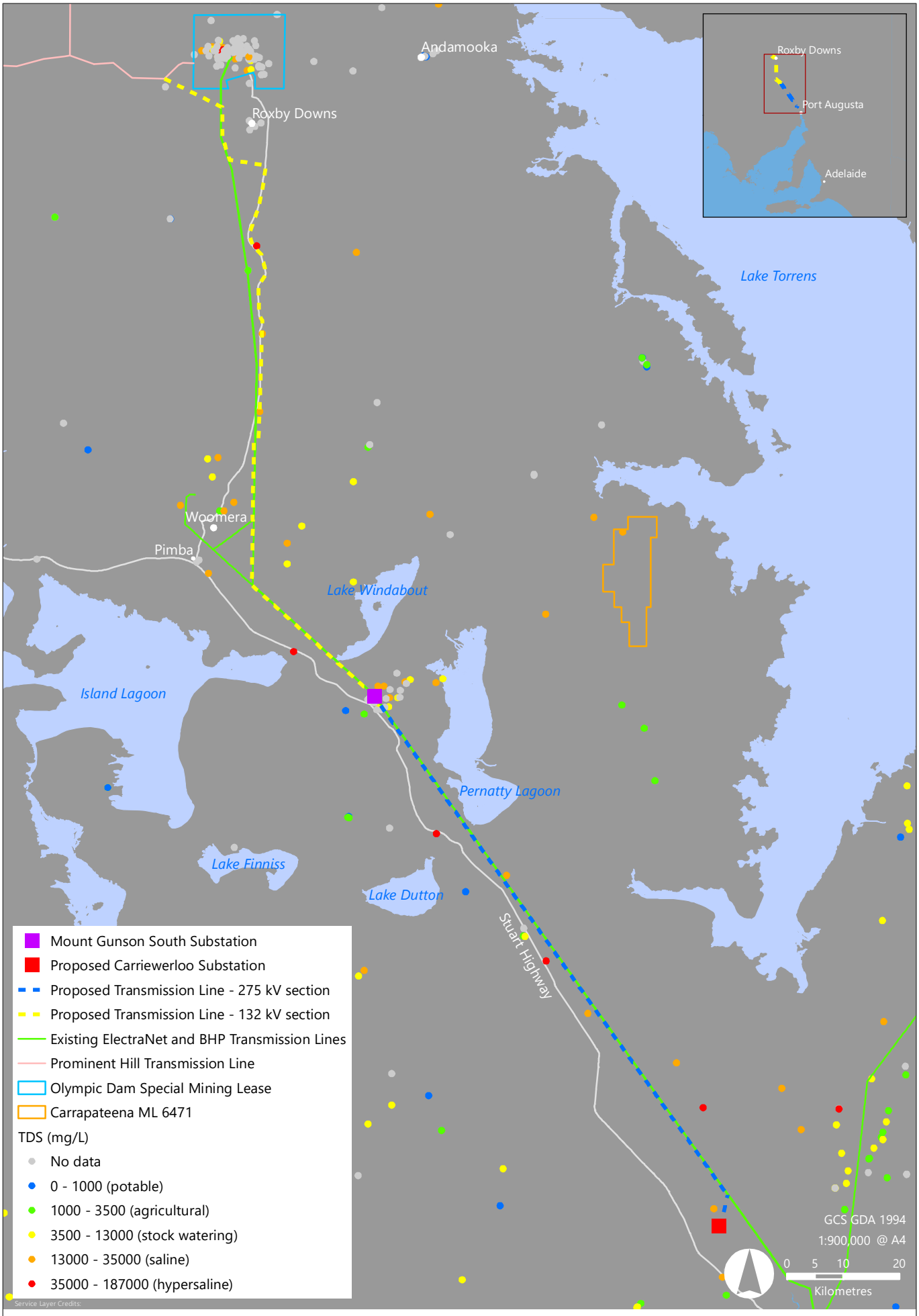


Figure 8.2: Distribution and Salinity of Groundwater Wells

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

8.2 Impact Assessment

8.2.1 Description of Effects

This section describes the interaction of the Project (Chapter 5) with the baseline groundwater environment (Section 8.1). The only activity with the potential to alter groundwater quantity or quality that may subsequently have an impact on receptors is presented in Table 8.2. These effects are discussed further below.

Control measures that are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs are summarised below in Section 8.4.

Table 8.2: Groundwater Potential Effects

Source	Potential Effect	Receptors	ID
Groundwater abstraction	Abstraction of groundwater during construction reduces groundwater quantity	Aquatic Ecology Terrestrial Ecology Third-party Users	GW01 GW02 GW03
Accidental spills*	Contaminates shallow groundwater (other pathways include soil and surface water)	Flora Fauna Third-party Users	L01 L21 L22

*Other pathways for accidental spills include soils and surface water. These unplanned events are discussed in more detail under the primary receptors Land Use (Section 15.3) and Ecology (Section 11.3).

Groundwater Abstraction

Use of groundwater has the potential to result in drawdown of aquifers and reduction in groundwater availability for flora, fauna and groundwater users. However, as discussed below, the limited groundwater use for the project is not anticipated to have any significant impact.

Construction would require approximately 65 ML of water in total, principally for dust suppression, tower foundations, domestic use (camp supply) and concrete manufacture. The water is likely to be obtained from a range of sources, including existing and new groundwater wells and the South Australian potable water network (e.g. the existing Woomera pipeline and proposed SolarReserve water pipeline).

If groundwater is used (e.g. for dust suppression), the volumes used will be relatively low and extraction will be short term. If existing groundwater wells are used for water supply, the use of the wells and volume extracted will be in agreement with the landowner. Any new wells would be assessed to ensure that they will not impact any existing groundwater users. Groundwater use in the Project Area is relatively limited. Consequently, the effect of groundwater abstraction is anticipated to be negligible.

Accidental Spills

Accidental spills from the transport, storage and handling of hydrocarbons and chemicals can lead to local contamination of soil, which could have potential secondary effects via groundwater (or surface water) in regard to land use or habitat for native flora and fauna. This effect is covered under Soils and Landform in Section 6.2.1.

8.2.2 Effect S-P-R Linkage

The information provided in Table 8.3 identifies the potential impacts to groundwater pathways at identified receptors using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor.

Table 8.3: S-P-R Linkage Summary for Groundwater Effects

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Abstraction of ground water during construction reduces groundwater quantity (assessed for Aquatic Ecology, Terrestrial Ecology)	No	There are no groundwater dependent ecosystems of note recognised in the Study and reliance of flora and fauna on groundwater is likely to be very limited. Limited and short-term groundwater use for the transmission line would have negligible effects on the groundwater quantity for aquatic or terrestrial ecosystems.	GW01 GW02
Abstraction of ground water during construction reduces groundwater quantity for Local Communities	No	Limited and short-term groundwater use for the transmission line would have negligible effects on the groundwater quantity for groundwater users. Groundwater use in the Study Area is relatively limited and existing wells would not be used for water supply without specific agreement from the owner.	GW03
Accidental spills contaminate Land (Secondary pathways include surface water and groundwater) impacting native flora, native fauna and third-party users	No	Hydrocarbons and chemicals will be stored within appropriate containers relevant to the material being stored. An impact can only occur as a result of an unplanned event that results in the uncontrolled release of hydrocarbons or chemicals. Unplanned event is addressed in Sections 11.3 (Ecology) and 15.3 (Land Use).	L01 L21 L22

8.2.3 Impact Significance Assessment

No impacts with an S-P-R linkage have been identified for groundwater. Consequently, no impact assessments have been carried out for groundwater, in accordance with the OZ Minerals Impact Assessment Framework.

8.3 Unplanned Events

Accidental Spills

The risk of shallow groundwater contamination during construction or operation will be minimised by storage and handling of fuel and chemicals in accordance with relevant standards and guidelines. Procedures will be implemented to contain and clean up spills should they occur. The volumes of fuel or chemicals used will generally be low. Depth to groundwater is generally in the order of 10 – 20 m. The risk posed by accidental spills during construction or operation is described in Section 11.3 (Ecology) and Section 15.3 (Land Use) and has been assessed as low.

8.4 Summary of Control and Mitigation Strategies

Table 8.4: Summary of Design Controls

Design Controls	Impact ID
Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards.	L01, L21, L22
Appropriate permits for the construction of water supply wells obtained where required.	GW01, DE02, GW03
Abstraction rates and volumes within limits agreed with well owner.	GW01, DE02, GW03

Table 8.5 Summary of Management Controls

Management Controls	Impact ID
New water supply wells assessed to ensure they will not impact existing groundwater users.	GW01, DGE07, GW03
Spill and emergency response procedures.	L01, L21, L22
Equipment maintenance to prevent spills.	L01, L21, L22
Licensed chemical and waste transporters.	L01, L21, L22
Wastewater managed in accordance with health regulations and Environment Protection (Water Quality) Policy.	L01, L21, L22

9 AIR QUALITY

9.1 Existing Environment

9.1.1 Atmospheric Conditions

As covered in Section 6.1.2, the region is arid to semi-arid and subject to hot summers and cool to mild winters with low but unpredictable rainfall.

The proposed site for the route alignment is generally dominated by light to moderate southerly winds. Winds from the south and south east tend to dominate in summer and autumn while in winter, northerly winds often prevail. The annual wind roses for Port Augusta and Woomera are presented in Figure 9.1.

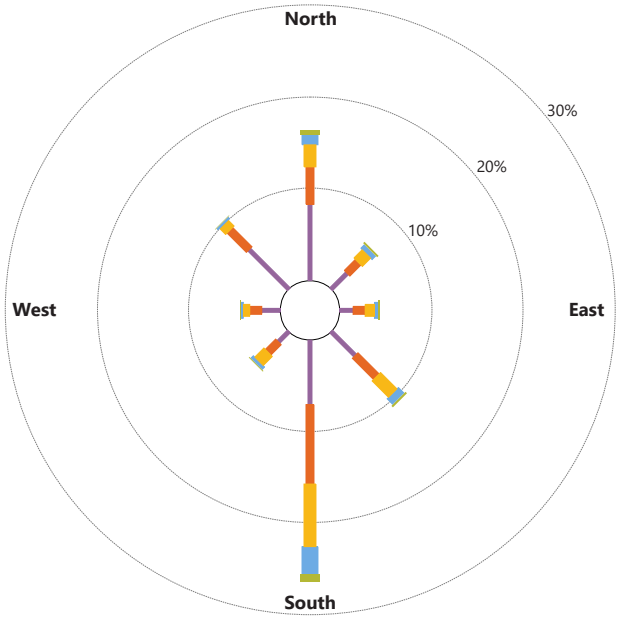
9.1.2 Air Quality

The air environment along the corridor is characterised by clean air, typical of the remote, rural setting within South Australia. Existing sources of emissions within the broader area include operations, vehicle emissions and dust generated by traffic on unsealed roads, mineral exploration, mining operations and pastoral activities.

The dry nature of the region can give rise to dust storms, which can blanket large areas with wind-blown dust. These meteorological phenomena, common to arid and semi-arid regions of Australia, increase in frequency during prolonged dry periods when there is a lack of soil moisture and vegetation to help bind the dust particles to the ground. The Gawler bioregion[2] within which the transmission line lies has a low to moderate Dust Storm Index value with areas within the transmission corridor experiencing on average two dust storms per year (BHP Billiton, 2009).

There are six potential dwellings within 5 km of the proposed transmission line, however at the time of submission, only one of these (Kootaberra homestead, 1.8 km west of the proposed line) is known to be occupied.

[2] Bioregions and subregions are defined by the Interim Biogeographic Regionalisation for Australia (IBRA) Version 7.0. Bioregions are broad landscape units based on major geomorphic features. See Section 6.1.1.



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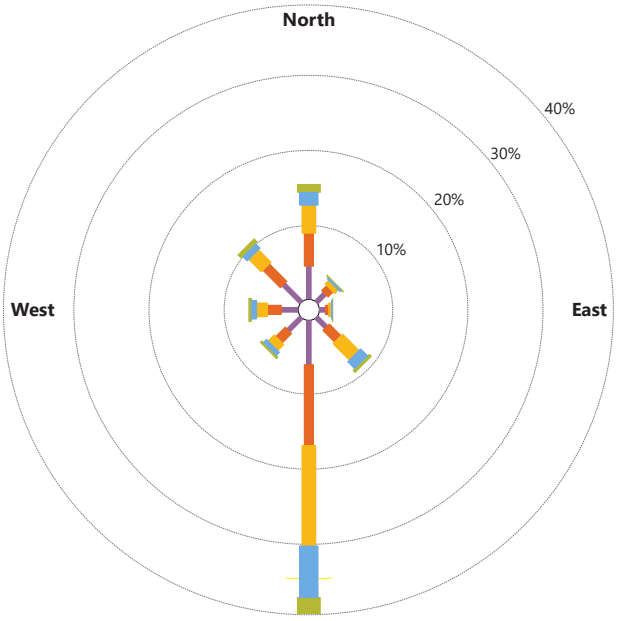

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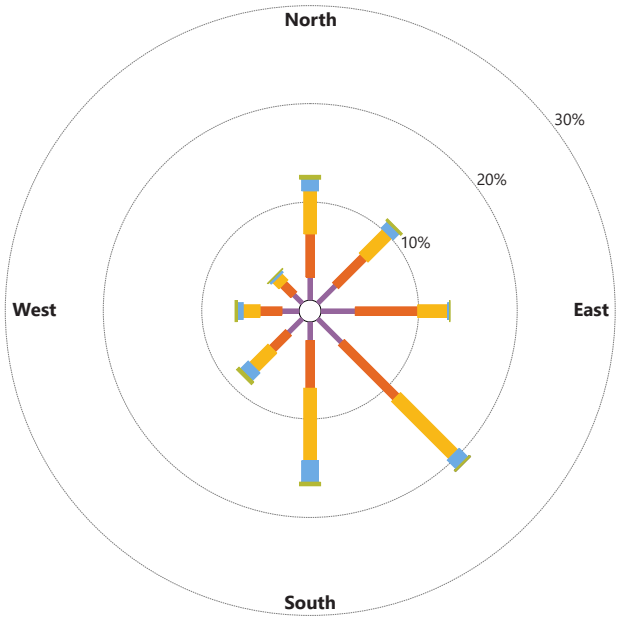

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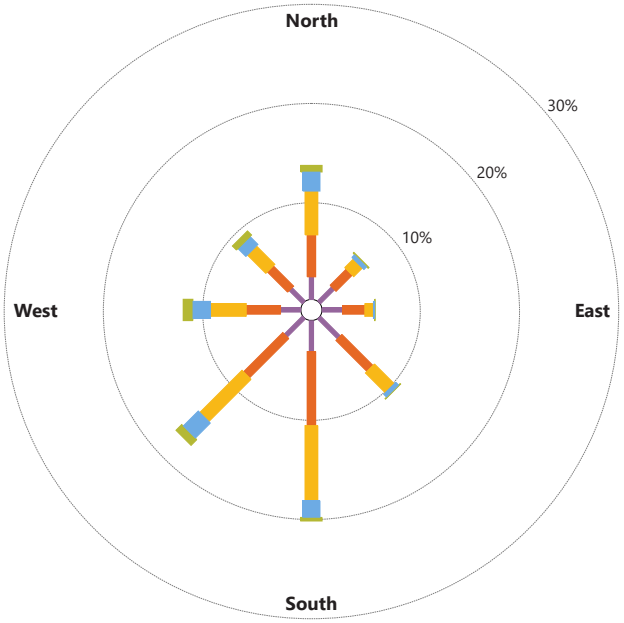

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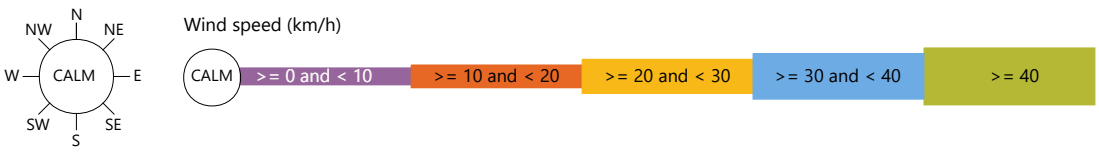

Source: Bureau of Meteorology

Figure 9.1: Wind Roses for Port Augusta and Woomera (9am and 3pm)

9.2 Impact Assessment

9.2.1 Description of Effects

This section describes the interaction of the Project (Chapter 5) with the baseline air quality environment (Section 9.1). The activities that potentially alter air quality which may subsequently have an impact on receptors are presented in Table 9.1. These effects are discussed further below.

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised below in Section 9.2.2.

Table 9.1: Air Quality Potential Effects

Source	Potential Effect	Receptors	ID
Greenhouse Gas Emissions	Combustion of fossil fuels (GHG emissions).	Australia – State of South Australia	AQ01
Dust emissions / deposition	Activities including land clearing, material movement and vehicles on unpaved roads generate dust / particulate matter.	Terrestrial Ecology Local Communities (Health) Local Communities (Amenity)	AQ02 AQ03 AQ11

Combustion of Fossil Fuels

Construction activities will result in the release of greenhouse gas emissions primarily from the use of diesel fuel for construction machinery, vehicles and generators. The combustion of fossil fuels will result in the emission of nitrogen oxides (NO_x), sulphur oxides (SO_x) and diesel particulates. Annual Australian and South Australian GHG emissions are currently 533 Mt $CO_{2\text{-}e}$/annum and 26.4 Mt $CO_{2\text{-}e}$/annum respectively report for 2016 (DEE, 2018a). The Project will contribute a negligible amount (less than 0.004 Mt $CO_{2\text{-}e}$) or 0.03% and 0.002% to state and national greenhouse gas emissions respectively, during construction and operations.

Although there is the potential for a negligible change in ground level concentrations associated with gaseous emissions from the combustion of fossil fuels during construction, the Project is not expected to have any significant effect on air quality, primarily based on the low volume of diesel required and the transient nature and limited scale of construction along the corridor.

Dust Emissions

There is the potential for localised changes to air quality because of dust generated during construction. Construction activities are not expected to generate significant quantities of dust, based on the relatively limited ground disturbance footprint and short-term, transient nature of construction along the corridor. Potential sources of dust include:

- Wind-borne dust from exposed surfaces, such as cleared areas, temporary stockpiles and excavations
- Materials handling activities associated with earthworks
- Wheel-generated dust from heavy and light vehicle movements on unsealed surfaces.

The potential for wind erosion will be relatively low, given the nature of the dominant soils in the Project Area and the stabilisation provided by vegetation that will be allowed to remain outside the discrete disturbance footprint. Areas that are temporarily disturbed (e.g. laydown areas) will be rehabilitated following the completion of construction.

The proposed route alignment is generally dominated by light to moderate southerly winds. Winds from the south and south east tend to dominate in summer and autumn while in winter, northerly winds often prevail. Dust emissions are anticipated to be restricted to the areas immediately surrounding Project infrastructure footprint.

9.2.2 Effect S-P-R Linkage

The information provided in Table 9.2 identifies the potential impacts to air quality pathways at identified receptors using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor. Although noise travels via the air pathway, it is dealt with separately in Chapter 10.

Table 9.2: S-P-R Linkage Summary for Air Quality Effects

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Combustion of fossil fuels (i.e. diesel) releases greenhouse gas (GHG) to the atmosphere impacting on the ability to achieve state and national greenhouse gas reduction targets.	No	The emissions contribution is considered not material due to the negligible contribution to state (0.03%) and national (0.002%) levels.	AQ01
Activities including land clearing, material movement and vehicles on unpaved roads generate dust emissions that deposit on vegetation and reduce vegetation health impacting on the abundance and/or diversity of native vegetation and fauna.	Yes	An increase in dust deposition onto vegetation in the nearby vicinity of construction activities may occur. See Section 11.2.3 for impacts on ecological receptors.	AQ02
Activities including land clearing and material movement and vehicles on unpaved roads generate particulate emissions ($PM_{2.5}$ and PM_{10}) that result in health impacts to the local community.	No	Construction activities may result in wind-blown particulate matter. However, there are no sensitive receptors within 1.5 km of the proposed alignment.	AQ03

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Activities including land clearing and material movement and vehicles on unpaved roads generate dust emissions that result in amenity impacts to the local community.	No	Dust will be generated and may affect receptors in close proximity to the proposed corridor. However, there are no sensitive receptors within 1.5 km of the proposed alignment.	AQ11

9.2.3 Impact Significance Assessment

This section discusses the significance of potential impacts where a linkage has been identified between the air quality effects of the Project and receptors. An impact assessment using the OZ Minerals Impact Assessment Framework has been carried out for each of these potential impacts. These impact assessments are presented in Appendix I. Supporting discussion is provided below followed by a table summarising the outputs of the Impact Assessment Framework.

In accordance with the Impact Assessment Framework, only those potential impacts that have been identified as having an S-P-R linkage (or are found to be "material") have had an impact significance assessment carried out. Potential impacts where there is no identified S-P-R linkage are discussed above in Table 9.2.

Dust Emissions

There is the potential for localised impacts to air quality during construction. The potential for wind erosion from cleared areas during operation will be low, given the nature of the soils and the stabilisation provided by vegetation that will be allowed to remain (or regenerate) across the site. Areas that are temporarily disturbed (e.g. laydown areas) will be rehabilitated following the completion of construction.

EPA guidelines for evaluation of distances for effective air quality management indicate no recommended distance from the proposed activity to assess potential effects; however, as a minimum standard, 1000 m distance from source to sensitive receptor is recommended for heavy industries (EPA, 2016). On this assumption, a conservative 1.5 km was used as a buffer along the transmission line to evaluate the presence of any potential sensitive receptors that could be affected by dust emissions. There are no residences within 1.5 km of proposed Project activities, therefore any wind-blown particulate matter resulting from construction activities is unlikely to cause any amenity or health impacts to the local community.

There is the potential for an increase in dust deposition onto vegetation near construction activities. However, the impact is expected to be small scale, temporary and confined to the immediate vicinity of the disturbance footprint, and is predicted to not have any significant impacts on the abundance and/or diversity of native vegetation and fauna (see Section 11.2.3).

The Construction Environmental Management Plan (CEMP) will include standard dust control measures to minimise dust emissions during the construction period. The impact of construction dust emissions

on surrounding sensitive receivers is considered not significant based on the transient nature of construction along the corridor, limited scale and duration of planned earthworks at any particular site, the separation distance between construction activity and sensitive receivers.

A summary of air quality impact significance is presented in Table 9.3.

Table 9.3: Summary of Air Quality Impact Significance

Impact ID	Potential Impact Description	Impact Significance				Impact Uncertainty			Overall
		Resilience	Importance	Duration	Significance	Input	Methodology	Sensitivity	
AQ02	Activities including land clearing, material movement and vehicles on unpaved roads generate particulate emissions that reduce vegetation health impacting on the abundance and/or diversity of native vegetation and fauna.	1	5	3	15	A	A	B	19 - Low

9.3 Summary of Control and Mitigation Strategies

Controls for the mitigation of potential impacts and risks associated with the Project have been categorised for each pathway as either design controls or management controls. Those related to potential air quality impacts are presented below in tables Table 9.4 (design controls) and Table 9.5 (management controls). Project-wide control and mitigation strategies related to environmental management during construction are consolidated in the CEMP in Appendix H.

Table 9.4: Summary of Design Controls

Design Controls	Impact ID
Existing tracks will be incorporated into the design where possible to avoid construction of new access tracks, and reduce clearance footprint.	AQ02, AQ03, AQ11
Use of emissions control equipment on fixed and mobile plant and equipment.	AQ01
Progressive rehabilitation of disturbed areas (primary, secondary rehabilitation and/or revegetation).	AQ02

Table 9.5: Management Controls

Management Controls	Impact ID
Use of low sulphur diesel and regular maintenance of equipment to ensure emissions control devices are functioning correctly.	AQ01
Dust suppression on unsealed roads.	AQ02. AQ03, AQ11
Dust suppression on disturbed land (construction) where required.	AQ02. AQ03, AQ11
The disturbance footprint will be restricted to the minimum necessary to safely carry out the activities.	AQ02. AQ03, AQ11
Maintenance of unsealed roads.	AQ02. AQ03, AQ11
Regular maintenance of equipment to ensure emissions control devices are functioning correctly.	AQ01
Complaints register and corrective action program.	AQ02. AQ03, AQ11
Community consultation process.	AQ02. AQ03, AQ11

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10 NOISE

10.1 Existing Environment

The main identified noise sources surrounding the Project Area include traffic along the Stuart Highway and Olympic Dam Highway, mining exploration and production activities, generators at some station homesteads and outstations, and aerial mustering of livestock. Traffic volumes along roads adjacent the Project Area are relatively low with a high proportion of heavy vehicles (see Section 14.1).

A baseline noise assessment was undertaken as part of OZ Minerals Carrapateena Project (OZ Minerals, 2017). This is considered representative of the of the baseline landscape and land use of the regional area, except for the highway and localised noise sources that may exist in some specific locations (e.g. immediately surrounding pastoral homesteads). Beyond these anthropogenic noise sources, other sources of noise include wind blowing over vegetation and noises from insects and birds.

In the absence of road traffic noise and other localised noise sources mentioned, baseline noise surveys undertaken for the Carrapateena Project (OZ Minerals 2017) indicate that ambient daytime noise levels are approximately 43 dBL_{Aeq} with night time noise levels of approximately 25 – 30 dBL_{Aeq}, which is typical of a remote area.

There are limited social receptors within close proximity to the route alignment. Sensitive receivers for potential noise impacts related to the Project include pastoral stations and fauna.

As noted in Section 9.1, there are six potential dwellings within 5 km of the proposed transmission line, however at the time of submission, only one of these (Kootaberra homestead, 1.8 km west of the proposed line) is known to be occupied.

In addition, a dwelling (Corraberra homestead) is located in the vicinity of the potential laydown and camp area at the southern end of the transmission line (see Figure 5.10). The location of the laydown is being negotiated with the landowner, and it is expected that it will be in the order of 2 km from the dwelling.

Table 10.1: Potential Dellings Within 5 km of the Proposed Transmission Line

Location Name	Distance (km)	Direction from Proposed Transmission Line
Nantillo	4.3 km	East
Kootaberra Outstation	0.4 km	West
Kootaberra	1.8 km	West
Maslin	2.5 km	East
Old Oakden Hills	5.2 km	West of Mount Gunson South Substation
Purple Downs	1.7 km	West

10.2 Impact Assessment

10.2.1 Description of Effects

This section describes the interaction of the Project (Chapter 5) with the baseline noise environment (Section 10.1). The activities that potentially alter the noise environment which may subsequently have an impact on receptors are presented in Table 10.2. These effects are discussed further below.

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised below in Section 10.4.

Table 10.2: Noise Potential Effects

Source	Potential Effect	Receptors	ID
Noise – construction operations and helicopters	Operation of mobile fleet (including helicopter) and construction activities, will result in noise emissions.	Fauna (displacement) Local Community (Amenity)	AQ04 AQ05
Noise from interaction of wind and rain with transmission lines and structures	Noise from interaction of wind and rain with transmission lines and structures will result in aeloian and corona-related noise emissions.	Fauna Local Communities (Amenity)	AQ09 AQ10
Blasting	Blasting during construction will result in noise emissions.	Local communities impacted by air quality or noise (amenity)	AQ08

Noise During – Construction and Operation

Noise emissions are predominantly expected to occur during the construction phase of the Project, as minimal noise is likely to be generated during operation and maintenance. Sources of noise during construction of the proposed transmission line, include:

- Road traffic noise
- General construction noise
- Aircraft noise - helicopters.

The movement of vehicles along the access tracks would generate noise emissions, however traffic volumes are expected to be low, in the order of approximately 130 movements per day to each of the northern and southern sections of the transmission line alignment, including 15 to 20 light vehicle movements.

Equipment used during construction would include earthmoving equipment for civil works, diesel generators, trucks and cranes with similar noise outputs to farm machinery, e.g. tractors.

Very little ongoing maintenance is likely to be required for the transmission line. Access tracks to the transmission line structures would be used for inspection and maintenance activities, predominantly by light 4WD vehicles. Maintenance programs would typically involve two visual inspections per year for signs of unusual wear, corrosion or damage. Helicopter-based inspections would be undertaken

annually. A more detailed inspection by vehicle would occur about every four years. Insulators would typically be replaced every 25 years.

Noise from Interaction of Wind, Transmission Lines and Structures

Potential noise associated with the Project during operation is that associated with the structures and lines themselves, including aeolian noise (wind passing through the lines) and corona noise from the transmission lines (a phenomenon associated with the natural discharge of electricity into the air).

Aeolian noise is uncommon and requires steady winds blowing perpendicular to the lines to set up an aeolian vibration, which can produce resonance if the vibration frequency matches the natural frequency of the line. As described in Section 7.1.1, prevailing winds run parallel rather than perpendicular to the line, therefore reducing likelihood of the effect.

Corona noise from the transmission lines is a cracking, hissing or buzzing sound associated with the natural discharge of electricity into the air, which is usually only audible in humid weather, or during heavy rains. The generally dry conditions that prevail across the alignment would maintain any potential corona effects to a minimum.

Blasting

Excavations for tower foundations are typically dug using equipment such as excavators or borers. Blasting or pile driving may sometimes be used in areas where it is dictated by the geology, however these are not expected to be extensively required. This activity, if undertaken, will generate noise but will be infrequent, localised and small-scale. The transient nature of construction activities will also move noise emissions from potential blasting, being transient rather than a constant fixed-point location.

10.2.2 Effect S-P-R Linkage

The information provided in Table 10.3 identifies the potential impacts from noise emissions at identified receptors using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor.

Table 10.3: S-P-R Linkage Summary for Noise Effects

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Noise generated by surface plant and mobile fleet (including helicopters) during construction and operation activities displaces nearby fauna impacting on the abundance and/or diversity of native fauna.	Yes	Project activities will generate short term and transient noise emission effects from surface plant and mobile fleet during construction. See Section 11.2.3 (Ecology) for assessment of impacts to fauna.	AQ04
Noise generated by surface plant and mobile fleet (including helicopters) during construction and operation activities results in nuisance impacts to the local community.	Yes	The nearest receptor is 1.8 km from the Project Area. The Project will introduce a number of mobile noise sources associated with construction and operational activities. There is predicted to be a localised and temporary increase in noise in the vicinity of the Project.	AQ05
Generation of noise from interaction of wind, transmission lines and structures displaces native fauna and impacts on the abundance and/or diversity of native fauna.	No	Prevailing winds run parallel rather than perpendicular to the line, therefore the effect is unlikely to occur. Potential effect is very localised and fauna in immediate vicinity will not be negatively affected. Not considered to have a material linkage to native fauna as a receptor.	AQ09
Generation of noise from interaction of wind, transmission lines and structures results in amenity impacts to the local community.	No	There is predicted to be a low-level increase in noise immediately adjacent to the transmission line. However, consolidation of the Project with the existing transmission line will not increase the noise above existing levels.	AQ10
Noise from blasting during construction activities results in nuisance impacts to the local community.	Yes	The nearest receptor is 1.8 km from the Project Area. Although blasting is unlikely to be required, there is a potential linkage.	AQ08

10.2.3 Impact Significance Assessment

This section discusses the significance of potential impacts where a linkage has been identified between the noise effects of the Project and receptors. An impact assessment using the OZ Minerals Impact Assessment Framework has been carried out for each of these potential impacts. These impact assessments are presented in Appendix I. Supporting discussion is provided below followed by a table summarising the outputs of the Impact Assessment Framework.

In accordance with the Impact Assessment Framework, only those potential impacts that have been identified as having an S-P-R linkage (or are found to be "material") have had an impact significance assessment carried out. Potential impacts where there is no identified S-P-R linkage are discussed above in Table 10.3.

Noise – Construction and Operation

The *Environment Protection (Noise) Policy 2007* generally restricts construction activities resulting in noise with an adverse impact on amenity to between 7am and 7pm, Monday to Saturday. Although this restriction does not apply to public infrastructure, noise-generating activities from the Project will predominantly occur within these times but may be on a 7-day per week basis. Nightworks at construction sites are not expected to occur.

Construction activity near residences will be scheduled in accordance with EPA guidance for normal construction working hours as far as practicable. Landowners will be consulted if unavoidable out-of-hours work is required near residences.

Given the remote location of the Project Area, the distance from sensitive receptors, the transient nature of construction activities (i.e. once each transmission pole is erected, construction activities will move on to a new site), the exposure of sensitive receptors to fixed-point emissions will be short term. The impact of noise emissions from construction activities to sensitive receptors has been assessed as very low.

Noise generated from maintenance activities are considered to have a negligible effect on the surrounding environment due to the short-term duration, and infrequent nature of the activities. Annual helicopter fly-overs are also a source of noise but are considered to have a negligible effect on sensitive receivers due to the short term, infrequent nature of the activity.

Potential impacts to fauna from construction noise are discussed in Chapter 10.

Noise – Presence of Infrastructure

Consolidation design of the Project with the existing transmission line will not increase the noise above existing background levels. This coupled with the fact that the noise emitted would not reach sensitive receptors means this is a negligible impact. Potential impacts to fauna are discussed in Chapter 11.

Noise from Blasting

Although blasting is unlikely to be required, there is a potential linkage. If blasting is required for excavation purposes, events will be small scale, controlled, localised and transient (i.e. blasting will only occur at a site to assist excavation, before poles are erected and construction moves on to the next location). Sensitive receptors are also a significant distance from the transmission line, as discussed above. The impact of noise emissions from potential blasting activities to sensitive receptors has been assessed as very low.

Table 10.4: Summary of Noise Impact Significance

Impact ID	Potential Impact Description	Impact Significance				Impact Uncertainty			Overall
		Resilience	Importance	Duration	Significance	Input	Methodology	Sensitivity	
AQ05	Noise generated by surface plant and mobile fleet (including helicopters) during construction and operation activities results in nuisance impacts to the local community.	1	1	2	2	B	C	B	3 Very Low
AQ08	Noise from blasting during construction activities results in nuisance impacts to the local community.	1	1	1	1	B	C	B	2 Very Low

10.3 Unplanned Events

No unplanned events were identified in relation to noise emissions.

10.4 Summary of Control and Mitigation Strategies

Table 10.5: Summary of Design Controls

Design Controls	Impact ID
Design of equipment in accordance with relevant standards and industry guidelines.	AQ10

Table 10.6: Summary of Management Controls

Management Controls	Impact ID
Noise management addressed in the Construction Environmental Management Plan.	AQ05
Regular maintenance of equipment.	AQ05
Consult with landowners if noise generating activities in the vicinity of residences are planned outside normal construction hours.	AQ05
Complaints register and corrective action program.	AQ05
Community consultation process.	AQ05
All civil aircraft comply with the Air Navigation (Aircraft Noise) Regulations 2018.	AQ05
Blasting (if required) undertaken in accordance with regulatory requirements.	AQ08
Landowners in close proximity to potential blasting events (if required) will be notified.	AQ08

11 ECOLOGY

11.1 Existing Environment

11.1.1 Assessment Methods

The information provided in this chapter is based on data collected during the ecological survey undertaken for the Project in March 2018 (see Appendix D1) and desktop assessment utilising the extensive ecological investigations that have previously been undertaken for the infrastructure corridor to Olympic Dam in which the Project is located (which are summarised in BHP Billiton, 2009). In addition, this chapter uses information prepared for assessments of impacts to nationally threatened species, which are contained in Appendix D3.

The ecological survey undertaken in March 2018 included:

- A vegetation survey performed by accredited ecologists in accordance with the Rangelands Assessment Method (RAM) devised by the Native Vegetation Council (NVC, 2017)
- Targeted surveys for key flora species (in particular the Endangered *Frankenia plicata*) in areas where there was considered to be a higher likelihood of occurrence
- An opportunistic fauna assessment undertaken concurrently with the vegetation survey, which included records of signs of fauna, targeted observations of bird presence and a targeted search for the Pernatty Knob-tailed Gecko
- An assessment of the value of habitat for threatened fauna listed under the EPBC Act and NPW Act, which was determined when searching the Study Area.

The desktop assessment reviewed information from a range of sources including:

- A Biological Database of South Australia (BDBSA) search extract covering Study Area (i.e. a 10 km corridor along the proposed alignment)
- An EPBC Act Protected Matters database search covering the Study Area
- A review of relevant reports, reference materials and published papers including:
    - environmental assessments of potential impacts for existing and proposed linear infrastructure projects located adjacent to the proposed transmission line for much of the alignment, including WMC (1997, cited in BHP Billiton 2009) and numerous flora and fauna surveys of the infrastructure corridor described in BHP Billiton (2009) including surveys undertaken by Ecological Associates in 2006, 2007 and 2008, ENSR in 2007, EBS Ecology in 2008 and Ecological Horizons in 2008 (cited in BHP Billiton 2009)
    - vegetation mapping of the Study Area in previous reports including the Olympic Dam Expansion EIS (BHP Billiton, 2009)
    - regional biological surveys such as Brandle (1998) and Slaytor (1999)
    - review of publicly available imagery
    - threatened species profiles, reference texts and published material.

There have been minor changes to the alignment since the field survey was undertaken, principally in the area between Mount Gunson South Substation and Woomera on the 132 kV section, where the current alignment runs on the western side of the existing transmission lines rather than crossing to the east at Mount Gunson South and running on the eastern side. There are very minor changes in the length of vegetation associations intersected by the alignment as a result of this change, however it does not have a material impact on the conclusions of the assessments and is likely to result in lower overall impact, as the existing access track is expected to be used more extensively. The current alignment is still in the central part of the Study Area.

Additional targeted ecological surveys are planned to be undertaken during the detailed design phase to review and refine proposed structure and track locations and ensure that they are appropriately located and minimise or avoid impacts, particularly impacts on listed species or potential habitat.

11.1.2 Regional Context

The Project Area is located in the Gawler Bioregion defined under the Interim Biogeographical Regionalisation of Australia (IBRA), as discussed in Section 6.1. The IBRA classification identifies geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. The Project Area also intersects three IBRA subregions within the Gawler Bioregion: Gawler Lakes, Arcoona Plateau and Roxby. Detail on these subregions is provided in Table 6.1 and Appendix D1.

The Gawler Bioregion is characterised by semi-arid to arid flat topped to rounded hills, rocky quartzite hills, sandstone plateaus, depositional plains, gibber plains and salt-encrusted lake beds. Typical vegetation includes open woodlands of Black Oak and Myall, open Mallee Scrub, chenopod shrublands (Bluebush / Saltbush) and tall Mulga shrublands. The native vegetation across the area is generally relatively intact, but in some areas, particularly near stock watering points, it is highly disturbed.

The environment of the region has been influenced by pastoral activities and infrastructure (e.g. sheep and cattle stations) and mining operations such as Olympic Dam, as well as the construction and operation activities of the Woomera Rocket Range (Department of Defence, 2018). Grazing by livestock and rabbits has led to extensive habitat modification across the region and coupled with the introduction of predators such as foxes and cats, has resulted in the extinction of many small to medium sized mammals (Morton, 1990).

Weeds are present in the region, particularly ephemeral species that can respond favourably to cool-season rains. Whilst the density of weeds is generally low in these arid areas, they are relatively common along tracks, near dams, roadsides and other areas of disturbance. The most common weeds in the region, are the environmental weeds *Carrichtera annua* (Ward's Weed), which dominates chenopod shrublands and Western Myall Woodlands on clay loams, and *Brassica tournefortii* (Wild Turnip) which occurs on sand dunes where present (BHP Billiton, 2009).

Numerous pastoral dams exist in the Regional Study Area. The dams are regularly manipulated for livestock use and tend to be highly altered, often presenting with high siltation and nitrification. Dam management can result in dams retaining water through extended droughts (via pumping from other

areas) or conversely remaining dry when stock is absent (even during wetter periods). Pastoral dams within this landscape therefore provide opportunistic habitats to native fauna and flora, but the nature of dam management generally renders them ineffective in providing consistent ecological habitat values or habitats that would support core populations of significant species.

The region supports no natural, permanent water bodies, though the numerous ephemeral lakes provide important habitat for waterbirds and other fauna when flooded.

11.1.3 Vegetation Associations

Following field surveys, BHP Billiton (2009) described 65 vegetation associations that are relevant to the Study Area. These are summarised in Appendix D1 and have been used to prepare vegetation mapping for the Study Area (see Figure 11.1 to Figure 11.4). Relevant vegetation associations for the Project Area (the transmission line corridor) are discussed below.

Twenty different vegetation associations were identified in the Project Area. These vegetation association categories are based on the vegetation associations identified by BHP Billiton (2009), with some simplification and consolidation to align with the requirements of the Native Vegetation Council's Rangelands Assessment Method. Table 11.1 summarises the vegetation associations of the Project Area as they relate to the vegetation associations of the wider Study Area as defined by BHP Billiton (2009).

Brief descriptions of the vegetation associations occurring within the Project Area are presented in Table 11.2, and more detail is provided in Appendix D1.

These vegetation associations occur across five key habitat / landform types: sandplain / low plain, dunes and swales, stony tablelands / Arcoona plateau, salt lakes and ephemeral claypans and ephemeral creeklines (see Section 11.1.4 below). The condition of vegetation in these associations recorded during the field survey was generally medium according to the Native Vegetation Council's Rangelands Assessment Method (condition scores ranged from 28 to 62 out of a possible 80 and averaged 45) as discussed in Section 11.1.5.

No vegetation associations within the Study Area listed as threatened at a regional, state or national level were observed (EBS, 2018). There are no groundwater dependent ecosystems recognised in the Study Area and reliance of flora and fauna on groundwater is likely to be limited, predominantly due to the depth and salinity.

Table 11.1: Vegetation Associations Identified in the Project Area as they Relate to Vegetation Associations Mapped for the Study Area

Number	Project Area (EBS, 2018) Vegetation Association Description	BHP Vegetation Associations Mapped for the Study Area (BHP Billiton, 2009)
1	*Acacia papyrocarpa* (Western Myall) Open Woodland	*Acacia papyrocarpa* woodland
2	*Acacia aneura* (Mulga) Mixed Woodland	*Acacia aneura / A. tetragonophylla +/- Maireana sedifolia* tall shrubland; *Acacia aneura* woodland; *Acacia aneura* woodland - *A. papyrocarpa* woodland; *Maireana pyramidata / Atriplex vesicaria* low shrubland; *Maireana pyramidata / M. sedifolia* low shrubland
3	*Casuarina pauper* (Black Oak) / *Acacia aneura* (Mulga) Open Woodland	*Acacia aneura / Casuarina pauper* woodland; *Acacia aneura* woodland
4	*Casuarina pauper* (Black Oak) Woodland	*Acacia aneura* woodland - *A. papyrocarpa* woodland; *Casuarina pauper* woodland
5	*Callitris glaucophylla* (Northern Cypress Pine) Woodland	*Callitris glaucophylla* woodland; *Callitris glaucophylla* woodland - *Acacia aneura* woodland
6	*Acacia aneura* (Mulga) / *Acacia papyrocarpa* (Western Myall) Mixed Woodland	*Acacia papyrocarpa* woodland - *A. ramulosa +/- A. aneura +/- A. burkittii* shrubland
7	*Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrubland	*Atriplex vesicaria / Sclerostegia sp. +/- Maireana eriantha* low shrubland - *Acacia aneura +/- Casuarina pauper* woodland; *Atriplex vesicaria / Sclerostegia sp*. low shrubland
8	*Acacia aneura* (Mulga) *+/- Alectryon oleifolius* (Bullock Bush) Shrubland	*Acacia burkittii +/- A. aneura +/- A. ramulosa +/- Alectryon oleifolius ssp. canescens* shrubland
9	*Maireana sedifolia* (Pearl Bluebush) Low Open Shrubland	*Maireana sedifolia / Atriplex vesicaria* low shrubland; Maireana sedifolia low shrubland
10	*Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)	*Acacia papyrocarpa* woodland
11	*Atriplex vesicaria* (Bladder Saltbush) *+/- Maireana astrotricha* (Low Bluebush) Mixed Low Open Shrubland	*Atriplex vesicaria / Maireana astrotricha* low shrubland; *Atriplex vesicaria* low shrubland; *Sclerolaena spp*. low shrubland
12	*Acacia aneura* (Mulga), *Acacia ramulosa* (Horse Mulga) Woodland over *Acacia ligulata* (Sandhill Wattle)	*Acacia ligulata +/- Maireana pyramidata* shrubland; *Acacia ramulosa +/- A. aneura +/- A. ligulata +/- Dodonaea viscosa ssp. angustissima* shrubland; *Acacia ramulosa +/- A. aneura +/- A. ligulata +/- Dodonaea viscosa ssp. angustissima* shrubland - *A. aneura* woodland
13	*Acacia ligulata* (Sandhill Wattle) / *Dodonaea viscosa* (Sticky Hop-bush) Shrubland	*Atriplex vesicaria / Halosarcia spp. +/- Maireana pyramidata* low shrubland; *Atriplex vesicaria / Sclerostegia arbuscula +/- Maireana sedifolia* low shrubland

Number	Project Area (EBS, 2018) Vegetation Association Description	BHP Vegetation Associations Mapped for the Study Area (BHP Billiton, 2009)
14	*Tecticornia* spp. (Samphire) +/- *Atriplex vesicaria* (Bladder Saltbush) Low shrubland	*Acacia aneura / Casuarina pauper* woodland
15	*Casuarina pauper* (Black Oak) Creekline	*Atriplex vesicaria +/- Sclerostegia sp.* low shrubland - *Eragrostis australasica* grassland; *Eragrostis australasica* grassland
16	*Atriplex vesicaria* (Bladder Saltbush) +/- *Eragrostis australasica* (Swamp Canegrass) Low Open Shrubland	*Atriplex vesicaria / Sclerostegia sp.* low shrubland; *Maireana astrotricha* low shrubland +/- *M. aphylla* shrubland
17	*Maireana aphylla* (Cotton Bush) Low Shrubland	*Atriplex vesicaria / Sclerostegia sp.* low shrubland
18	*Melaleuca pauperiflora* ssp. *mutica* (Boree) Shrubland +/- *Acacia ligulata* (Sandhill Wattle)	*Atriplex vesicaria* low shrubland - *Halosarcia spp.* low shrubland - *Acacia aneura / Melaleuca pauperiflora ssp. mutica* tall shrubland
19	*Maireana astrotricha* (Low Bluebush) Low Open Shrubland	*Eremophila duttonii / Maireana sedifolia / Scaevola spinescens* shrubland - *Acacia tetragonophylla* shrubland *Maireana astrotricha +/- Ptilotus obovatus* low shrubland
20	*Chenopodium nitrariaceum* (Nitre Goosefoot) Open Shrubland	*Atriplex vesicaria* low shrubland - *Maireana aphylla +/- Chenopodium nitrariaceum* shrubland

Source: EBS, 2018 and BHP Billiton, 2009

Table 11.2: Project Area Vegetation Association Descriptions

Vegetation Association	Description	Approx. Length on Alignment (km)
1. *Acacia papyrocarpa* (Western Myall) Open Woodland	Open woodland that dominates the southern section of the Project Area where shallow loams on sandplains and clay-loam plains occur over limestone and are also scattered at the edge of interdunal swales or in small swales in the Roxby land system at the northern end of the Project Area. Understorey typically dominated by chenopod shrubs, including *Atriplex vesicaria*, *Maireana sedifolia* and M. *pyramidata*. Forms a mosaic with *A. aneura* woodland on sandplains and *Myoporum platycarpum* and *Casuarina pauper* on clay-loam plains. Declared and environmental weeds sparsely present (*Carrichtera annua* (Wards Weed), *Carthamus lanatus* (Star Thistle) and *Sisymbrium sp.* (Mustard)). Vegetation condition within the Project Area varies is primarily medium, with some areas of low to medium and others of medium to high. *Santalum spicatum* (South Australia: Rare) – recorded in this association.	46.1
2. Acacia aneura (Mulga) Mixed Woodland	Low, open woodland dominated by *A. aneura* on deeper sandplains, in sandy swales and on the lower slopes of dunes. Other dominant species include *Alectryon oleifolius* (Bullock Bush), many other *Acacia spp.* (Wattles) and Casuarina pauper (Black Oak). Midstorey species present include *Maireana spp.* (Bluebushes), *Atriplex vesicaria* (Bladder Saltbush), *Chenopodium curvispicatum* (Cottony Goosefoot) and *Rhagodia spinescens* (Spiny Saltbush). The understorey is dominated by *Sclerolaena spp.* (Bindyis).	1.4

Vegetation Association	Description	Approx. Length on Alignment (km)
	Declared and environmental weeds sparsely present (*Carrichtera annua* (Wards Weed)). Vegetation condition within the Project Area is medium / medium to high. *Santalum spicatum* (South Australia: Rare) – recorded in this association.	
3 *Casuarina pauper* (Black Oak) / *Acacia aneura* Open Woodland	*Casuarina pauper* present as patches or clumps of trees amongst other areas of Mulga and or other communities. Groves are also commonly prominent occupying areas of outcropping stone or rises where other species are unable to compete and have low overstorey diversity. Understorey species include chenopods (*Maireana sp.* Bluebush, *Enchylaena tomentosa* Ruby Saltbush), *Ptilotus obovatus* (Silver Mulla Mulla), *Sida spp.* (Sidas) and *Sclerolaena obliquicuspis* (Oblique spined Bindyi). This community is widespread and well represented both within the Project Area and in the region generally. No declared or environmental weeds observed. Vegetation condition within the Project Area is medium. No threatened species observed.	1.4
4.*Casuarina pauper* (Black Oak) Woodland	Well represented across South Australia. Typically growing in groves in red-brown soils with light-textured topsoil and calcareous subsoil. Understories are often dominated by chenopod shrubs and forbs including species of *Maireana spp*. (Bluebushes), *Chenopodium spp*. (Goosefoots), *Enchylaena tomentosa* (Ruby Saltbush), *Rhagodia spinescens* (Spiny Saltbush) and *Sclerolaena spp*. (Bindyis). This association often occurs on exposed outcrops and has low diversity. No declared or environmental weeds observed. Vegetation condition within the Project Area is medium. No threatened species observed.	1.0
5. *Callitris glaucophylla* (Northern Cypress Pine) Woodland	Present as small communities on high dune ridges within Mulga communities. Old growth trees are present within the Study Area. Additional overstorey species include *Acacia ramulosa* (Horse Mulga), *Alectryon oleifolius ssp. canescens* (Bullock Bush), and *Pittosporum angustifolium* (Native Apricot). Midstorey and understory species include *Ptilotus obovatus* (Silver Mulla Mulla), *Dodonaea viscosa ssp. angustissimus* (Sticky hop-bush), chenopods *Enchylaena tomentosa* (Ruby Saltbush), *Maireana sp.* and grasses (*Enneapogon sp.*). Declared and environmental weeds present (*Carrichtera annua* (Wards Weed) and *Sonchus oleraceus* (Sow Thistle)). Vegetation condition within the Project Area is medium. No threatened species observed.	9.8
6. *Acacia aneura* (Mulga) / *Acacia papyrocarpa* (Western Myall) Mixed Woodland	This community is transitional between Mulga and Myall and occurs as a community where neither overstorey species dominated clearly within areas. The understorey and mixed tree and shrub species was consistent with both of the directly dominant overstorey species, with *Myoporum platycarpum* (False Sandalwood) also present. Dominant midstorey and undestorey species include chenopods (*Maireana* sp. Bluebushes, *Atriplex* sp. and *Rhagodia* Saltbushes), *Chenopodium curvispicatum* (Cottony Goosefoot), *Acacia ramulosa* (Horse Mulga) and *Podolepis capillaris* (Invisible Plant). Declared and environmental weeds present (*Opuntia spp.* (Wheel Cactus)).	23.2

Vegetation Association	Description	Approx. Length on Alignment (km)
	Vegetation condition within the Project Area is medium. No threatened species observed.	
7. *Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrubland	This association occurs on clay or clay-loam soils, Aeolian accession and over large areas of arid and semi-arid southern Australia. Dominant midstorey and understorey species present within this association in the Study Area include *Frankenia serpyllifolia* (Sea Heath), *Maireana eriantha* (Silver Bluebush), *Abutilon halophilum* (Plains Lantern and several *Sclerolaena* (Bindyi / Poverty Bush) species. Environmental weeds present (*Carthamus lanatus* (Star Thistle)). Vegetation condition within the Project Area is predominantly medium, with some medium to high areas. No threatened species observed.	38.3
8. *Acacia aneura* (Mulga) +/- *Alectryon oleifolius* (Bullock Bush) Shrubland	This community occurs in small patches where the dominance is shared between Mulga (*Acacia aneura and A. ramulosa*) and Bullock Bush. Bullock bush communities are usually associated with floodplains and areas of temporary wetting; however, this species regularly occurs as a mixed component of many other communities. Midstorey and understorey species that are present include chenopods (*Maireana pentatropis* (Tall Bluebush), *M. georgei* (Satiny Bluebush), *Enchylaena tomentosa* (Ruby Saltbush)), *Abutilon leucopetalum* (Desert Lantern), *Solanum quadriloculatum* (Plains Nightshade), *Sida fibulifera* (Pin Sida), *Podolepis capillaris* (Invisible Plant), and *Ptilotus obovatus* (Silver Mulla Mulla. No declared and environmental weeds observed. Vegetation condition within the Project Area is medium. No threatened species observed.	10.2
9. *Maireana sedifolia* (Pearl Bluebush) Low Open Shrubland	This shrubland occurs on limestone/calcrete and alkaline soil conditions. The calcareous earths have surface textures ranging from clay loams to loams. Overgrazing in this landscape has resulted in the replacement of palatable perennial pastures by poor quality grasses such as *Austrostipa spp*. and *Aristida spp.* as well as thorny sub-shrubs from the genera *Dissocarpus* and *Sclerolaena*. Additional overstorey species include *Senna sp*. (Senna) and *Maireana sp*. (Bluebushes). Midstorey and understory species include *Ptilotus obovatus* (Silver Mulla Mulla), *Atriplex vesicaria* (Bladder Saltbush), *Sclerolaena sp.*, and Maireana trichoptera (Hairy Fruit Bluebush). No declared or environmental weeds observed. Vegetation condition within the Project Area is medium. No threatened species observed.	2.7
10. *Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)	Key values of this association include maintenance of landscape function and soil productivity. Other midstorey species include *Dodonaea viscosa ssp. angustissimus* (Sticky Hop-bush), chenopods (*Atriplex vesicaria* Bladder Saltbush), *Maireana sp.* Bluebushes, *Enchylaena tomentosa* Ruby Saltbush, *Rhagodia spinescens* Spiny Saltbush) and *Exocarpos aphyllus* (Leafless Ballart / Currant Bush). Understorey species include grasses (*Enneapogon polyphyllus* Bottlewashers, *Aristida contorta* Kerosene Grass), *Dissocarpus paradoxus* (Cannonball) and *Sclerolaena cuneata* (Yelow-stemmed Bindyi). No declared or environmental weeds observed. Vegetation condition within the Project Area is medium / medium to high.	0.1

Vegetation Association	Description	Approx. Length on Alignment (km)
	No threatened species observed.	
11. *Atriplex vesicaria* (Bladder Saltbush)+/- *Maireana astrotricha* (Low Bluebush) Mixed Low Open Shrubland	This association dominates the areas where the soil profile is reduced to shallow loam over bedrock, providing a limited ability for larger species to persist. Additional dominant overstorey species include *Alectryon oleifolius ssp. canescens* (Bullock Bush), *Dodonaea viscosa ssp. angustissimus* (Sticky hop-bush), *Maireana astrotricha* sp. (Bluebushes) and *Gunniopsis quadrifida* (Sturts Pigface). Midstorey species that occur include *Sida ammophila* (Sand Sida), *Sporobolus actinocladus* (Ray Grass), *Sclerolaena* sp., and *Frankenia sp.* (Sea Heath). Understorey species include *Enneapogon sp.* (Bottlewashers), *Aristida contorta* (Kerosene Grass) and *Dissocarpus paradoxus* (Cannonball). No declared and environmental weeds observed. Vegetation condition within the Project Area is generally medium with some areas of medium to high. No threatened species observed.	10.8
12. *Acacia aneura* (Mulga) / *Acacia ramulosa* (Horse Mulga) Low Woodland over *A. ligulata* (Sandhill Wattle)	This community occupies the low dune rises between the sand plains and deeper dune profiles. Acacia ligulata prefers deeper sand areas and *A. ramulosa* (Horse Mulga) prefers the shallower areas, with the transition from the typical A. aneura (Mulga) sand plain structure. The transitional nature of this community means they intergrade with other communities and therefore a wide range of habitat niches and species richness as a result. Midstorey species that are present include *Pimelea microcephala ssp. microcephala* (Desert Riceflower), *Aristida holathera var. holathera* (Three-awn Grass), chenopods (*Maireana sp. Chenopodium sp.*) and *Leiocarpa leptolepis* (Plains Plover-daisy). Understorey species include *Dissocarpus paradoxus* (Cannonball), *Sclerolaena obliquicuspis* (Oblique-spined Bindyi), *Solanum quadriloculatum* (Plains Nightshade), grasses (*Enneapogon sp., Aristida* sp.), *Sida ammophila* (Hill Sida) and *Digitaria brownii* (Cotton Panic Grass). Environmental weeds present (*Brassica tournefortii* (Wild Mustard)). Vegetation condition within the Project Area is predominantly medium, with some areas of medium to high. No threatened species present.	33.8
13. *Acacia ligulata* (Sandhill Wattle) / *Dodonaea viscosa* (Sticky Hop-bush) Shrubland	This vegetation association occurs on undulating dune areas where there was a relatively mobile sand structure. These communities are highly reliant on perennial low shrubs and grasses to provide stability. *Acacia ramulosa* (Horse Mulga) also occurs as a dominant overstory species. Midstorey and understorey species include chenopods (*Enchylaena tomentosa* Ruby Saltbush, *Rhagodia* spinescens Spiny Saltbush), *Aristida contorta* (Kerosene Grass), *Salsola australis* (Salsola), *Sida ammophila* (Hill Sida). Environmental weeds present (*Brassica tournefortii* (Wild Mustard)). Vegetation condition within the Project Area is ranges from low to medium / medium / medium to high. No threatened flora species observed. This community is known habitat for the Pernatty Knob-tailed Gecko (*Nephrurus deleani*) (South Australia: Rare).	3.5

Vegetation Association	Description	Approx. Length on Alignment (km)
14. *Tecticornia spp.* (Samphire) *+/- Atriplex vesicaria (Bladder Saltbush)* Low shrubland	This association occurs in areas surrounding claypans and inland salt lakes. These habitats are highly variable, both spatially and temporally in terms of their salt concentration, which influences diversity and cover of vegetation any one location. Overstory species include *Melaleuca pauperiflora ssp. mutica* (Boree) and *Myoporum montanum* (Western Boobialla). Midstorey species include *Atriplex vesicaria* (Bladder Saltbush), *Tecticornia indica ssp. leiostachya* (Samphire), *Maireana oppositifolia* (Heathy Bluebush), *Tecticornia arbuscula* (Shrubby Samphire), *Gunniopsis quadrifida* (Sturts Pigface) and *Maireana appressa* (Bluebush), *Tecticornia pergranulata* (Black seed Samphire), *Atriplex acutibractea* (Sandhill Saltbush). *Osteocarpum sp.* (Bonefruit), *Sclerolaena decurrens* (Green bindyi) and *Disphyma crassifolium ssp. clavellatum* (Round-leaf Pigface) were also present. No declared and environmental weeds observed. Vegetation condition within the Project Area is medium / medium to high. No threatened species observed.	1.7
15. *Casuarina pauper* (Black Oak) Creekline	Occurs in an ephemeral creekline. This community can provide valuable ecological and hydrological functions in arid systems. Additional dominant overstorey species present within the Study Area include: *Myoporum montanum* (Western Boobialla), *Scaevola spinescens* (Spiny Fan flower), *Senna artemisioides ssp. artemisioides* (Silver-leaf Senna), *Acacia aneura* (Mulga), *Dodonaea lobulata* (Lobe-leaf Hop-bush). Midstorey and undestorey species present include *Abutilon halophilum* (Plains Lantern Bush), Saltbush species, *Eremophila serrulata* (Emu-bush), *Pterocaulon sphacelatum* (Fruit Salad Plant), *Solanum quadriloculatum* (Plains Nightshade) and *Ptilotus obovatus* (Silver Mulla Mulla). Environmental weeds present (*Malvastrum americanum var. americanum* (Malvastrum)). Vegetation condition within the Project Area is medium. No threatened species observed	1.7
16. *Atriplex vesicaria* (Bladder Salt Saltbush) +/- *Eragrostis australasica* (Swamp Canegrass) Low Shrubland	This community is typical of the Arcoona Plateau area and is highlighted by silcrete duricrusts formed on top of soils characterised by heavy clays and interspersed by gilgai depressions. The soils are highly sodic providing a narrow niche for halophytic (saline tolerant) flora species. Midstorey species include *Dissocarpus paradoxus* (Cannonball), *Sclerolaena intricata* (Intricate Poverty Bush), *Teucrium racemosum* (Grey Germander). Understorey species include *Atriplex holocarpa* (Pop Saltbush), *Eragrostis australasica* (Swamp Canegrass), *Eragrostis setifolia* (Neverfail), *Euphorbia tannensis ssp. eremophila* (Desert Spurge) and *Frankenia serpyllifolia* (Sea Heath). Declared and environmental weeds present (*Solanum nigrum* (Black Nightshade)). Vegetation condition within the Project Area is medium. No threatened species observed.	34.2

Vegetation Association	Description	Approx. Length on Alignment (km)
17. *Maireana aphylla* (Cottonbush) Low Shrubland	This community occurs where the soil is temporarily inundated for short periods. Additional overstorey species include *Atriplex vesicaria* (Bladder Saltbush), *Santalum lanceolatum* (Native Plum), and *Rhagodia spinescens* (Spiny Saltbush). Midstorey and understorey species include *Frankenia serpyllifolia* (Sea Heath), *Maireana georgei* (Satiny Bluebush) and *Eriochiton sclerolaenoides* (Woolly-fruit Copperburr). Environmental weeds observed (*Citrullus lanatus* (Bitter Melon), *Medicago sp.* (Medic)). Vegetation condition within the Project Area is low to medium. No threatened species observed, but habitat known to support Thick-billed Grasswren (*Amytornis modestus*), and provide refuge habitat for the Plains Mouse (*Pseudomys australis*).	6.8
18. *Melaleuca pauperiflora* (Boree) Shrubland +/- *Acacia ligulata* (Sandhill Wattle)	This community typically occurs in areas of ephemeral salt pans and saline springs. Within the Project Area it primarily occurs at the Lake Mary fringes adjacent to the main road. Very widely scattered individuals of *M. pauperiflora* were also present on the banks of Lake Windabout. These were commonly associated with *Tecticornia* species and gypseous tolerant halophytes or as a very narrow transition from sand loving species such as *Acacia ligulata*. Understorey species present include *Tecticornia spp.* (Samphires), *Atriplex vesicaria* (Bladder Saltbush), *Enchylaena tomentosa* (Ruby Saltbush) and *Gunniopsis quadrifida* (Sturts Pigface). Environmental weeds present (*Brassica tournefortii* (Wild Mustard)). Vegetation condition within the Project Area is medium. No threatened species observed.	6.5
19. *Maireana astrotricha* (Low Bluebush) Low Open Shrubland	This community occurs on areas of stone outcropping with shallow loams and is well represented within the Project Area. Other overstorey species present include *Atriplex vesicaria* (Bladder Saltbush), *Maireana pyramidata* (Black Bluebush), *Myoporum montanum* (Western Boobialla), and *Acacia victoriae* (Elegant Wattle). Midstorey and undestorey species present include *Amyema quandang var. quandang* (Mistletoe), several *Enneapogon sp.* (Bottlewasher Grasses), *Maireana coronata* (Fissure Bluebush), *Eragrostis setifolia* (Neverfail), *Pterocaulon sphacelatum* (Fruit Salad Plant), *Sclerolaena obliquicuspis* (Oblique-spined Bindyi), and *Euphorbia drummondii* (Caustic Weed). Environmental weeds present ((*Citrullus lanatus* (Bitter Melon)). Vegetation condition within the Project Area is medium. No threatened species observed, but the flock Bronzewing Pigeon (*Phaps histrionica*), rated rare in South Australia, is likely to utilise this habitat.	1.7
20. *Chenopodium nitrariaceum* (Cottony Goosefoot) Open Shrubland	This community occupies ephemeral swamps on very heavy cracking clay soils. *Duma florulenta* (Lignum) is also present in the overstorey. Midstorey and understorey species include *Maireana integra* (Bluebush), *Atriplex holocarpa* (Pop Saltbush), *Eragrostis dielsii* (Mulka), *Sclerolaena decurrens* (Green Bindyi), *Dissocarpus paradoxus* (Cannonball), and *Eriochiton sclerolaenoides* (Woolly-fruit Copperburr). No declared and environmental weeds observed. Vegetation condition within the Project Area is medium.	0.7

Vegetation Association	Description	Approx. Length on Alignment (km)
	No threatened species observed, but this community can provide refuge habitats for the nationally threatened species Plains Mouse (*Pseudomys australis*).	
Clay Pan	(no vegetation)	1.3

Source: adapted from (Appendix D1).

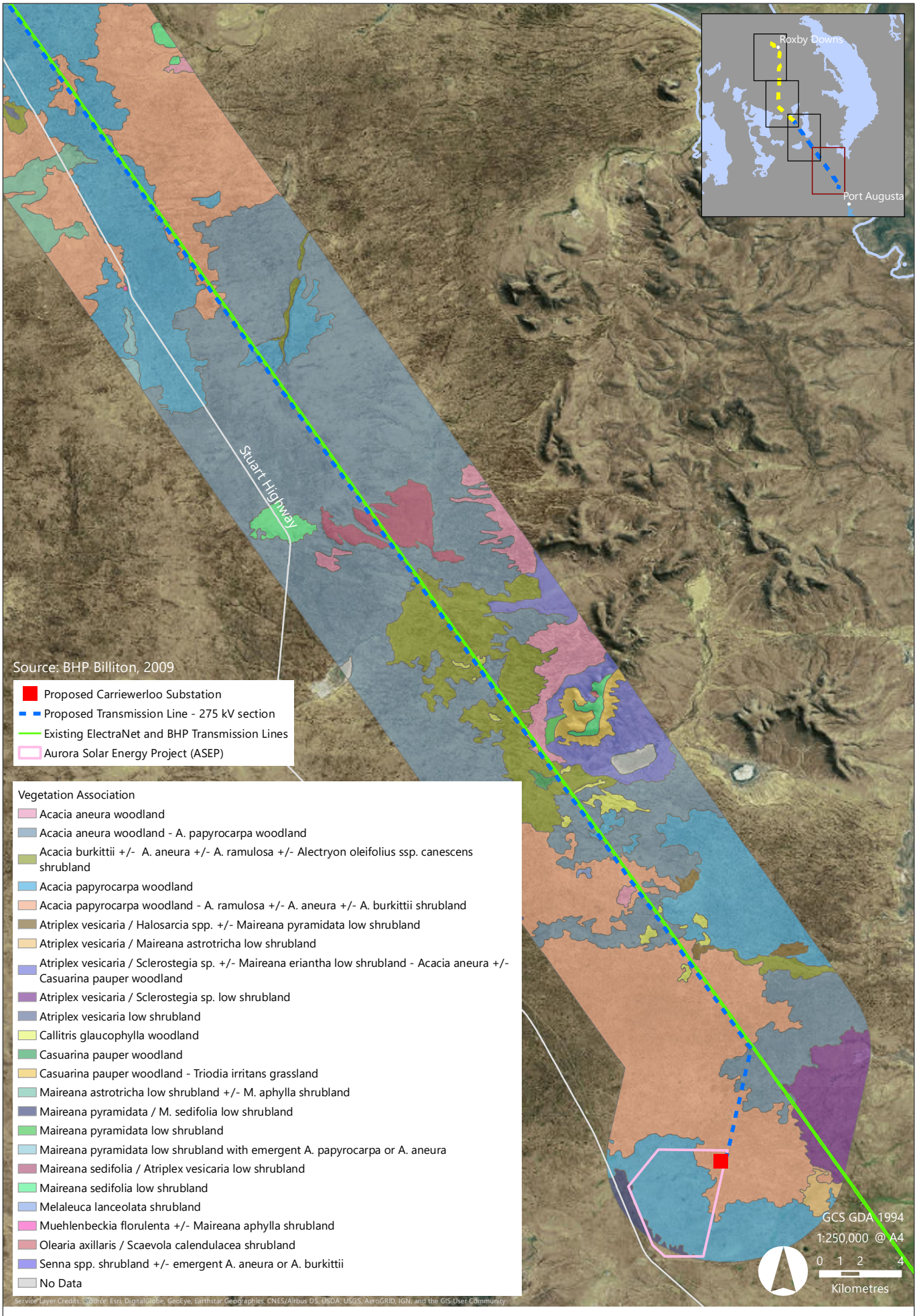

Figure 11.1: Vegetation Associations along the Proposed Transmission Line - 275 kV section (A)
CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

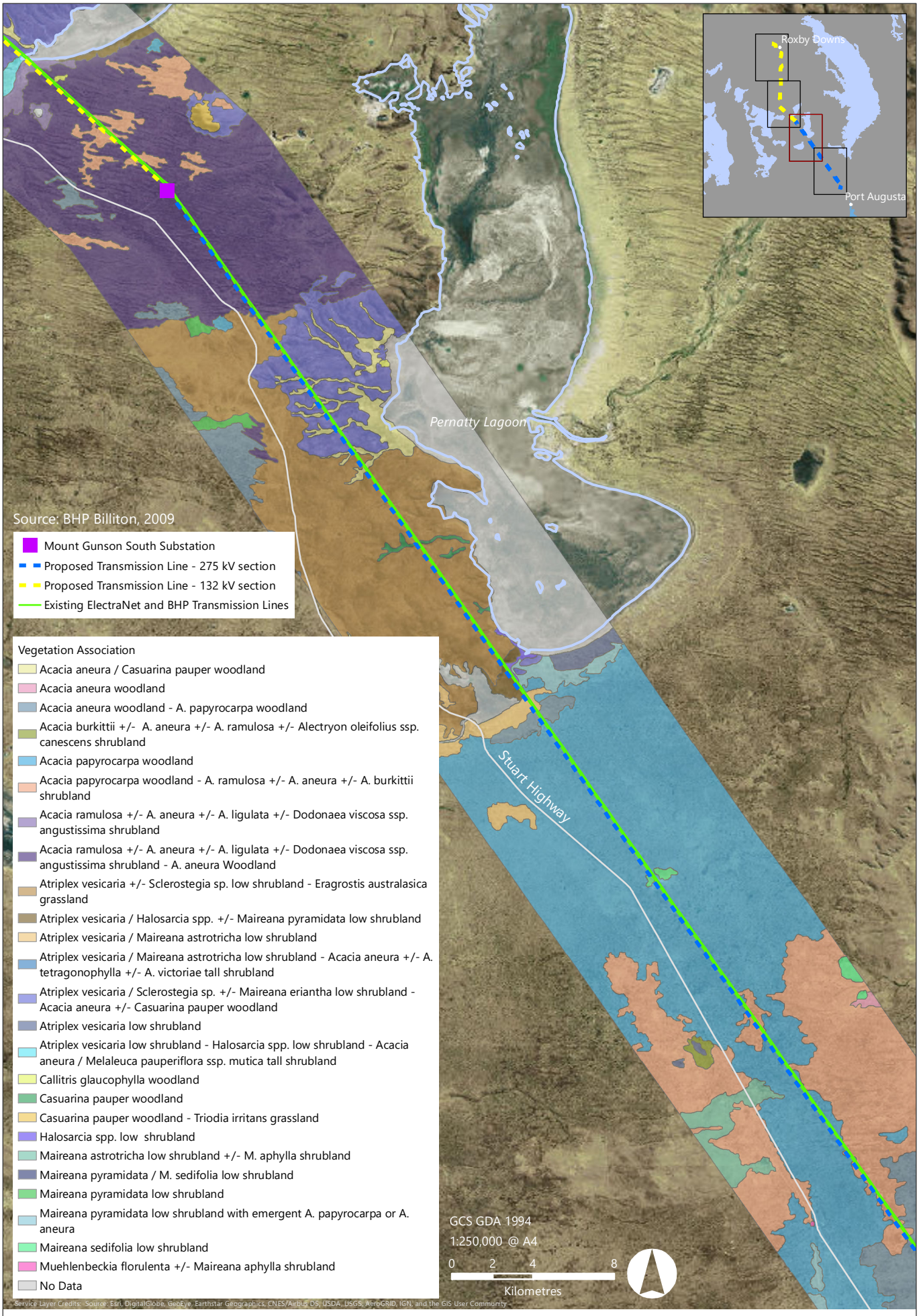

Figure 11.2: Vegetation Associations along the Proposed Transmission Line - 275 kV section (B)
CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

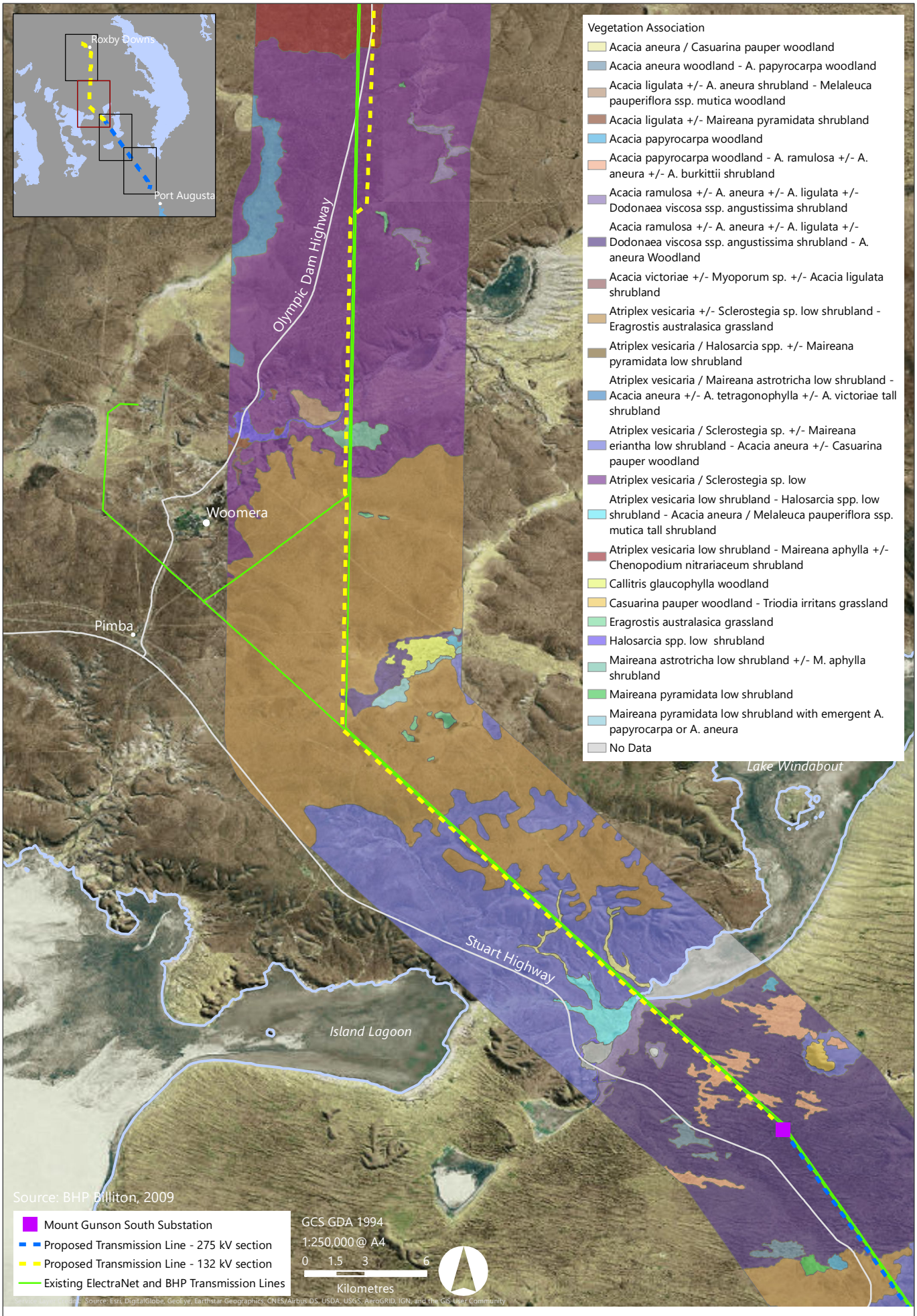

Figure 11.3: Vegetation Associations along the Proposed Transmission Line - 132 kV section (A)
CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

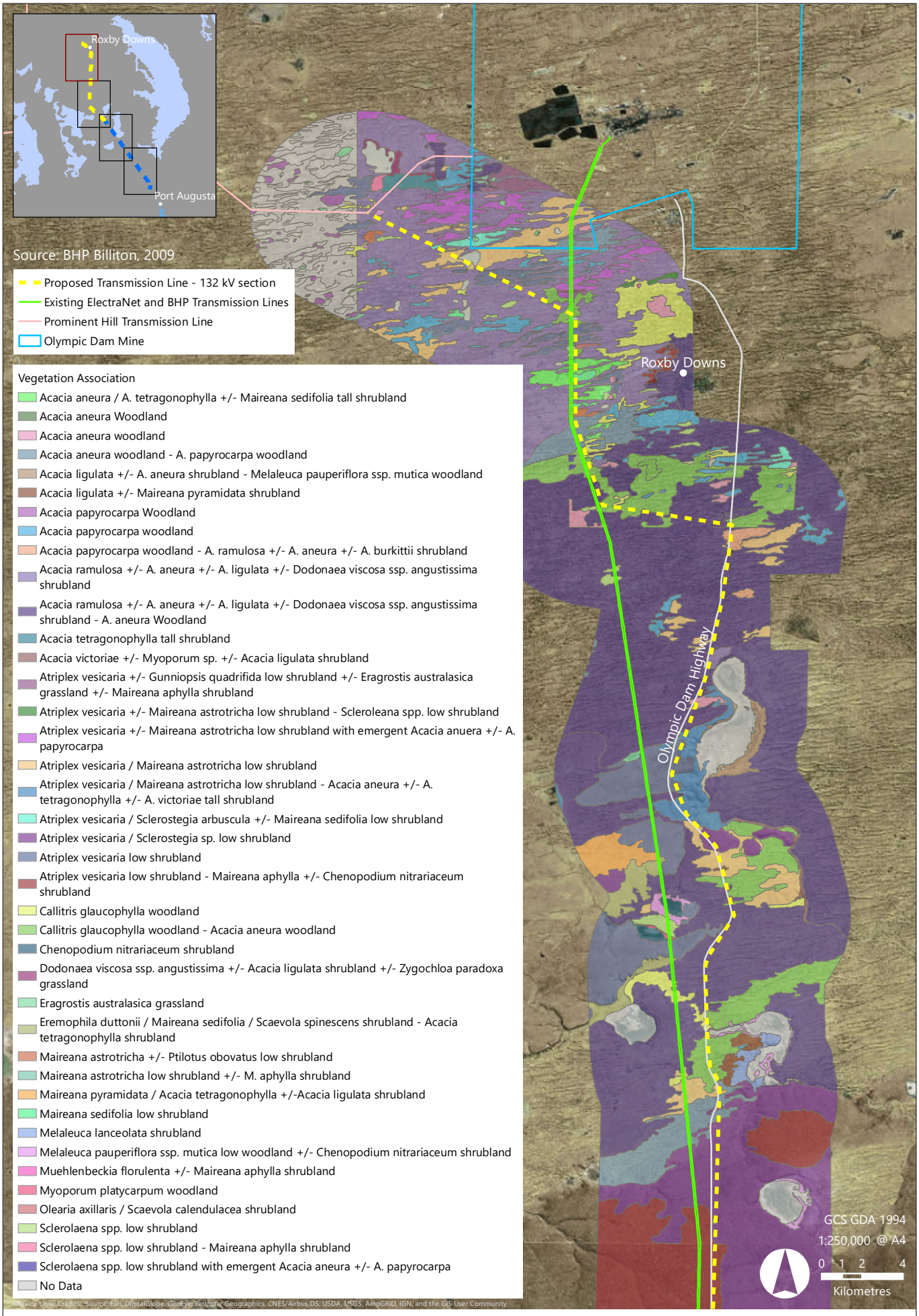

Figure 11.4: Vegetation Associations along the Proposed Transmission Line - 132 kV section (B)
CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

11.1.4 Key Habitats

Several key habitats occur in the Study Area. A brief description is provided below with further detail provided in Appendix D1.

Sandplain / Low Plain

This habitat primarily occurs at the southern end of the alignment where sand clay loams are over limestone. These soil types are dominated by chenopods, primarily *Maireana astrotricha* (Low Bluebush), *Maireana sedifolia* (Pearl Bluebush), *Maireana pyramidata* (Black Bluebush) and *Maireana georgei* (Satiny Bluebush). Other dominant shrubs include *Atriplex vesicaria* (Bladder Saltbush), *Rhagodia spinescens* (Thorny Saltbush) and *Senna spp*. (Senna). Areas where the loam depth exceeds 0.5 m are generally dominated by overstorey species such as *Acacia papyrocarpa* (Western Myall), grading to *Acacia aneura* (Mulga) in sandier zones or those with less limestone calcrete underlying.

Dunes and Swales

Remnant sand dunes and swales are typically dominated by an *Acacia aneura* (Mulga) dominant community with a range of understorey shrubs dependent largely on soil type and structure. Co-dominant species such as *Myoporum platycarpum* (False Sandalwood), *Casuarina pauper* (Black Oak) and *Callitris glaucophylla* (Northern Cypress Pine) occur spasmodically within these areas. A wider range of understorey shrubs inhabits the dunes and swales in comparison to low plain areas largely in the form of Acacias such as *Acacia ramulosa* (Horse Mulga), *Acacia burkittii* (Pin Bush), *Acacia ligulata* (Sandhill Wattle) and *Acacia tetragonophylla* (Dead Finish). In many areas short lived perennial and perennial grass species provide significant cover where rainfall volume in the preceding six months is adequate for growth.

Stony Tablelands / Arcoona Plateau

The Arcoona Plateau provides a specialised habitat as it is comprised of heavy clay soils and a self-mulching cover of stones. A naturally tree-less community is present with a shrub dominant overstorey, primarily *Atriplex vesicaria* (Bladder Saltbush) as well as other halophytic tolerant species such as *Frankenia serpyllifolia* (Sea Heath), *Abutilon halophilum* (Plains Lantern), *Tecticornia medullosa* (Samphire), *Maireana eriantha* (Silver Bluebush) and *Maireana appressa* (Pale-fruit Bluebush). This habitat is well represented at a regional level, however in terms of the rangelands as a whole, this community is relatively unique in its structure, providing significant refuge habitat for the Nationally Vulnerable Plains Mouse (*Pseudomys australis*).

Ephemeral Creeklines

Ephemeral creeklines were largely present in the stony tableland communities on the Arcoona Plateau where runoff falls away to inland salt lakes. These were commonly dominated by *Casuarina pauper* (Black Oak) with an understorey of low shrubs and perennial grass species. Ephemeral creeks did not have any species of conservation significance identified in the desktop searches or observed during the baseline assessment present.

Salt Lakes and Ephemeral Claypans

A number of salt lakes occur in the region. Ephemeral claypans also occur, particularly in the Roxby subregion general landscape. The lake bed and claypan areas generally have no vegetation present however lake margins are often home to a diverse and poorly represented vegetation structure that are highly tolerant of gypseous conditions. These areas typically support species such as *Gunniopsis quadrifida* (Sturt's Pigface), *Tecticornia spp.* (Samphire), *Sarcozona praecox* (Sarcozona), *Disphyma crassifolium* (Round-leaf Pigface) and *Melaleuca pauperifolia* ssp. *mutica* (Boree).

A suite of endemic invertebrate fauna such as scorpions, spiders, ants, beetles and crickets, are known to occur on dry salt lake beds in South Australia, including Lake Torrens and its surrounding water bodies such as Pernatty Lagoon and Lake Windabout (Hudson, 1997).

The region is also home to aquatic invertebrates which will lay dormant as eggs until rainfall events stimulate their life cycle. For example, Brine Shrimp species lay eggs that survive long periods of drought or dry conditions, reproducing in large numbers following substantial rainfall. These species can then provide large quantities of food resources for birds (e.g. Banded Stilts) (EBS, 2018).

The lakes in the South Australian arid lands only contain water episodically and have widely variable salinities. Salt lakes and claypans are prominent drainage features of the Gawler bioregion, and mainly occur at the ends of drainage lines, or as a series of depressions along ancient river channels that have been in-filled by river sands or gravels, and are now covered by more recent sediments (DEH, 2009).

The substantial lakes in the Study Area include Pernatty Lagoon and Lake Windabout. Pernatty Lagoon is the larger of these two lakes, being 65 km long and 4 to 12 km wide (Creelman, 2005), while Lake Windabout is 21 km long and 6 km wide. Both these lakes fill via run off from the Arcoona Hills, located to the east of the lakes. These two lakes are surrounded by substantial red sand dune fields (EBS, 2018).

A number of smaller lakes (collectively referred to as the Arcoona Lakes) are also located in the northern section of the Study Area. Although these are reduced in geographic extent when compared to Lake Torrens, Pernatty Lagoon or Lake Windabout, they are still potentially able to support a large number of bird species, especially when in flood (Pedler and Kovac, 2013).

The Arcoona Lakes wetland complex comprises 11 smaller waterbodies of 50 – 600 ha in area and other smaller swamps between Roxby Downs and Woomera on the Arcoona Tableland (see Figure 7.2). These ephemeral lakes fill and remain inundated only after well above average rainfall every 15 – 20 years, most recently in the mid-1950s, 1970s, 1989 and 2007 (Pedler and Kovac, 2013). Local catchment characteristics shape the diverse hydrology and water chemistry of the Arcoona Lakes; some are large, shallow and highly saline providing ideal habitat for shorebirds, while others provide deeper freshwater habitats that remain for several years after filling. The volume of species and abundance of birds arriving at these inlands wetlands when in prime condition can be very high. This was highlighted after the exceptional rainfall event in 1989; during the following five years while these Arcoona tableland lakes held water, more than 150,000 birds from 56 species were observed inhabiting the Arcoona tableland lake system. Over 45,000 waterbirds from 46 different species were recorded when the lakes were inundated in the most recent filling event between 2007 and 2010. This system is therefore considered

to have high conservation value. As noted in Section 7.1.2, the proposed transmission line alignment passes close to two of the ephemeral lakes in the Arcoona Lakes complex (Coorlay Lagoon and Lake Mary). The distance from the lakes has been maximised by aligning the line immediately adjacent to the Olympic Dam Highway.

11.1.5 Flora

Desktop review of the Biological Database of South Australia (BDBSA) records from historical surveys conducted in the region indicate that 469 flora species have been recorded within the Study Area. Of the species recorded, approximately 11% are exotic species.

Extensive studies have been undertaken in the region as part of the Olympic Dam Expansion EIS (BHP Billiton, 2009). Ecological features of the Southern Infrastructure Corridor (SIC) (sections a-d) for that project are relevant to the current Project from Carriewerloo Substation to Roxby Down Municipality where the alignment traverses west (EBS, 2018). Within this infrastructure corridor, WMC (1997) recorded 318 flora species and BHP Billiton (2009) recorded an additional 81 species (however some of these were recorded south of Port Augusta, outside the current Study Area (EBS, 2018)).

Whilst there are records for many species in this region, this often relates to the variety of habitats present in the region, and the tolerance and response of species in relation to rainfall events. Appendix D1 provides further detail about species that occur in the region.

Table 11.3 provides a summary of threatened and exotic flora species that potentially occur in the Study Area. Further detail is provided in Sections 11.1.7 and 11.1.11 below.

Table 11.3: Threatened and Exotic Species Summary

Subject	Summary
Threatened Species (National)	Two nationally threatened flora species have the potential to occur within the Study Area: *Frankenia plicata* (Braided Sea-heath) and *Senecio megaglossus* (Large-flower Groundsel). See section 11.1.7 for further detail.
Threatened Species (State)	One state threatened flora species is known to occur within the Project Area - *Santalum spicatum* (Sandalwood). It is possible that a further five species may occur within the Project Area, see Section 11.1.11 below.
Plants and Pest Weeds	Annual weeds such as *Carrichtera annua* (Wards Weed), were observed with sparse to moderate cover intermittently throughout the Study Area, despite very little rain since the beginning of 2018 and exceptionally dry conditions present at the time of the ecology survey. Other weeds present included common species largely considered as naturalised within the rangelands, including *Carthamus lanatus* (Star Thistle), *Sonchus oleraceus* (Sow Thistle), *Malvastrum americanum* (Malvastrum) and *Brassica tournefortii* (Wild Turnip) (Appendix D1).

Vegetation Condition

Vegetation condition of the Project Area was assessed as part of vegetation clearance assessments and baseline assessments (EBS, 2018; Appendix D1) using the Rangelands Assessment Method (RAM) (NVC,

2017). The outcomes from these assessments are reflective of condition and the offset requirements associated with any clearance (EBS, 2018). The three components of the biodiversity value of the individual sites are:

- Landscape context (e.g. landform features, size of area, native vegetation regional status)
- Vegetation condition (e.g. use of flora species, disturbance, vegetation strata presence, weed cover
- Conservation value (e.g. presence of threatened species that have recent records within 50 km).

Given the linear nature of this Project, the assessment of true vegetation condition is somewhat limited as the assessment is not designed for linear communities, but rather assessment of larger blocks. However, a high-level summary of preliminary RAM scoring sheets indicates the condition of the vegetation associations within the Project Area is predominantly moderate (e.g. 73% of RAM sites). When vegetation condition is considered in association with landscape context and conservation value, biodiversity value within the Project Area is predominantly poor to medium (e.g. 87% of Unit Biodiversity Scores for RAM sites assessed ranged from 40 to 65) and this is summarised in Table 11.4.

Table 11.4: Summary of Vegetation Condition and Unit Biodiversity Score (UBS) of the Project Area Vegetation Associations (VA)

RAM sites	Vegetation Association		UBS Range	Vegetation condition
	No.	Description		
1, 4, 5, 13, 15, 20	1	Western Myall Open Woodland	37 – 73	50% medium, 16% low to medium, 16% medium to high
3, 8, 10, 17, 48	2	Mulga Mixed Woodland	52 – 62	60% medium, 40% medium to high
6	3	Black Oak / Mulga Open Woodland	58	medium
7	4	Black Oak) Woodland	57	medium
9, 36, 39, 41, 3, 43	5	Northern Cypress Pine Woodland	48	medium
2, 11	6	Mulga / Western Myall Mixed Woodland	46 – 58	medium
12, 23, 28, 32, 35, 37	7	Bladder Saltbush / Samphire Shrubland	45 – 69	83% medium, 16% medium to high
14	8	Mulga) +/- Bullock Bush Shrubland	50	medium
18, 52	9	Pearl Bluebush Low Open Shrubland	53 – 52	medium
19, 25, 38, 47, 49	10	Western Myall Woodland over Bladder Saltbush	45 – 70	60% medium to high, 40% medium
21, 45, 53, 55, 56	11	Bladder Saltbush)+/- Low Bluebush Mixed Low Open Shrubland	47 – 72	80% medium, 20% medium to high
24, 46, 51	12	Mulga, Horse Mulga Woodland over Sandhill Wattle	48 – 66	67% medium, 33% medium to high
26, 34, 42	13	Sandhill Wattle / Sticky Hop-bush Shrubland	34 – 60	33% low to medium, 33% medium, 33% medium to high
22, 27	14	Samphire +/- Bladder Saltbush Low shrubland	52 – 61	50 % medium; 50% medium to high
29	15	Black Oak Creekline	59	medium
30	16	Bladder Saltbush +/- Swamp Canegrass Low Open Shrubland	43	medium
31	17	Cotton bush Low Shrubland	36	low to medium
40	18	Boree Shrubland +/- Sandhill Wattle)	46	medium
33, 44, 50	19	Low Bluebush Low Open Shrubland	47 – 52	medium
54	20	Nitre Goosefoot Open Shrubland	41	medium

Sourced from Appendix D1 draft Rangelands Assessment Method (RAM) score sheets, UBS indicative rating ranges considered from 40 (poor), 50 – 65 (medium) through to 70 – 80 (good), raw UBS scores rounded, VA = Vegetation Association.

Weeds

Arid and semi-arid weeds are often annual species, which respond to heavy rainfall events with a flush of growth and seed production, before contracting to areas with more permanent water (e.g. adjacent to damns, tanks and troughs). With long soil residence times, seed can lay dormant in topsoil until favourable conditions occur. Dispersal mechanisms for these species include rainfall events and fauna transportation (native, introduced and stock), however, many of these species are also easily distributed by vehicle movements and by earthworks.

A summary of weed species that have records in the Study Area, were observed in the field survey or are predicted to occur by the EPBC Act Protected Matter Search Tool (DEE, 2018) is provided in Table 11.5 below.

Table 11.5: Exotic Flora Summary

Scientific Name	Common Name	Status[1]	Likelihood of Occurrence Within Project Area	Observed Within Study Area (EBS 2018)[2]	BDBSA Records Within Study Area[3]
Species predicted by EPBC Act Protected Matters Search Tool					
Asparagus asparagoides	Bridal Creeper	WoNS, D	Unlikely	No	No
Austrocylindropuntia spp.	Prickly Pears	WoNS,	Possible	No	No
Carrichtera annua	Ward's Weed	WoNS, E	Likely	Yes	Yes, 2007
Cylindropuntia spp.	Prickly Pears	WoNS,	Possible	No	No
Lycium ferocissimum	African Boxthorn	WoNS, D	Likely	Yes	Yes, 1991
Opuntia spp.	Prickly Pears	WoNS, D	Likely	Yes	Yes, 1984
Parkinsonia aculeata	Jerusalem Thorn	WoNS, D	Unlikely	No	Yes, 1989
Prosopis spp.	Mesquite	WoNS,	Unlikely	No	No
Solanum elaeagnifolium	Silver Nightshade	WoNS,	Possible	No	No
Tamarix aphylla	Athel Pine	WoNS, D	Likely	No	No
Additional species BDBSA records within 20 years					
Brassica tournefortii	Wild Turnip / Mustard	2	Present	Yes	10/09/2006
Carthamus lanatus	Star / Saffron Thistle	2	Present	Yes	No
Cenchrus ciliaris	Buffel Grass	3, D	Likely		12/03/2015
Citrullus amarus	Bitter Melon	1	Likely		27/03/2007
Citrullus colocynthis	Colocynth	1	Likely		26/03/2007
Citrullus lanatus	Bitter Melon	1	Present	Yes	No
Cucumis myriocarpus ssp. *myriocarpus*	Paddy Melon	-	Likely		26/03/2007
Eragrostis trichophora	Hairyflower Lovegrass	-	Likely		18/03/2015
Euphorbia terracina	False Caper	3, D	Likely		27/03/2007

Scientific Name	Common Name	Status[1]	Likelihood of Occurrence Within Project Area	Observed Within Study Area (EBS 2018)[2]	BDBSA Records Within Study Area[3]
Galenia pubescens var. *pubescens*	Coastal Galenia	2	Likely		26/03/2007
Heliotropium europaeum	Common Heliotrope	1	Likely		26/03/2007
Malvastrum americanum var. *americanum*	Malvastrum	-	Present	Yes	26/03/2007
Medicago sp.	Medic	2	Present	Yes	> 20 years
Peganum harmala	African Rue	-	Likely		16/10/2009
Rumex vesicarius	Rosy Dock	2	Likely		26/03/2007
Sisymbrium erysimoides	Smooth Mustard	1	Present	Yes	27/03/2007
Sonchus oleraceus	Common Sow-thistle	1	Present	Yes	27/03/2007
Solanum nigrum	Black Nightshade	2	Present	Yes	> 20 years
Suaeda baccifera	Seablite	2	Likely		1/04/2000
Verbena supina var. *supina*	Trailing Verbena	-	Likely		26/03/2007
Xanthium spinosum	Bathurst Burr	3, D	Likely		26/03/2007

[1]Weed threat status WoNS = Weed of National Significance; D = Declared, E = Environmental, 1-2 low weed threat as per DEWNR Bushland Manual (DEWNR 2017a) for Northern Yorke / Eyre Peninsula regions, 3 = Environmental Weed as per DEWNR 2017a. [2] Weed presence as per Appendix D1 (further detail in Vegetation Clearance Report). [3]BDBSA (Biological Database of South Australia) records within 20 years. PMST (Protected Matters Search Tool).

11.1.6 Fauna

Biological Database of South Australia (BDBSA) records for the Study Area include 282 fauna species (see Appendix D1). This includes two amphibian species, 177 birds (including six exotic species), 26 mammals (including eight exotic species) and 77 reptiles. Of these, 24 bird, one mammal and two reptile species are identified as rare or threatened.

Table 11.7 provides a summary of threatened and exotic fauna species that potentially occur in the Study Area. Further detail is provided in Sections 11.1.7 and 11.1.11 below.

Table 11.6: Threatened and Pest Fauna Species Summary

Subject	Summary
Threatened and Migratory Species (National)	Five nationally threatened fauna species and ten migratory species possibly occur within the Study Area. See section 11.1.7 and 11.1.8 for further detail.
Threatened Species (State)	There are records for 27 state threatened fauna within the Study Area, of which six are nationally threatened or migratory and discussed above. Four state-only listed species were considered likely to occur in the Project Area; the Musk Duck, Blue-billed Duck, Freckled Duck and Pernatty Knob-tailed Gecko and one species possibly occurs; the Australian Bustard. None of these species were observed during the baseline survey. Refer to Section 11.1.11 for further detail.
Conservation Areas and Important Habitats	No formally designated conservation areas occur within the Project Area. Areas of deep sand dunes in the Oakden Hills and Pernatty pastoral leases area, provide important habitat for the Pernatty Knob-tailed Gecko (*Nephrurus deleani*, Rare, South Australia). The fringes and sections of salt lakes also provide potential habitat for a variety of migratory waders at times during wet periods. Areas of stony tablelands provide refuge habitat for the nationally threatened Plains Mouse (*Pseudomys australis*). These sites have a tapestry of cracking clay gilgai and areas of *Eragrostis australasica* (Swamp Canegrass) known provide refuge habitat for this species. This refuge habitat is widespread on the Arcoona Plateau and in the broader region and the Project Area represents a very small proportion of the potential habitat available in the region. Small areas of *Maireana aphylla* (Cottonbush) are known habitat for the nationally threatened species Thick-billed Grasswren (*Amytornis modestus*). These habitats are often linear, with Cottonbush preferring areas with drain off channels or areas temporarily inundated or have periods of extended wetting. Habitat for this species is widespread across the broader region to the north. Suitable habitat is not extensive within the Project Area.
Pest and Feral Animals	Fifteen pest fauna species were highlighted as having potential to occur in the area, of these 10 are known, likely or possibly occur in the Study Area and four have been observed in the Project Area; the Skylark, House Sparrow, Goat, Rabbit.

11.1.7 EPBC-Listed Threatened Species

The EPBC PMST output suggested one nationally threatened flora species and eight nationally threatened fauna species (seven birds and one mammal) as potentially occurring within the Study Area. An additional EPBC-listed species, *Senecio megaglossus* (Large-flower Groundsel) was not identified in the PMST output, however it was identified in the BDBSA from a single record in 1999 approximately 5.2 km to the south of the southern extent of the Project (Carriewerloo Substation). *Senecio megaglossus* has therefore been included in the assessment undertaken in this report.

An assessment of likelihood of presence was undertaken, based on recent records for the Study Area, known habitat preferences and knowledge of the species (see Appendix D3). This assessment considered that seven of these threatened species (five fauna and two plant) possibly occur within the Project Area. These EPBC-listed threatened species are summarised in Table 11.7.

The likelihood of occurrence summarised in Table 11.7 is defined as:

- Likely – based on the presence of suitable habitat and multiple recent database records from the study area or immediate proximity within the last twenty years

- Possible – suitable habitat is present for the species, but no or very limited recent (last twenty years) database historic record(s) exist from the study area or proximity
- Unlikely – there is a lack of suitable habitat for the species (or community) and a lack of proximate historic records which indicate previous or current occurrence.

Table 11.7: EPBC-Listed Threatened Species – Likelihood Assessment

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
Plants				
Frankenia plicata Braided Sea-heath	EN	V	Possible	EPBC PMST suggests species or species habitat likely to occur. Low mat-forming shrub. Preferred habitat is minor drainage lines and outwash plains with stony surfaces and loamy sand or clay sand soils. Most records are from the Stony Plains bioregion (to the north of the Study Area), particularly the Breakaways and Stuarts Range north east of Coober Pedy (DEWHA, 2008). Review of historic records (ALA, 2018) indicates a distribution largely confined to the south-western portion of the Lake Eyre Basin (approximately 500 km north west of the alignment), and two isolated small populations to the west of Lake Torrens on the Arcoona Plateau (approximately 43 km east of the northern portion of the alignment and 30 km east of the central portion of the alignment) in South Australia. There also historical single BDBSA records from 1989 near Woomera in the Gairdner Torrens floristic region, approx. 9 km west of alignment and from 1999 approx. 16 km west of the northern end of the proposed alignment. No BDBSA records in Study Area (alignment plus buffers) and not detected in previous regional surveys (BHP Billiton, 2009) and recent survey of the transmission line (EBS, 2018). Similarly, not detected during extensive survey effort and during targeted survey at the Carrapateena site, approximately 50 km to the north-east of the alignment. Suitable habitat may be present on the footslopes and outwash plains of the Arcoona Plateau in the northern portion of the proposed alignment.

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
Senecio megaglossus Large-flower Groundsel	VU	E	Possible	Not identified by the EPBC protected matters search, but a single 1999 BDBSA record exists from a Spinifex (*Triodia* sp.) slope approx. 5.2 km to the south of the southernmost extent of the alignment. Not identified during ground survey of Project Area (EBS, 2018). A perennial shrub with large, showy yellow flowers. Most records pre-date 1990 and are from rocky gorge and valley slopes in a variety of vegetation types including mallee scrub particularly near Port Augusta and the western footslopes of the Flinders Ranges (DEWHA, 2008). Vegetation mapping undertaken by BHP Billiton (2009) indicates that preferred habitat includes rocky slopes and rocky creek banks and drainage lines supporting grasslands associated with *Triodia, Callitris columellaris* and *Eucalyptus camaldulensis* open woodland over sparse shrubs, or tall open shrublands of *Pittosporum sp. Cassinia sp.* or *Bursaria sp.* This habitat type is not found within the Study Area.
Birds				
Amytornis modestus Thick-billed Grasswren (eastern)	VU	V	Possible	EPBC PMST suggests species or habitat likely. However, there are no BDBSA records within Study Area. Records for the species exist to the north of the Study Area (BHP Billiton, 2009), and an extensive study undertaken by Black *et al.*, (2011) identified four discrete known populations of the species outside of the Study Area; west of Lake Eyre and Lake Torrens (North West), north-east of Lake Eyre (Eyre) (both Lake Eyre subspecies *indulkanna*) around the edges of the Northern Flinders Ranges (Flinders, ssp. *raglessi*) and south-west of Lake Frome (Frome, ssp. *curnomona*). Preferred habitat of the eastern subspecies is arid and semi-arid zone chenopod shrublands, especially shrublands dominated by saltbush *Atriplex* spp. (Saltbush) and *Maireana* spp. (Bluebush, Blackbush), sometimes with widely scattered trees (Higgins *et al.*, 2001). In South Australia they have been recorded in habitats that include *Sclerolaena* spp. (Bindii), *Salsola kali* (Roly-poly), *Tecticornia* spp. (Glasswort / Samphire) and various daisies including *Rhodanthe* spp., *Calotis hispidula* and *Craspedia* spp. The preferred habitat is however known to be taller and denser chenopods that occur on drainage lines (DEE, 2018c; NPWS, 2002; Black *et al.*, 2011). The northern portion of the Study Area traverses the currently known broader distribution of the species and includes isolated sections of preferred taller Chenopod shrubland and Lignum habitat in minor drainage lines (DEWNR veg mapping).

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
Amytornis textilis myall Western Grasswren (Gawler Ranges)	VU		Possible	EPBC PMST suggests species or habitat likely within the Project Area. The alignment almost entirely avoids the area indicated as 'species or species habitat likely to occur', but the southern portion of the alignment traverses the area indicated as 'species or species habitat may occur' (SPRAT Profile DEE, 2018d). No BDBSA records within Study Area. This species is restricted to the Eyre Peninsula between Whyalla, Middleback and the Gawler Ranges, west to south of the Study Area, with records northwest, west to southwest of Whyalla / Port Augusta (Black *et al*., 2009, Black et al. 2011). There are no records to the east of the Stuart Highway (Black *et al*., 2009), where the alignment runs. Species prefers open chenopod shrublands that surrounds minor drainage lines supporting *Acacia tetragonophylla* (Dead Finish), *Maireana pyramidata* (Blackbush) and *Lycium australe* (Australian Boxthorn) / *Acacia papyrocarpa* (Western Myall) / *Casuarina cristata pauper* (Black Oak) open woodland and, less commonly on stony hillsides with *Triodia spp*. (Spinifex) hummock grassland (DEE, 2018d). Study Area traverses preferred *Maireana pyramidata* (Blackbush) +/- *Lycium australe* (Australian Boxthorn) low shrubland and *Acacia papyrocarpa* (Western Myall) low woodland in the southern portion of the alignment (Black *et al*., 2009).
Calidris ferruginea Curlew Sandpiper	CE, MW		Possible	EPBC PMST suggests species or habitat likely. Migratory wader, shorebird. Breeds in Siberian high arctic coastal tundra, migrates to Africa, Asia and regular spring/summer migrant to Australia (Geering *et al*., 2008). Preferred habitat includes exposed intertidal mudflats and less frequently inland freshwater wetlands, saltworks and mudflats (Geering *et al*., 2008, Simpson and Day, 2010). Two historical BDBSA records from smaller ephemeral freshwater lakes (Lake Mary, 1993; Lake Coorlay, 1994) on the Arcoona Plateau. No BDBSA records since 1994. Alignment traverses near smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that provide foraging habitat when holding water.
Leipoa ocellata Malleefowl	VU	V	Unlikely	EPBC PMST suggests species or habitat likely. Terrestrial ground-dwelling species which makes large conspicuous nesting mounds. Preferred habitat includes scrubland and woodland dominated by long unburnt mallee (Benshemesh, 2007; DEE, 2018e). Preferred nesting and foraging habitat of mallee sand plains and sand dunes not present in the Study Area.

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
				Acacia tall shrubland that occurs to the south of the Arcoona Plateau in the central portion of the alignment provides marginal nesting and foraging habitat, however unlikely to provide the deeper litter levels that the species prefers. Recorded in mallee dune habitats on the southern Eyre Peninsula. No BDBSA records for the Study Area.
Numenius madagascariensis Eastern Curlew	CE, MW		Unlikely	EPBC PMST suggests species or habitat may occur. Migratory wader / large shorebird. Breeds in NE Asia, Siberia and spring migrant to Australia, with a major stronghold in Queensland (Geering *et al*., 2008). Mostly recorded in coastal habitat including sand spits, intertidal mudflats on exposed seagrass beds, coastal estuaries and mangroves (Geering *et al*., 2008, Simpson and Day, 2010). No BDBSA records for the Study Area and no records for inland South Australia (ALA, 2018).
Pezoporus occidentalis Night Parrot	EN		Possible	EPBC PMST suggests extinct. Nocturnal / elusive ground-dwelling bird, listed as extinct in South Australia, however recent evidence suggests a population possibly utilising Samphire low shrubland habitat northeast of Lake Eyre (Night Parrot Recovery Team 2018a), approximately 250 km to the north of the northern point of the proposed transmission line. Extant breeding populations in Qld and WA recorded in *Triodia* spp. (Spinifex) hummock grassland on stony plains and / or chenopod shrublands. Other habitat species include *Sclerolaena* spp., *Maireana* spp. *(Saltbush* spp.*), Astrebla* spp. (Mitchell grass*),* shrubby samphire and chenopod associations, scattered trees and shrubs, *Acacia aneura* (Mulga) woodland (TSSC, 2016; DEE, 2018f). Vegetation mapping of the Project Area (BHP Billiton, 2009) indicates areas of potential foraging habitat (Samphire low open shrubland, Chenopod shrubland, areas of Mulga, *Sclerolaena* and *Astrebla*) within the Study Area, and the site occurs in areas mapped as potential Night Parrot Habitat (Night Parrot Recovery Team, 2018b). It is noted however, that these areas are based on broad vegetation mapping data that covers most of arid South Australia.

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
				A recent targeted survey for Night Parrot, as well as extensive general bird survey effort at the OZ Minerals Carrapateena site (50 km to the northeast) over a number of years failed to detect any evidence of Night Parrot across these habitat types. BDBSA records indicate *Triodia* hummock grassland to be present on Euro Bluff approx. 1.5 km east of the proposed alignment, which aligns with preferred breeding habitat types of recent records for the species. There are no BDBSA records for the Study Area, however, the species is known to be difficult to detect, there are renewed observations across its range and there is potential foraging / nesting habitat within the vicinity of the Study Area, therefore the possibility of presence cannot be 100% excluded.
Rostratula australis Australian Painted Snipe	EN		Unlikely	EPBC PMST suggests species or habitat may occur. Medium shorebird. Endemic to Australia, widespread, but rarely observed. Prefers inland swamps and temporary water regimes, marshes with moderate cover. Can be nomadic, appearing in response to rainfall (Geering *et al.,* 2008, Simpson and Day, 2010.). Preferred habitat of well vegetated margins and shallow water and shorelines of wetlands not prevalent in the Study Area. No BDBSA records for the Study Area and closest record 50 km west of Study Area (ALA, 2018)
Mammals				
Pseudomys australis Plains Rat / Plains Mouse	VU	V	Possible	EPBC PMST suggests species or species habitat likely to occur within the northern portion of the Project Area. Small arid zone rodent that prefers gibber (stone-covered) plains, mid slopes with boulders, small stones and gilgais. Primary habitat is considered to be within drainage channels, depressions and deep cracking clays (Brandle et al., 2008; Moseby, 2012), but evidence suggests that during population expansions the habitat usage may be more broad temporarily, followed by a retraction to preferred refugia habitat during drier periods. Current known populations largely restricted to the Stony Plains Bioregion in South Australia, extending into the NT. The species now occupies a north/south band of stony plain habitat to the west of Lake Eyre extending from Pernatty Station in South Australia to Andado Station in the NT (Moseby, 2012) Preferred Chenopod shrubland / tussock grassland cracking clay habitat present in broad interdune swales immediately south of Olympic Dam and on the Arcoona Plateau in the northern portion of the alignment.

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
				Recorded for stony tableland habitat on the Arcoona Plateau following good seasons in 2012 and 2013 approximately 45 km east of the Study Area (Appendix D3). Single BDBSA record (2010) from Study Area in interdune swale approx 13 km SW of Olympic Dam and approx. 300 m north of the proposed transmission line alignment.

[1]*Environment Protection and Biodiversity Conservation Act 1999* Status: Endangered (EN), Vulnerable (VU);
[2]South Australian *National Parks and Wildlife Act 1972* Status: Endangered (E); Vulnerable (V); Rare (R);
[3]Biological Database of South Australia (BDBSA), Protected Matters Search Tool (PMST); Atlas of Living Australia (ALA); Species Profiles and Threats Database (SPRAT); Night Parrot Recovery Team.[4]See Appendix D3 for reference list.

11.1.8 EPBC Migratory species

A total of 15 migratory species have been identified as potentially occurring within the Project Area. Twelve of these species (of which two are also listed as threatened) were highlighted in the EPBC PMST output and three species were contained in the BDBSA output. The two migratory species that are also listed as EPBC-threatened are discussed in Table 11.7 above (Eastern Curlew and Curlew Sandpiper). The EPBC Migratory species are listed together with an assessment of the likelihood of their occurrence (or suitable habitat occurring) in Table 11.8 below (excluding the two threatened species which are discussed above). Of the 15 Migratory species assessed, five species are considered unlikely to occur, eight species possibly occur and two likely occur within the Study Area, based on criteria outlined in Section 11.1.7.

Table 11.8: Migratory Species Likelihood Assessment

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
Apus pacificus Fork-tailed Swift	MM	-	Possible	EPBC PMST suggests species or species habitat likely within Study Area. Highly mobile, migratory, almost entirely aerial species, flying <1 m to 1000 m above the ground. This species seldom recorded on the ground (Pizzey and Knight, 2012; Simpson and Day, 2010 (DOTE, 2015). Primarily occurs over inland plains in Australia, but sometimes recorded over coastal cliffs. Feeds on insects whilst flying, roosts on the wing. The entire global population can visit Australia during summer, where it is widespread throughout Australia. In South Australia, occurs west of Spencer Gulf, Coastal Eyre Peninsula, Flinders Ranges, Maree, Lake Eyre and Innamincka (DOTE, 2015). Species unlikely to utilize terrestrial habitat within the Study Area, but may occur as an overfly visitor. Two BDBSA flyover records (1999 and 2000).
Actitis hypoleucos	MW	R	Possible	EPBC PMST suggests species or habitat likely.

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
Common Sandpiper				Migratory wader / shorebird. Breeds in northern hemisphere (Eurasia), migrates to Africa, regular summer migrant to Australia (more common in northern than southern Australia (Geering *et al.*, 2008, Simpson and Day, 2010). Alignment traverses near smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that may provide foraging habitat when holding water. Nine BDBSA records, none since 2001.
Calidris acuminata Sharp-tailed Sandpiper	MW	-	Possible	EPBC PMST suggests species or habitat known. Migratory wader / shorebird. Breeds in Siberia, migrates to New Guinea and Australia. Prefers coastal and inland areas, non-tidal fresh or brackish wetlands (Geering *et al.*, 2008, Simpson and Day, 2010). Alignment traverses near smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that may provide foraging habitat when holding water. 20 BDBSA records with no records since 2000.
Calidris melanotos Pectoral Sandpiper	MW	R	Possible	EPBC PMST suggests species or habitat may occur. Migratory wader / shorebird. Breeds in North America and Siberia. Prefers freshwater or brackish wetlands, grassy or lightly vegetated coastal and inland swamps (Geering *et al.*, 2008). Study Area includes smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that provide foraging habitat when holding water No BDBSA records for Study Area.
Charadrius veredus Oriental Plover	MW	-	Unlikely	EPBC PMST suggests species or habitat may occur. Predominantly land based migratory wader / shorebird. Species breeds in China and Mongolia, spring non-breeding migrant to northern Australia (Sept -Mar). Prefers short dry grasslands inland, rarely feeds on wet habitats, but will inhabit mudflats, beaches and coastal habitat during hot conditions and when they first arrive (Geering *et al.*, 2008; DEE, 2018g). Limited habitat within the Study Area. No BDBSA records in Study Area; nearest record 15 km west of southern end of the alignment (1996).
Gallinago hardwickii Latham's Snipe	MW	R	Likely	EPBC PMST suggests species or habitat may occur. Migratory wader / marsh dweller. Breeds in Japan and summer non-breeding migrant to Australia, primarily along the east coast (Geering *et al.*, 2008; Simpson and Day 2010). Prefers tussock grass and low dense sedges surrounding freshwater wetland, permanent and

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
				ephemeral wetlands. Can also occur in habitats with saline or brackish water (Geering *et al.*, 2008). Recorded within the Study Area in shallow freshwater lakes or swamps on the Arcoona Plateau; three BDBSA records (2000-2001).
Motacilla cinerea Grey Wagtail	MT	-	Unlikely	EPBC PMST suggests species or habitat may occur. Uncommon migratory wagtail (DOTE, 2015). Breeds in Europe and Asia and rarely spring/ summer non-breeding migrant to Australia (Pizzey and Knight, 2012). Prefers higher altitudes, near fast-running water, rocky substrates, lakes and marshes (DOTE, 2015). Has occurred previously in northern Australia from the Kimberley to SE QLD (Simpson and Day, 2010). No records for inland South Australia (ALA, 2018). No BDBSA records for the Study Area.
Motacilla flava Yellow Wagtail	MT	-	Unlikely	EPBC PMST suggests species or habitat may occur. Uncommon migratory wagtail (DOTE, 2015). Breeds in Europe, Africa and Alaska and occasional spring/summer non-breeding migrant to Australia (Pizzey and Knight, 2012). Habitat includes well-watered open grasslands, fringes and wetlands. Roosts in mangroves and other dense vegetation (D0TE, 2015). One record for inland South Australia (Coober Pedy) (ALA, 2018). No BDBSA records for the Study Area.
Pandion haliaetus Osprey	MW	E	Unlikely	EPBC PMST suggests species or habitat may occur. Raptor. Prefers open water foraging habitat and tall woodland nesting habitat (Pizzey and Knight, 2012). Preferred habitat of open water bodies not present within Study Area. No BDBSA records for the Study Area
Tringa nebularia Common Greenshank	MW	-	Likely	EPBC PMST suggests species or habitat likely occurs. Migratory wader/shorebird. Breeds in northern hemisphere from Europe to Siberia, summer migrant to Australia, Africa and Asia. Prefers intertidal mudflats, fresh and saltwater wetlands of coast and inland (Geering *et al.*, 2008). Alignment traverses near smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that provide foraging habitat when holding water. Twenty BDBSA records from swamps and freshwater lakes in the northern portion of the Study Area and no records since 2002.
Migratory species not highlighted by PMST				

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
Arenaria interpres Ruddy Turnstone	MM	R	Possible	Not identified in EPBC PMST, but historic BDBSA record (1993) (Olympic Dam EIS, BHP Billiton, 2009). Breeds in Siberia, rarely occurs in inland Australia; where it may inhabit shallow waters and sewage ponds. This species typically inhabits coastal habitats where seaweed wrack covers sandy shores and / or rocks, tidal flats (Simpson and Day 2010, Mehkhorst *et al.*, 2017). Has been recorded inland at Lake Coorlay (1993) (BDBSA, 2018), adjacent the alignment. Dams and areas of shallow open water within the Study Area could provide occasional foraging habitat for the species.
Limosa limosa Black-tailed Godwit	MM	R	Possible	Not identified in EPBC PMST, but historic BDBSA record (1998). Migratory wader / shorebird. Breeds in northern hemisphere (Eurasia) and regular summer migrant to Australia. Most common in coastal habitats with large intertidal mudflats and/or sandflats. However, the species also frequents inland Australia, on mudflats and in water less than 10 cm deep (belly depth), around muddy lakes and swamps, fresh and brackish wetlands (Geering *et al.*, 2008, Simpson and Day 2010, Menkhorst *et al.*, 2017). Has been historically recorded (nine records 1992-1998) within arid zone areas such as Lake Coorlay, (BDBSA, 2018), adjacent the alignment. Dams and areas of shallow open water within the Study Area could provide foraging habitat for the species.
Tringa glareola Wood Sandpiper	MM	R	Possible	Not identified in EPBC PMST, but five BDBSA records (1991-2001). Small migratory shorebird, breeds in Siberia to Europe and migrates to Africa, southern Asia and Australia (Geering *et al.*, 2008). More common in northern Australia, the species mainly occurs on inland freshwater wetlands with vegetation and rarely on mudflats on mud or shallow water. Occurs between August and April (Geering *et al.*, 2008, Menkhorst *et al.*, 2017). Pastoral dams and inland waterbodies may provide foraging habitat for this species within the Study Area.

[1]*Environment Protection and Biodiversity Conservation Act 1999* Status: Critically Endangered (CE); Endangered (EN), Vulnerable (VU); Migratory Marine (MM); Migratory Terrestrial (MT); Migratory Wetland (MW), LM = Listed Marine.
[2]*South Australian National Parks and Wildlife Act 1972* Status: Rare (R); Vulnerable (V); Endangered (E)
[3]Biological Database of South Australia (BDBSA), 2018 Study Area search, Protected Matters Search Tool (PMST), Atlas of Living Australia (ALA).

11.1.9 EPBC Threatened Ecological Communities

No EPBC-listed Threatened Ecological Communities (TECs) were highlighted in the PMST for the Study Area. In addition, no TECs were observed during the field survey of the Project Area (EBS, 2018).

11.1.10 State Threatened Ecosystems

No vegetation communities present are listed as threatened for the relevant sub region on the Provisional List of State Threatened Ecosystems (DEH, in progress). There are two communities listed as 'of concern' for the Arcoona Sub Region (GAW 04):

- *Eucalyptus coolabah* (Coolibah) Woodland on levees and channel banks of regularly inundated floodplains
- *Atriplex nummularia* (Golden Goosefoot) Open Shrubland with occasional emergent *Eucalyptus camaldulensis* (River Red Gum) or *E. coolabah* (Coolibah) on low sandy rises of floodplains.

Neither of these vegetation communities were observed during the field survey or were recognised as pre-existing vegetation associations in past vegetation association mapping.

11.1.11 NPW Species

The BDBSA highlighted eight state-listed rare or threatened flora recorded within the Study Area. One species is known from the Project Area; Sandalwood (*Santalum spicatum*) and five species are considered to possibly occur within the Project Area; *Citrus glauca* (Desert Lime), *Ophioglossum polyphyllum* (Large Adders Tongue), Australian Broomrape (*Orobanche cernua var. australiana*), *Gratwickia monochaeta* and *Swainsona microcalyx* (Wild Violet).

The BDBSA highlighted 27 state-listed rare or threatened fauna with records within the Study Area, of which five are migratory and discussed in Section 11.1.8 and one (Plains Mouse) is nationally threatened and discussed in Section 11.1.7. Four species were considered likely to occur in the Project Area; the Musk Duck, (*Biziura lobata*), Blue-billed Duck (*Oxyura australis*), Freckled Duck (*Stictonetta naevosa*) and Pernatty Knob-tailed Gecko (*Nephrurus deleani*) and one species possibly occurs, Australian Bustard (*Ardeotis australis*).

Likelihood assessment for NPW species with BDBSA records that are not migratory or nationally threatened, based on criteria provided in EBS, 2018 (Appendix D1) is summarised in Table 11.9 below.

Table 11.9: State-listed Threatened Species Likelihood Assessment

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
Plants				
Brachyscome eriogona	-	R	Unlikely	Historical BDBSA record (1966). Occurs around gilgais and low areas which get wet after good rainfall. Record is from low dune areas within Study Area. Not detected during survey, but conditions were not ideal for detection and it is an annual species. Grows in sand on gibber plains and along watercourses (SA Seedbank, 2018). The majority of records are north-west of Coober Pedy. Study Area is approaching the southern limits of its natural distribution (NatureMaps, 2018).
Calandrinia sphaerophylla Bead Purslane	-	R	Unlikely	Conspicuous during spring. One historical BDBSA record (1990) at the southern end of the transmission line however was not located during the survey. Endemic to South Australia and known only from a few collections from the Nullarbor and the Eyre Peninsula (SA Seedbank, 2018).
Citrus glauca Desert Lime	-	V	Possible	Four historical BDBSA records (1965-1993). Occasionally occurs within low dunes and sandy swales. Species has Cultural heritage importance and is conspicuous, however can appear in Summer following adequate Spring rainfall. No known occurrences in Study Area. Regional occurrences at near Port Augusta (Corraberra Station), Pernatty Station (SAAL, 2010).
Gratwickia monochaeta One-bristle Everlasting	-	R	Possible	Two historical BDBSA record (1985, 1991). Conspicuous, yellow short-lived annual herb, which can be widespread when conditions allow. Endemic to central South Australia, growing on various sites, but usually sand (SA Seedbank, 2018). Not observed during survey.
Ophioglossum polyphyllum Large Adder's-tongue	-	R	Possible	One historical BDBSA record (1991). Species known to inhabit moist areas of sand hills / sand plains and can often form large colonies on open clay loams. It is frequently encountered in ranges where it occurs in shallow soil pockets subject to flooding or amongst rocks or along stream banks. Historically recorded (1991) alongside the transmission line track south of Lake Windabout in a sandy loam swale (BDBSA 2018). It is likely to be present during or after periods of significant rainfall. Was recorded in the SIC (Southern Infrastructure Corridor) of the Olympic Dam Expansion EIS (BHP Billiton, 2009).

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
Orobanche cernua var. australiana Australian Broomrape	-	R	Possible	Historical BDBSA record (1990). Locally common in the region, often encountered, primarily in sandy creeks lined with *Acacia ligulata* and *Senecio magnificus*. *Acacia ligulata* occurs in the Project Area. Can be parasitic on native Senecio species, conspicuous species.
Santalum spicatum Sandalwood	-	V	Present	Recent BDBSA record (2007). Grows in loam soils and amongst rocks in woodland and scrubland areas and is primarily found in the southern half of Western Australia and South Australia. Often occurs sporadically as individuals in a variety of habitats throughout the semi-arid rangelands of South Australia. Recorded from within the Study Area, from within Vegetation Associations 1 and 2. Individuals are sparsely scattered. Minimal regeneration observed within the Study Area.
Swainsona microcalyx Wild Violet	-	R	Possible	Two historical BDBSA records (1987). Often grows in areas adjacent to saline lagoons and creeks, and is also reliant on good rainfall so difficult to detect in drier times. Preferred habitat occurs around southern edge of Pernatty Lagoon and Lake Windabout. Most records west of Study Area.
Birds				
Ardea ibis / Bubulcus ibis Cattle Egret	-	R	Possible	One historical BDBSA record 1998 at Olympic Dam Village. Occurs in grasslands and shallow open and freshwater wetlands with low vegetation (Menkhorst *et al*., 2017). Habitats are present within the broader Study Area
Anas rhynchotis rhynchotis Australasian Shoveler	-	R	Possible	Thirteen historical BDBSA records (1992-1999). Waterfowl species that regularly occurs inland. Prefers permanent well vegetated wetlands, but will use most freshwater habitats (Menkhorst, 2017). Within the Study Area, the species is likely to occur at pastoral dams and may temporally inhabit inland waterbodies during flood.
Anhinga novaehollandiae Australasian Darter	-	R	Unlikely	Seven historical BDBSA records, one recent BDBSA record (2000). Moderate to large sized diving waterbird. Considered unlikely to occur due to the absence of preferred habitat (river channels) within the Study Area.
Ardeotis australis Australian Bustard	-	V	Possible	BDBSA record (1998) in the Study Area, more recent record to the south of the Study Area just outside the Project Area (2006). Large ground-dwelling species that inhabits plains over much of the Australian continent, but is largely restricted to inland Australia (Menkhorst *et al*., 2017). Suitable habitat occurs in tableland and chenopod shrubland habitat which are widespread over the Study Area.
Biziura lobata Musk Duck	LM	R	Likely	Eighteen historical BDBSA records (1990-1998) and 24 recent BDBSA records (2000-2007). Waterfowl that

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
				inhabits inland waterbodies. Preferred habitats occur in the Study Area, e.g. records at Lake Coorlay, golf course dams, sewage ponds within Study Area.
Cladorhynchus leucocephalus Banded Stilt	-	V	Possible	Eleven historical BDBSA records (1990-1998), five recent BDBSA records (1998-2000). Shorebird that regularly occurs inland, breeding upon Salt Lakes. Flooded inland waterbodies are also expected to provide foraging habitat for this species. Preferred habitats occur in the Study Area.
Climacteris affinis White-browed Treecreeper	-	R	Unlikely	Two historical BDBSA records (1900). Passerine that occurs in well vegetated inland scrubs, where stands of rough-barked trees occur. This habitat type is largely absent for the Study Area.
Egretta garzetta Little Egret	LM	R	Possible	Three historical BDBSA records (1993) from Lake Coorlay. Wading waterbird species that typically occurs within coastal and subcoastal areas. Potential habitats occur within the Study Area.
Falco peregrinus Peregrine Falcon		R	Possible	Two historical BDBSA records (1998). Raptor that is distributed over the entire Australian continent. The species can inhabit a wide range of habitats from plains to woodlands, and these habitats are present within the Study Area. They typically nest on cliffs; however, human created structures or the disused nests of other raptors may also support breeding opportunities for this species within the Study Area.
Larus dominicanus Kelp Gull	LM	R	Unlikely	Historical BDBSA record (1982). Restricted to coastal environments, preferred habitats do not occur within the Study Area. Therefore, is considered unlikely to occur within Study Area.
Lophochroa leadbeateri Major Mitchell's Cockatoo	-	R	Possible	Two historical BDBSA records (1999). Restricted to semi-arid and arid Australia. Suitable habitat for this species is relatively widespread in the Study Area, including chenopod shrublands, timbered watercourses, Mulga and *Casuarina pauper* woodland habitats.
Neophema chrysostoma Blue-winged Parrot	LM	V	Possible	Two historical BDBSA records (1998-1999). Migratory parrot that primarily breeds in the south-east of Australia. Following the breeding season, the species expands its distribution in to semi-arid regions. Suitable habitat is widespread within the Study Area; and includes chenopod shrublands, Mulga and Myall woodlands.
Neophema splendida Scarlet-chested Parrot	-	R	Possible	Three Historical BDBSA records (1993-1996). Highly nomadic and irruptive (variable migrant) parrot that inhabits arid Australia. The species would be most likely to occur within areas of vegetated dunes and Mulga present within the Study Area.
Oxyura australis	-	R	Likely	Six historical BDBSA records (1991-1993), four recent records (1998-2000). Waterfowl that inhabits inland

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
Blue-billed Duck				waterbodies, deep freshwater wetlands. Suitable habitats are present within the Study Area and records from Lake Coorlay and Lake Mary.
Phaps histrionica Flock Bronzewing	-	R	Possible	BDBSA record (2013) northern end of Coorlay Lagoon. Highly nomadic pigeon that forms flocks numbering thousands of individuals. Irregularly recorded at Roxby Downs, and would be expected to be most likely to occur in the northern sectors of the Study Area.
Plegadis falcinellus Glossy Ibis	MM	R	Possible	Seven historical BDBSA records (1991-1993). Recent BDBSA record (1999). Nomadic and irruptive waterbird. Regularly occurs at ephemeral waterbodies, and therefore, could occur within the Study Area on exceptionally wet years.
Podiceps cristatus Great Crested Grebe	-	R	Possible	Ten historical BDBSA records (1990-1994), two recent records (1999). Waterfowl that inhabits inland waterbodies. Prefers large waterbodies with a combination of open water and vegetation, will also occur on large saline lakes. Study Area is outside of regular range and adjacent occasional range (Menkhorst, 2017). Suitable occasional habitat may occur within the dams and salt lakes of the Study Area.
Porzana tabuensis Spotless Crake	LM	R	Possible	Two BDBSA records (1998, 2000). Small shorebird that is reliant upon well vegetated wetlands. As such, dams with emergent and fringing vegetation may support this species, and these are present within the Study Area.
Stictonetta naevosa Freckled Duck	-	V	Likely	Twenty six historical BDBSA records (1991-1994), recent BDBSA records (2004). Waterfowl that regularly occurs inland. Within the Study Area, the species is likely to occur at pastoral dams and may temporally inhabit inland waterbodies during flood periods.
Reptiles				
Aspidites ramsayi Woma Python	-	R	Unlikely	Historical BDBSA record (1990). Most recent sightings in South Australia have come from sandy areas in the north-east of the state, predominantly along the Birdsville and Strzelecki Tracks. Large python with an average length of 1.5 m and a maximum length of approximately 2.7 m. Widespread throughout arid and semi-arid Australia from coastal Western Australia to western Queensland. Ground dweller that seeks shelter in hollow logs, animal burrows or thick herbage during the day. It can also use its head like a shovel to dig and enlarge its burrow. Preferred habitats occur in the Study Area, but occurrence in the Study Area and wider region are limited.
Nephrurus deleani Pernatty Knob-tailed Gecko	Delisted 2009	R	Likely	Twenty one historical BDBSA records (1950-1997), three recent records (1998-2000). Endemic to South Australia, only occurring within an area of approximately 500 km^2 north of Port Augusta, to the east of Island Lagoon and Lake Macfarlane and

Species and Common Name	Status AUS[1]	Status SA[2]	Likelihood of Occurrence within Project Area	Habitat Preference / Justification
				around Pernatty Lagoon (Ehmann and Watson, undated cited in EBS, 2018). It occupies vegetated sand dune habitat where it digs burrows, backfilling them from within, to refuge during the day. Preferred habitat occurs within the Study Area, which occurs within the known species range (Cogger, 2014). Not recorded during a short night time survey in the Study Area a *Callitris glaucophylla* Woodland on sand (EBS, 2018).

[1]Environment Protection and Biodiversity Conservation Act 1999 Status: Critically Endangered (CE); Endangered (EN), Vulnerable (VU); Migratory Marine (MM); Migratory Terrestrial (MT); Migratory Wetland (MW), Listed Marine (LM – only applicable 2 nautical miles of the continental shelf). [2]South Australian National Parks and Wildlife Act 1972 Status: Rare (R); Vulnerable (V); Endangered (E). [3]Biological Database of South Australia (BDBSA), Protected Matters Search Tool (PMST), Atlas of Living Australia (ALA), field survey refers to 2018 baseline survey.

In addition to the state listed fauna species listed above there are historical BDBSA records for five subspecies which have records in the Study Area, however the records are not to subspecies level, are likely to be the subspecies that do not have ratings. These subspecies are unlikely to occur, based on the following:

- *Cinclosoma castanotus castanotus* (Chestnut-backed Quail thrush), listed as Rare. Unlikely to occur as Study Area is near the extent of the occasional range of the eastern subspecies (Menkhorst et al., 2017).
- *Manorina flavigula* (Yellow-throated Miner (Black-eared)), listed as Endangered. Unlikely to occur as it occupies a very restricted range close to the border of South Australia, Victoria and NSW, well outside the Study Area (Menkhorst et al 2017).
- *Melanodryas cucullata cucullata* (Hooded Robin (South-east Subspecies)), listed as Rare. Unlikely to occur as the Study Area is outside the core range of the subspecies which extends west of Port Augusta to the east of Australia.
- *Microeca fascinans fascinans* (Jacky Winter (South-east Subspecies)), listed as Rare. Unlikely to occur as the Study Area is outside the range, which extends from Yorke Peninsula, South-east South Australia to the east of Australia.
- *Northiella narethae* (Blue Bonnet (western subspecies)), listed as rare. Unlikely to occur in the Study Area as it is outside range which overlaps the border of Western Australia and South Australia.

11.1.12 Bushfire Susceptibility

South Australia's dry climatic conditions cause frequent bushfires. In general, the incidence of bushfires, scrub and grass fires is higher in the hotter months. In the sparsely vegetated arid regions, bushfires are more often associated with the growth of ephemeral grasses following significant rainfall events, and their subsequent dieback as dry conditions return. To control bushfires and protect lives and property, restrictions are imposed on the lighting of fires during a designated fire danger season. The Project is located within the North West Pastoral District. Annual fire restrictions are in place for the North West Pastoral District from 15 October to 31 March (CFS, 2018). It should be noted that the North East Pastoral District area is adjacent the north part of the alignment (having the same restrictions as the North West

Pastoral district) and the Flinders District is adjacent the southern end of the corridor covering the Port Augusta area and immediate surrounds (restrictions between 1 November to 15 April) (CFS, 2018).

11.2 Impact Assessment

11.2.1 Description of Effects

This section describes the interaction of the Project (Section 5) with the baseline ecological environment (Section 11.1).

The activities that potentially have an impact on ecological receptors are presented in Table 11.10. Since ecology is a major receptor for Project impacts, this Chapter includes effects from various pathways that may impact ecological receptors.

The effects are discussed in Table 11.10. Some effects listed have already been discussed in the Surface Water (SW), Groundwater (GW) and Air Quality (AQ) Chapters (as indicated by the Impact ID). These effects are marked with an asterisk (*) and are not discussed in detail in this Chapter.

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised below in Section 11.4.

Table 11.10: Ecology Potential Effects

Source	Potential Effect	Receptors	ID
Land clearing	Land clearance for the construction of Project infrastructure removes vegetation and habitat for fauna	Common native vegetation and fauna NPW Act flora and fauna EPBC Act flora and fauna	L02 L03 L04
Construction / presence of transmission line and access track	The construction of the transmission line and access track leads to fragmentation of habitat	Native fauna (including NPW and EPBC-listed species)	L05
Saline overspray from sprayed water	Saline overspray from dust suppression deposit onto soil or native vegetation reducing vegetation health	Terrestrial ecology	L08
Land disturbance-introduction of weeds	Land clearing creates conditions favourable for an increase in weed density that outcompete native vegetation	Native vegetation Terrestrial fauna	L09 L10
Introduction of feral animals	Project activities attract predatory pest species to the Project Area during construction	Common native fauna NPW Act fauna EPBC Act fauna	L11 L12 L13
Fauna Interaction (construction activity and vehicles)	Project activity / vehicle movements interact with native and introduced fauna, including stock, causing serious injury or death of fauna	Native fauna. including NPW and EPBC Introduced fauna (including stock)	L16
Fauna Interaction (infrastructure)	Presence of transmission line infrastructure including towers, lines and conductors leads to serious injury or death of avifauna	Common native fauna State significant fauna EPBC-listed fauna.	L17 L18 L19
Illumination	Illumination at night from camp and construction areas displaces nearby fauna	Native Fauna	AQ06
Bushfire	Fire resulting from construction and operation of the transmission line leads to a loss of native vegetation and fauna habitat	Terrestrial Ecology	L20
Placement of Infrastructure*	Placement of transmission line infrastructure leads to the disruption and / or reduction of surface water flows	Aquatic Ecology Terrestrial Ecology	SW01 SW02
Erosion and Sedimentation*	Erosion of soils and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water	Aquatic Ecology Terrestrial Ecology	SW04 SW05
Excavation and earthworks*	Excavation and earthworks disturb acid sulphate soils	Aquatic Ecology Terrestrial Ecology	SW07 SW08

Source	Potential Effect	Receptors	ID
	leading to generation of acid leachate		
Groundwater abstraction*	Abstraction of groundwater during construction activities leads to a reduction of groundwater quantity	Aquatic Ecology Terrestrial Ecology	GW01 GW02
Dust emissions / deposition*	Activities including land clearing, material movement and vehicles on unpaved roads generate particulate emissions that reduce vegetation health	Native Fauna (including NPW and EPBC-listed species)	AQ02
Noise*	Noise generated by surface plant and mobile fleet (including helicopters) during construction and operation activities displaces nearby fauna	Native Fauna (including NPW and EPBC-listed species)	AQ04
Noise from interaction of wind transmission lines and towers*	Generation of noise from interaction of wind, transmission lines and towers displaces native fauna	Native Fauna (including NPW and EPBC-listed species)	AQ09
Accidental Spills*	Accidental Spills from the transport, storage and handling of hydrocarbons and chemicals contaminates land leading to a decrease in soil / water quality	Native Vegetation Native Fauna (including NPW and EPBC-listed species)	L01 L22

*Effect has been described in detail in other chapters. See discussion below for cross references.

Land Disturbance

The Project involves clearance of native vegetation and associated habitat to accommodate transmission structures, access tracks, temporary construction areas including laydown and accommodation camps, and to permit ongoing access during construction and operation phases.

The construction disturbance footprint is influenced by factors to be determined in detailed design, including structure size, location and spacing, access track details (e.g. extent of use of existing ElectraNet and BHP tracks and location of new tracks) and construction methodology (e.g. stringing methods).

Existing tracks and other disturbed areas will be used where possible, however for assessment purposes, land disturbance for construction has been derived based on a worst-case scenario, using the following assumptions:

- 50 m x 50 m land clearance at structure bases, of which there is one every 450 m for the 275 kV transmission line section
- 40 m x 40 m land clearance at structure bases, of which there is one every 300 m for the 132 kV transmission line section
- Clearance of a 5 m access track and a 5 m stringing easement along the entire length of the transmission line
- Clearance of two 50 m x 50 m areas at strain structures for equipment and conductor cable drum storage during line stringing (assumed 100 strain structures along the entire length of the transmission line)
- Ten laydown yards of 1 ha and four larger yards of 10 ha.

The resultant land disturbance equates to a conservative disturbance footprint for the Project of 470 ha. The actual clearance is likely to be significantly less than this, as the existing access track along the ElectraNet transmission line is expected to be used for over half the length of the transmission line. Also, an additional stringing easement would generally not be required if a new track is established or if helicopter stringing is used. If a stringing easement is required, it would generally be rolled rather than completely cleared.

As noted in Section 5.5.2, it is possible that some clearance or lopping of trees may be required under the conductors in areas of taller woodland to ensure that required clearance distances between vegetation and transmission lines are established and maintained. This requirement will be confirmed when LIDAR data is collected and detailed line design is undertaken. Where possible, conductor heights will be set to avoid or minimise vegetation clearance both during construction and ongoing maintenance.

An application for clearance of native vegetation will be submitted under the Native Vegetation Act (as discussed in Section 3.2.7). It is expected that this application will utilise conservative estimates of vegetation clearance, with a more accurate calculation of clearance provided to the Native Vegetation Council during the detailed design phase to enable more accurate calculation of the final significant environmental benefit requirement.

Land clearance will reduce and potentially fragment native vegetation and available fauna habitat. Fauna may also be temporarily disturbed or displaced by construction activities. The effect of land clearance will be confined to the disturbance footprint, which is relatively small in size at any given location. The effect will increase and peak during the construction phase as progressive clearance is undertaken, and is permanent for all areas that will accommodate permanent infrastructure (e.g. structure bases and access tracks). Areas cleared for construction workspace at the base of structures and temporary facilities (e.g. laydown areas, camps) would be rehabilitated after the completion of construction, reducing the potential effect.

The estimated area of land clearance for each vegetation association along the proposed transmission line is summarised in Table 11.11.

Table 11.11: Estimated Land Clearance by Vegetation Association

Vegetation Association	Description	Area cleared (ha)
1	*Acacia papyrocarpa* (Western Myall) Open Woodland	91.5
2	*Acacia aneura* (Mulga) Mixed Woodland	2.8
3	*Casuarina pauper* (Black Oak) / *Acacia aneura* (Mulga) Open Woodland	2.8
4	*Casuarina pauper* (Black Oak) Woodland	2.0
5	*Callitris glaucophylla* (Northern Cypress Pine) Woodland	19.4
6	*Acacia aneura* (Mulga) / *Acacia papyrocarpa* (Western Myall) Mixed Woodland	46.0
7	*Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrubland	75.9
8	*Acacia aneura* (Mulga) +/- *Alectryon oleifolius* (Bullock Bush) Shrubland	20.2
9	*Maireana sedifolia* (Pearl Bluebush) Low Open Shrubland	5.4
10	*Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)	0.2
11	*Atriplex vesicaria* (Bladder Saltbush) +/- *Maireana astrotricha* (Low Bluebush) Mixed Low Open Shrubland	21.4
12	*Acacia aneura* (Mulga), *Acacia ramulosa* (Horse Mulga) Woodland over *Acacia ligulata* (Sandhill Wattle)	67.1
13	*Acacia ligulata* (Sandhill Wattle) / *Dodonaea viscosa* (Sticky Hop-bush) Shrubland	7.0
14	*Tecticornia* spp. (Samphire) +/- *Atriplex vesicaria* (Bladder Saltbush) Low shrubland	3.4
15	*Casuarina pauper* (Black Oak) Creekline	3.3
16	*Atriplex vesicaria* (Bladder Saltbush) +/- *Eragrostis australasica* (Swamp Canegrass) Low Open Shrubland	67.8
17	*Maireana aphylla* (Cotton Bush) Low Shrubland	13.4
18	*Melaleuca pauperiflora* ssp. *mutica* (Boree) Shrubland +/- *Acacia ligulata* (Sandhill Wattle)	13.0
19	*Maireana astrotricha* (Low Bluebush) Low Open Shrubland	3.3
20	*Chenopodium nitrariaceum* (Nitre Goosefoot) Open Shrubland	1.4
Clay Pan	No Vegetation	2.6

Source: adapted from Appendix D1.

Fragmentation of Habitat by Transmission Line and Access Track

The construction of a permanent transmission line and access track has the potential to cause minor fragmentation of habitat within a largely continuous landscape dominated by native vegetation. The narrow nature of the footprint, and the ability to micro-site poles to avoid sensitive habitats and or to target areas of poorer habitat quality, will reduce the potential effect on native fauna and threatened species.

Saline Overspray from Sprayed Water

Saline water may be used for dust suppression on access tracks, stockpiles, and to compact the foundations at the tower sites. Water is likely to be extracted from new and existing groundwater wells (and potentially the South Australian potable water network) and applied via water cart sprinklers and or hoses. There may be a minor and temporary increase in the salts in the soil or depositing on the leaf surface of plants in the immediate vicinity of areas where dust suppression undertaken as a result of the use of saline water in this application.

The effect of saline overspray is expected to be confined to the disturbance footprint and even within the footprint, effects are likely to be very minor given the short-term nature of construction activities at any given location.

Introduction and Spread of Weeds

Weed incursion can potentially compete with and inhibit the regeneration of native species, altering community structures and dynamics, including the resources available to dependent native species and communities.

Buffel grass (*Cenchrus ciliaris*) is noted as a risk in the region. Although it was not detected on the field survey, it is known from the broader area.

During construction, the Project will include land clearance, earthworks, increased light and heavy vehicle movements, as well as the use of water for construction and dust suppression. These activities may facilitate weed introduction and or spread along access the tracks, laydown areas and cleared construction zones. Such an effect, if identified and managed promptly, would generally be restricted to the land disturbance footprint and overabundance outside of the disturbance footprint is not anticipated. However, outbreaks of invasive flora have the potential to act as new bases from which to spread further. During operations, the likelihood of weed introduction and or spread of weeds reduces with only occasional light vehicle and heavy vehicle movements needed to permit ongoing maintenance.

Attraction of Feral Animals

Feral animals are well established in the Project Area, including cats, foxes, wild dogs, rabbits, goats, rats and house mice. Temporary construction camps will generate waste and have the potential to attract and support a greater abundance of predatory pest species if not appropriately managed. A higher abundance of feral animals could negatively impact local populations of native fauna, including threatened species, through greater predation pressure and or competition for resources.

Fauna Interaction (construction activities and vehicles)

Vehicle movements may interact with native fauna and introduced fauna, including stock, causing serious injury or death potentially impacting on local abundance and or diversity. Fauna are more likely to be affected by high speed vehicle movements. Interactions may also be concentrated at particular times of the day (e.g. in the hours around dawn and dusk) or year (e.g. stock mustering, seasonal fauna mating and dispersal).

Heavy and light vehicle movements, and associated risk of fauna strike, will peak during the construction phase of the Project, and then significantly reduce with far fewer movements required during the operation and maintenance phase. The construction phase will be supported by a range of vehicle types including prime movers with semi-trailers, concrete trucks, cranes, dozers, graders, excavators, light trucks and 4X4 vehicles. The maintenance phase of the Project will include periodic inspections and maintenance, with only isolated periods of vehicle activity.

Open excavations (e.g. for structure foundations) during construction can potentially trap native fauna. These will be very limited in extent, and open for a short time. Escape measures will be provided, and excavations regularly checked, which will limit the potential effect.

Fauna Interaction (infrastructure)

Native and introduced avifauna may interact with electrical transmission lines. Collisions with transmission lines structures and conductors or contact with multiple conductors may cause electrocution or serious injury, and death. Mortality risk is expected to be greater in the vicinity of water bodies such as Island and Pernatty Lagoons and Lake Windabout, and the smaller Arcoona system lakes, which can support large populations of waterbirds including migratory species such as the Common Sandpiper, Sharp-tailed Sandpiper, Latham's Snipe, Common Greenshank and Ruddy Turnstone as well as state threatened species such as the Australasian Shoveler, Banded Stilt, Freckled Duck, Musk Duck and Blue-billed Duck. The Project is also likely to present a greater risk to larger avifauna such as eagles, which may also use the transmission towers as nesting sites. The effect will be fully realised in the operations phase once infrastructure has been commissioned.

Illumination

The Project will introduce temporary artificial sources of light, predominantly at construction camps. Existing light levels along the proposed alignment are very low and typical of the remote, rural setting within South Australia. The effect of Illumination at night on fauna in the region is poorly understood, but has the potential to attract or deter species, affect predator-prey interactions and possibly affect timing of fauna activity in the immediate vicinity. The limited illumination associated with the Project will only bring about a very minor and localised change to existing conditions.

Bushfire

Construction will involve the use of several ignition sources including the use of combustion engines in vehicles and generators and the use of welding equipment. Fire is an integral part of many ecological communities in arid regions. However, it is only intermittently that the vegetation within the Project Area will have significant biomass at a density that allows for the spread and movement of fire. Many species may benefit from fire to allow or aid regeneration. Other communities, however, are much altered when fire spreads and with additional impacts such as grazing and exotic species placing pressure on regenerative growth, are highly threatened by fire. Subsequently, uncontrolled fires could impact abundance and diversity of native vegetation and fauna habitat within and potentially beyond the Study Area.

Other Effects Described in Other Chapters

Other effects described in other chapters are:

- Surface Water effects related to placement of infrastructure, erosion and sedimentation, and excavation and earthworks are described under Surface Water in Section 7.2.1
- Groundwater abstraction-related effects are described in Section 8.2.1
- Dust emissions related to the Project are described in 9.2.1
- Noise-related effects are described in 10.2.1
- Accidental spills are first described in Section 6.2.1, Soils and Landscape.

11.2.2 Effects S-P-R Linkage

The information provided in Table 11.12 identifies the potential impacts to ecological receptors using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor. As above those greyed out have already been mentioned in previous chapters.

Table 11.12: S-P-R Linkage Summary for Potential Effects on Ecology

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Land clearance for the construction of Project infrastructure removes vegetation and habitat for fauna.	Yes	Land disturbance associated with the Project will result in the clearance of native vegetation and removal of habitat. The land disturbance footprint is conservatively estimated at 470 ha, along a corridor of 237 km. Unplanned event associated with incidental clearance is subject to a risk assessment in Section 11.3.	L02 L03 L04
The construction of the transmission line and access track leads to fragmentation of habitat.	No	The Project will not result in significant fragmentation, predominantly due to the narrow nature of the access track footprint, discrete nature of disturbance for structures, and the naturally open structure of the vegetation. The ability to micro-site infrastructure to avoid sensitive habitats or to target areas of poorer quality habitat further reduces the effect.	L05
Saline overspray from dust suppression that deposits onto soil or native vegetation reducing vegetation health.	No	Dust suppression activities will be small scale and short term. There may be a minor and temporary increase in the salts in the soil or depositing on the leaf surface of plants in the immediate vicinity of areas where dust suppression activities are undertaken, but no effect is expected outside of the disturbance footprint.	L08
Land clearing creates conditions favourable for an increase in weed density that outcompete native vegetation.	No	An increase in the density of existing weed species or the introduction/recruitment of new weed species outside of the disturbance footprint as a result of Project activities is not anticipated to occur without an unplanned event occurring. Unplanned event is subject to a risk assessment (see Section 11.3).	L09 L10
Project activities attract predatory pest species to the Project Area during construction.	No	There is unlikely to be an increase in existing predatory pest abundance across the Project Area or the introduction of new pests with the adoption of standard management protocols (see Section 11.4). The introduction of pests has been subject to a risk assessment (see 11.3).	L11 L12 L13
Project activity / vehicle movements interact with native and introduced fauna, including stock, causing serious injury or death of fauna.	No	Any injuries or deaths as a result of interaction with the Project would be as a result of an unplanned event Unplanned event is subject to a risk assessment (see Section 11.3).	L16
Presence of transmission line infrastructure including towers, lines and	No	Any injuries or deaths as a result of interaction with the Project would be as a	L17 L18

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
conductors leads to serious injury or death of avifauna.		result of an unplanned event (electrocution of birds striking or roosting on transmission lines). Unplanned event is subject to a risk assessment (see Section 11.3).	L19
Illumination at night from camp and construction areas displaces nearby fauna.	No	Construction camps are expected to be a localised and temporary source of light. It is expected that other than in close proximity to the Olympic Dam airport, where aviation warning lights may be required, the project infrastructure will not be illuminated. Measures will be implemented that will reduce the effect. The illumination associated with the Project is not considered to have material linkage to fauna as a receptor. Illumination from camps is further described under Land Use in Section 15.2.1.	AQ06
Fire resulting from construction and operation of the transmission line leads to a loss of native vegetation and fauna habitat.	No	Any fires associated with ignition sources will only occur as a result of an unplanned risk event. Unplanned event is subject to a risk assessment (see Section 11.3).	L20
Placement of transmission line infrastructure leads to the disruption and / or reduction of surface water flows impacting on the abundance and/or diversity of terrestrial ecology.	No	The Project will have a negligible effect on surface water flows as it will not provide any significant impediment to surface water flows or alter catchment areas. Unplanned event is subject to a risk assessment (see Section 11.3).	SW01 SW02
Erosion and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water impacting on the abundance and/or diversity of aquatic ecology.	Yes	Significant rainfall events may erode disturbed areas and stockpiles resulting in an increase in sediment loads entering local surface water catchments. This could possibly result in a small and localised increase above high background levels and result in very localised change in the abundance and diversity of aquatic invertebrates in ephemeral lakes. Refer to Section 7.2.2 for description of effects. The risk to terrestrial ecology from erosion and sedimentation has been subject to a risk assessment (see Section 11.3).	SW06
Runoff from stockpiles and disturbed surfaces leads to erosion of the land surface and increased sedimentation impacting on the abundance and/or	Yes	Significant rainfall events may erode disturbed areas and stockpiles resulting in altered land surfaces and increased sediment loads. This could possibly result in localised alteration to habitat suitability for terrestrial flora and fauna, and a small, localised increase in sediment loads above high	SW05

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
diversity of terrestrial ecology.		background levels which could result in very localised changes in the abundance and diversity of terrestrial species. Refer to Section 7.2.2 for description of effects. The risk to terrestrial ecology from erosion and sedimentation has been subject to a risk assessment (see Section 11.3).	
Excavation and earthworks disturb acid sulphate soils leading to generation of acid leachate.	No	See Section 6.2.2 and Appendix I.	SW07 SW08 SW09
Abstraction of groundwater during construction activities leads to a reduction of groundwater quantity for aquatic and terrestrial ecosystems.	No	See Section 6.2.2 and Appendix I	GW01 GW02
Activities including land clearing, material movement and vehicles on unpaved roads generate dust emissions that reduce vegetation health.	Yes	Potential increase in dust deposition onto vegetation in the vicinity of construction activities may occur in certain meteorological conditions. However, the impact is expected to be small scale, transient and confined to the immediate vicinity of the disturbance footprint.	AQ02
Noise generated by surface plant and mobile fleet (including helicopters) during construction and operation activities displaces nearby fauna.	Yes	Project activities will generate short term and transient noise emission effects from surface plant and mobile fleet during construction which may affect fauna in the immediate vicinity.	AQ04
Generation of noise from interaction of wind, transmission lines and towers displaces native fauna.	No	Effect is very localised and fauna in immediate vicinity will not be negatively affected. Not considered to have a material linkage to native fauna as a receptor. See Section 10.2.1 for description of noise effects.	AQ09
Accidental Spills from the transport, storage and handling of hydrocarbons and chemicals contaminates land leading to a decrease in soil / water quality.	No	Hydrocarbons and chemicals will be stored in appropriate containers relevant to the material being stored. An impact can only occur as a result of an unplanned event that results in the uncontrolled release of hydrocarbons or chemicals (see Section 11.3).	L01 L22

11.2.3 Impact Significance Assessment

This section discusses the significance of potential impacts where a linkage has been identified between the effects of the Project and ecological receptors. An impact assessment using the OZ Minerals Impact Assessment Framework has been carried out for each of these potential impacts. These impact assessments are presented in Appendix I. Supporting discussion is provided below followed by a table summarising the outputs of the Impact Assessment Framework. Further information is also provided in Appendix D2.

In accordance with the Impact Assessment Framework, only those potential impacts that have been identified as having an S-P-R linkage (or are found to be "material") have had an impact significance assessment carried out. Potential impacts where there is no identified S-P-R linkage are discussed above in Table 11.12.

Land Clearing of Native Vegetation and Habitat

The Project will require a worst-case clearance of 470 ha but is likely to be significantly less than this, as discussed in Section 11.2.1. Where clearance is unavoidable, the detailed design phase will include micro-siting of poles and access tracks to avoid sensitive habitats and/or to target areas of poorer quality habitat, further reducing potential impact to native species. Impact will be limited to areas clearly defined within the disturbance footprint, will be minimised through design and construction controls, and is not expected to be significant.

Native vegetation communities and habitats supporting native fauna are common, widespread and well represented in the broader region. As discussed in Section 11.2.1, a significant environmental benefit will be achieved, which will offset vegetation clearance.

In general, the habitats present on the alignment are well represented across the broader landscape, and do not provide critical habitat for any of the rare or threatened species identified as potentially present. The footprint for the project will impact a very small proportion of the available habitat for rare or threatened species.

The vegetation clearance footprint within potential Plains Mouse habitat will be comparatively minor and represents a very small portion of available regional habitat for the species (less than 0.02% of the stony plain habitat encompassed by the Arcoona Plateau IBRA subregion). In addition, mitigation measures including identification and avoidance where practicable of potential refuge habitat such as deep cracking clay gilgais (important to species survival during non-boom years or drought periods) when positioning towers and the access track will mean the action is unlikely to lead to any significant impacts (see Appendix D3 for further detail).

The vegetation clearance footprint is also unlikely to impact habitat of the Thick-billed Grasswren (Eastern or Western Subspecies) as the Study Area is either outside the known range (Western subspecies) or there are minimal isolated areas of preferred habitat within the Study Area. There are also no records or known populations of either subspecies in the Study Area. Mitigation measures, such as micro-aligning of the access track and micro-positioning of towers to avoid or minimise disturbance to

preferred habitats of key threatened species would avoid disturbance to populations of Thick-billed Grasswren, if present (see Appendix D3 for further detail).

Similarly, clearance of land and potential habitat for other threatened species (e.g. fauna such as Night Parrot (*Pezoporus occidentali*) and plants such as *Frankenia plicata* or *Senecio megaglossus*) is considered unlikely to impact these species. Night Parrot foraging habitat in general is present across the arid-zone areas of Australia and preferred nesting habitats, such as *Triodia* hummock grasslands, are not present within the Project Area. *Frankenia plicata* has specific habitat requirements, e.g. minor drainage lines with intergrades of outwash plains, stony surfaces and loamy clay or sand soils. *Senecio megaglossus* also has specific habitat requirements in stony slope habitat with *Triodia* that has not been located within the Project Area to date. Mitigation measures, such as targeted surveys and micro-aligning of the access track and micro-positioning of towers to avoid or minimise disturbance to preferred habitats of key threatened species would avoid disturbance to populations, if present (see Appendix D3 for further detail).

The impact has been assessed as low for NPW Act and EPBC Act flora and fauna, and very low for common flora and fauna (see Table 11.13).

Erosion and Sedimentation

As discussed in Section 7.2.1, land disturbance activities have the potential to generate suspended solids in surface water run-off during infrequent significant rainfall events. Surface water flows in the region are typically characterised by high total suspended solids and sediment transport from disturbed areas associated with the Project could have a small and localised effect on total sediment loads. Any effect on turbidity and sedimentation in ephemeral lakes, where inflows following rainfall are naturally highly turbid and are typically fed by large catchments, would be small, localised and short term. The significant distances to most ephemeral lakes further reduces the potential for impact. Aquatic fauna such as Brine Shrimp which are adapted to such conditions are unlikely to be significantly impacted and at most, a very localised impact would be expected.

Similarly, any increase in sedimentation in areas of predominantly terrestrial vegetation that receive runoff (e.g. claypans, swamps or riparian vegetation) would be a relatively small and localised effect. Erosion of disturbed areas (which can alter suitability of habitats for native vegetation and fauna through loss of topsoil and creation of scalds or erosion gullies) would generally be localised to the disturbed area, however in some areas such as gibber soils, can affect adjacent areas if not managed appropriately.

Appropriate measures to prevent erosion and sedimentation, and remediate it if it occurs, will be implemented as outlined in Section 11.4.

The impact has been assessed as low (see Table 11.13).

Unplanned indirect impacts to terrestrial ecology from erosion and sedimentation resulting from construction outside of design parameters and/or inappropriate application of construction has been subject to a risk assessment in Appendix I (see summary in Section 11.3).

Dust Impacts

The deposition of dust generated by activities including land clearing, progressive rehabilitation, material movements and stockpiling of materials have the potential to impact flora through smothering, inhibiting growth of native habitat and encouraging weed incursions. The potential for dust generation is discussed further in Chapter 9.

Vegetation typical of desert and arid areas are more tolerant of higher dust concentrations than vegetation in other, more temperate climates. Native vegetation communities and habitats supporting native fauna are well represented within the Project Area and broader Study Area.

An increase in dust deposition onto vegetation near construction activities may occur in certain meteorological conditions. However, the impact is expected to be small scale, transient and confined to the immediate vicinity of the disturbance footprint.

The impact has been assessed as low (see Table 11.13).

Noise

The potential for noise emissions is discussed in detail in Chapter 10. Construction activities are expected to generate noise that is short term and transient (i.e. 12 – 18 months total duration, moving along the

construction corridor as infrastructure is progressively developed) from construction equipment, vehicles and potentially blasting of hard rock material. Blasting, while unlikely, may cause localised over pressure and air blasts and the temporary displacement of fauna. If blasting is required, events will be small scale, controlled, localised and transient.

Species regularly utilising the area (that may be displaced by construction noise) are locally abundant. Any potential displacement will be short term. Habitat will remain, and any displaced individuals are expected to return to the area.

The impacts to native fauna from noise generated during construction activities are conservatively assessed as having a low impact on the abundance and diversity of native fauna.

Noise generated from activities during the operation and maintenance phase are considered to have a negligible effect on the surrounding environment due to the short-term duration, and infrequent nature.

Summary of Impact Significance for EPBC-listed species

Detailed assessments of potential impacts to Matters of National Environmental Significance (MNES) under the EPBC Act have been undertaken based on the results of the field survey and desktop review of existing data (see Appendix D).

As discussed in Section 3.2.1, OZ Minerals has undertaken a self-assessment of the potential for the Project to result in a significant impact to MNES and has concluded that the Project will result in no significant impacts on MNES. A conserted effort has been invested to understand the potential for MNES to be present within the Project Area and subsequently, to understand the potential impacts on MNES. This includes completing targeted in-field assessment of flora and fauna habitats (Appendix D1), which has informed a detailed Significant Impact Assessment for relevant protected matters. The Significant Impact Assessment is included as Appendix D3. This assessment builds upon the understanding of ecological values within the region.

The Significant Impact Assessment predicts that the action can be undertaken in a manner that prevents significant impacts upon MNES, and on this basis the proposed action has not been referred under the EPBC Act. Successful implementation of mitigation measure to avoid or reduce impacts would result in a further reduction in the likelihood of impacts to MNES.

An assessment of the potential impacts to EPBC-listed species with the realised potential to be present in the Study Area against the criteria set out in the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DOTE, 2013) has been undertaken and is detailed in Appendix D3.

In summary:

- No Threatened Ecological Communities were identified within the Study Area.
- The two EPBC-listed plant species identified as potentially occurring in the Study Area (*Frankenia plicata* and *Senecio megaglossus*) were considered unlikely to be present, or only present as scattered individuals and not forming important populations of either species. With the implementation of the proposed mitigation measures, including targeted surveys and micro-aligning of the access track and micro-positioning of towers to avoid any EPBC-listed threatened plants present, no significant impacts are anticipated to any of these plant species as a result of the Project.
- Five EPBC-listed threatened fauna species were considered as possible or likely to be present (Thick-billed Grasswren (eastern), Western Grasswren (Gawler Ranges), Curlew Sandpiper, Night Parrot and Plains Mouse). In general, habitat types present on the alignment are well represented across the broader landscape, and do not provide critical refuge for any of the EPBC-listed species identified. As described under *Land clearing of native vegetation and habitat* above, the footprint for the Project will affect a very small proportion of the available habitat. The proposed transmission line generally runs adjacent to existing service corridors, including high voltage power lines, roads and optic fibre installations thereby minimising the introduction of new impacts. The Project will not significantly reduce the area of occupancy, fragment any populations, or substantially reduce the size of a population. No significant impacts are anticipated to any EPBC-listed fauna species as a result of the Project. Targeted surveys and micro-aligning of the access track and micro-positioning of towers to avoid or minimise disturbance to preferred habitats of key threatened species will be undertaken avoid disturbance to populations.
- Fifteen EPBC-listed migratory species were included in the assessment (two of which were also threatened species). The majority of the migratory species identified breed overseas, or in significant areas of wetland or intertidal habitat, which will not be influenced by the Project. The Project is not located in an area where an ecologically significant proportion of a population of migratory species exists. The proposed alignment avoids ground impacts to ephemeral lakes and wetland habitat that may represent foraging habitat for migratory wader species, and where the alignment crosses Lake Windabout, two existing transmission lines are already present. Mitigation measures (such as installation of bird diverters in the vicinity of lake habitat where the level of risk increases beyond that already presented by existing transmission lines) are proposed to reduce the incidence of bird collisions with transmission lines. No significant impacts are expected to migratory species as a result of the Project.

Table 11.13: Summary of Ecological Impact Significance

Impact ID	Potential Impact Description	Impact Significance				Impact Uncertainty			Overall
		Resilience	Importance	Duration	Significance	Input	Methodology	Sensitivity	
L02	Land clearance for the construction of Project infrastructure removes vegetation and habitat for fauna, causing a loss of abundance and diversity of common native vegetation and fauna.	**1**	**1**	**3**	**3**	**B**	**A**	**A**	**4 Very Low**
L03	Land clearance for the construction of Project infrastructure removes vegetation and habitat for fauna, causing a loss of abundance and diversity of NPW Act-listed flora and fauna.	**1**	**4**	**3**	**12**	**B**	**A**	**B**	**17 Low**
L04	Land clearance for the construction of Project infrastructure removes vegetation and habitat for fauna, causing a loss of abundance and diversity of EPBC Act-listed flora and fauna.	**1**	**5**	**3**	**15**	**B**	**A**	**B**	**21 Low**
SW04	Erosion and runoff from stockpiles and disturbed surfaces leads to alteration of land surface and increased sedimentation of surface water impacting on the abundance and/or diversity of aquatic ecology.	**1**	**1**	**3**	**3**	**B**	**B**	**B**	**5 Low**
SW05	Erosion and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water impacting on the abundance and/or diversity of terrestrial ecology.	**1**	**5**	**3**	**15**	**B**	**A**	**A**	**19 Low**
AQ02	Activities including land clearing, material movement and vehicles on unpaved roads generate dust that deposits on vegetation, reducing vegetation health and impacting on the abundance and/or diversity of native vegetation and fauna.	**1**	**5**	**3**	**15**	**A**	**A**	**B**	**19 Low**
AQ04	Noise generated by surface plant and mobile fleet (including helicopters) during construction and operation activities displaces nearby fauna impacting on the abundance and/or diversity of native fauna.	**1**	**5**	**2**	**10**	**B**	**C**	**B**	**17 Low**

11.3 Unplanned Events

11.3.1 Incidental Land Clearance

Unplanned land clearance events may include land clearance undertaken without prior approval under the *Native Vegetation Act 1991* (SA) or land clearance undertaken outside the intended disturbance footprint (e.g. outside areas delineated for clearance in the field).

Both events could impact native vegetation through a loss of abundance and diversity of common native vegetation and fauna, and of listed flora, fauna and communities. This has been subject to a risk assessment in Appendix I which is summarised below. Multiple control and mitigation strategies are presented in Section 11.4.

11.3.2 Incidental Weed Incursion

Unplanned weed incursions may lead to an increase in density of existing or the introduction of new weed species that out-compete native vegetation and habitat. The proposed transmission line alignment generally runs adjacent to existing service corridors including high voltage transmission lines, pipelines, roads and optic fibre installations. Given the presence of this existing disturbance, the risk of the introduction of new invasive weed species through an additional easement is reduced as weeds that are easily transported and established are likely to have already done so.

Key mitigation and management controls will be implemented as outlined in Section 11.4. The level of risk has been assessed as moderate.

11.3.3 Attraction of Pest Fauna

Project activities are not expected to attract predatory pest species to the Project Area. Appropriate location of construction camps (e.g. avoidance of significant habitat for EPBC Act fauna) and appropriate management of waste generated at construction camps will reduce the risk of the Project increasing the abundance of predatory pest species in the Project Area from existing levels. This has been subject to a risk assessment in Appendix I which is summarised below.

11.3.4 Fauna Interaction (construction activity and vehicles)

The risk of impact to fauna will peak during the construction period at the height of vehicle activity and while excavation for foundations is undertaken, and then significantly decline as the Project enters the operations and maintenance phase, when vehicle movements are confined to periodic inspection and maintenance activities only. With the adoption of appropriate management and mitigation controls (see Section 11.4), the risk posed by fauna interaction is considered very low.

11.3.5 Fauna Interaction (infrastructure)

The proposed transmission line would increase the risk of bird collisions over that presented by the two existing lines. The additional risk can be minimised through a series of design measures adopted where the alignment is within close proximity (e.g. 1 – 2 km) of lakes (see Section 11.4). In a relatively open environment with sparse tree cover, the tower may also offer an attractive alternative nesting option for raptor species, enhancing to risk of collision and electrocution. Again, risk can be appropriately minimised through the adoption of design measures at towers to deter raptor use and minimise electrocution risk, as described by Section 11.4.

The proposed alignment largely avoids impacts to ephemeral wetlands which may represent foraging habitat for migratory wader species during non-breeding periods when they are in Australia. It has been aligned immediately adjacent to Olympic Dam Highway in the northern part of the alignment to maximise distance to the closest ephemeral lakes (Lake Mary and Coorlay Lagoon). Where the alignment spans the edge of Lake Windabout, two existing transmission lines are present and mitigation measures are proposed to reduce the incidence of bird collisions with transmission lines. Most waders breed overseas, or in ecologically significant areas of wetland or intertidal habitat which are not located in the Project Area and will not be influenced by this project. Migratory species that have the potential to occur in the Project Area during non-breeding seasons include: Common Sandpiper *(Actitis hypoleucos),* Sharp-tailed Sandpiper (*Calidris acuminata*), Pectoral Sandpiper (*Calidris melanotos*), Oriental Plover (*Charadrius veredus*), Latham's Snipe (*Gallinago hardwickii*), Common Greenshank (*Tringa nebularia*), Ruddy Turnstone (*Arenaria interpres*), Black-tailed Godwit (*Limosa limosa*) and Wood Sandpiper (*Tringa glareola*). With mitigation measures proposed, any impact on these species would not be significant.

Collisions with transmission lines are not considered likely to be a common cause of mortality for the EPBC Act Critically Endangered Curlew Sandpiper (*Calidris ferruginea*). In addition, the species are only occasional visitors to the Study Area, observed only in low numbers and consequently any collisions would not result in a material decrease in population sizes, Other EPBC Act listed birds that could potentially occur in the area (e.g. Thick-billed Grasswren, eastern (*Amytornis modestus*) or Night Parrot (*Pezoporus occidentalis*)) predominantly live on or near the ground and are highly unlikely to interact with transmission line infrastructure.

Similarly, the proposed transmission line is not anticipated to impact the breeding or feeding of the aerial migratory species, Fork-tail Swift (*Apus pacificus*). This migratory species breeds in eastern Asia and is almost exclusively aerial, feeding on the wing above a variety of habitats (from inland open plains to wooded areas) across large portions of Australia during summer months (DOTE 2015). This species generally flies well above the height of the proposed transmission lines, up to 1000 m.

This has been subject to a risk assessment in Appendix I. The level of risk has been assessed as low.

11.3.6 Accidental Spills

The transport, storage and handling of hydrocarbons and other chemicals may result in an accidental spill, which if uncontained, may cause local contamination of land and resources and habitat for native flora and fauna. Key mitigation and management controls will be implemented (see Section 11.4), and an accidental spill event would only result from a failure of the implementation of these measures or from inadequate design of the measures to manage the identified level of risk. This has been subject to a risk assessment in Appendix I. The risk has been assessed as low.

11.3.7 Bushfire

Accidental fires from ignition sources common to a construction zone may result in the loss of abundance and/or diversity of native vegetation. This has been subject to a risk assessment in Appendix I. The risk of accidental fires associated with Project fire ignition sources resulting in a loss of native vegetation has been assessed as low. Appropriate mitigation and management controls are provided in Section 11.4 to managed bushfire risk during the construction phase. Once commissioned, there is limited potential for bushfires to be initiated through vegetation making contact with transmission lines in an environment dominated by low, open vegetation communities.

11.3.8 Incidental Erosion and Sedimentation

Construction outside of design parameters and/or inappropriate application of construction methodologies or controls could lead to an increase in erosion and sedimentation effects and unplanned indirect impacts to terrestrial ecology.

This has been subject to a risk assessment in Appendix I. The consequences would be similar to the potential impacts discussed above (i.e. generally minor and localised) and the impact has been assessed as low.

11.3.9 Placement of Infrastructure Alters Surface Water Flows

If constructed as planned, the Project will not alter surface water flows to enable impacts to terrestrial ecology. Track construction outside of design parameters and/or inappropriate application of construction methodologies has the potential to alter the surface hydrology of the landscape by redirecting the surface flows causing a localised loss of flora species condition. This could affect species reliant on runoff to maintain their place within the landscape or communities that are intolerant of flooding.

This has been subject to a risk assessment in Appendix I. The risk to terrestrial flora and fauna from such an event occurring is considered low.

Table 11.14: Ecology Risk Events

Risk Description	Consequence	Likelihood	Risk	Impact ID
Land clearance undertaken without prior approval under the *Native Vegetation Act 1991* (SA) results in the loss of abundance and diversity of common native flora and fauna.	2-Minor	D-Unlikely	5-Low	L02
Land clearance undertaken without prior approval under the *Native Vegetation Act 1991* (SA) results in the loss of abundance and diversity of NPW Act listed flora and fauna.	3-Moderate	D-Unlikely	9-Moderate	L03
Land clearance undertaken without prior approval under the *Native Vegetation Act 1991* (SA) results in the loss of abundance and diversity of EPBC Act listed flora and fauna.	3-Moderate	D-Unlikely	9-Moderate	L04
Inadequate weed management practices lead to an increase in density of existing or new weed species that out-compete native vegetation and impacts on the abundance and diversity of native flora.	4-Major	E-Rare	10-Moderate	L09
Inadequate weed management practices lead to an increase in density of existing or new weed species that out-compete native vegetation and habitat and impacts on the abundance and diversity of native fauna.	2-Minor	D-Unlikely	5-Low	L10
Project activities (inadequate waste management, inadequate pest control) create conditions favourable to existing predatory pests or attract new pest species to the Project Area, impacting the abundance and diversity of common native fauna.	2-Minor	D-Unlikely	5-Low	L11
Project activities (inadequate waste management, inadequate pest control) create conditions favourable to existing predatory pests or attract new pest species to the Project Area, impacting the abundance and diversity of NPW Act threatened fauna.	2-Minor	D-Unlikely	5-Low	L12
Project activities (inadequate waste management, inadequate pest control) create conditions favourable to existing predatory pests or attract new pest species to the Project Area, impacting the abundance and diversity of EPBC Act threatened fauna.	3-Moderate	C-Unlikely	9-Moderate	L13

Risk Description	Consequence	Likelihood	Risk	Impact ID
Project construction activities and vehicle movements interact with native and introduced fauna, including stock, causing serious injury or death and a reduction in fauna abundance and or diversity.	2-Minor	D-Unlikely	5-Low	L16
Presence of transmission line infrastructure leads to serious injury or death of avifauna, impacting associated diversity and abundance of common native fauna.	2-Minor	D-Unlikely	5-Low	L17
Presence of transmission line infrastructure leads to serious injury or death of avifauna, impacting associated diversity and abundance of NPW Act listed fauna.	2-Minor	D-Unlikely	5-Low	L18
Presence of transmission line infrastructure leads to serious injury or death of avifauna, impacting associated diversity and abundance of EPBC Act listed fauna.	2-Minor	D-Unlikely	5-Low	L19
The transport, storage and handling of hydrocarbons and chemicals results in an accidental spill that contaminates land and secondary pathways impacting on native vegetation.	2-Minor	D-Unlikely	5-Low	L01
Accidental fires associated with fire ignition sources results in loss of native vegetation.	2-Minor	E-Rare	3-Low	L20
The transport, storage and handling of hydrocarbons and chemicals results in an accidental spill that contaminates land and secondary pathways and leads to a loss of abundance and/or diversity of native fauna.	2-Minor	D-Unlikely	5-Low	L21
Extreme wind events result in generation and deposition of particulate matter on to vegetation.	1-Insignificant	D-Unlikely	2-Low	AQ03
Construction/placement of infrastructure outside of design parameters and/or inappropriate application of construction alters surface water flows and leads to unplanned indirect impacts to terrestrial ecology.	1-Insignificant	D-Unlikely	2-Low	SW02

Risk Description	Consequence	Likelihood	Risk	Impact ID
Construction outside of design parameters and/or inappropriate application of construction methodologies may lead to potential increase in erosion and sedimentation effects and unplanned indirect impacts to terrestrial ecology.	1-Insignificant	D-Unlikely	2-Low	SW05

11.4 Summary of Control and Mitigation Strategies

Strategies to reduce and or eliminate the risk to ecological receptors are provided by Table 11.15 and Table 11.16.

Table 11.15: Summary of Design Controls

Design Controls	Impact ID
Land Clearance	
Restrict the disturbance footprint to the minimum necessary to safely carry out the activities.	L02, L03, L04, L05
Utilise existing disturbed or degraded areas where practicable (e.g. for laydown areas).	L02, L03, L04, L05
Where practicable, avoid locating transmission towers, access roads and laydown areas in the following habitats: • Minor drainage lines and outwash plains with stony surfaces and loamy sand or clay sand soils which are potentially important for the Southern Sea-heath and Large-flower Groundsel. • Taller and denser chenopod shrublands that occur in drainage lines and chenopod shrublands surround drainage lines supporting open woodlands which are potentially important for the Western Grasswren. • Taller chenopod shrubland and lignum habitat in minor drainage lines which are potentially important for the Thick-billed Grasswren (eastern). • Inland freshwater wetlands, mudflats and saline lakes which are potentially important for migratory waders including the Curlew Sandpiper. • If present, spinifex (Triodia spp.) hummock grassland on stony plains or chenopod shrublands and adjacent samphire low open shrubland, chenopod shrubland, and areas of mulga which are potentially important for the Night Parrot. • Low-lying gilgais (i.e., small, depression in the soil surface in expanding clay soils) and watercourses of gibber plains with chenopod shrubland or tussock grassland cracking clay habitat which are potentially important refuge habitat for the Plains Mouse.	L02, L03, L04, L05
Complete targeted pre-construction surveys for important habitats of nationally threatened flora and fauna, including: • Southern Sea-heath prior to construction on outwash plains on southern foot-slopes of Arcoona Plateau. • Large-flower Groundsel prior to construction on preferred stony slope habitat in the southern portion of alignment. • Thick-billed Grasswren (eastern) preferred habitats of taller chenopod shrubland and lignum habitat in minor drainage lines within the northern portion of the alignment. • Western Grasswren (Gawler Ranges) preferred habitats of open chenopod shrublands that surrounds minor drainage lines supporting open woodland within the southern portion of the alignment. • Any unknown areas of potential breeding habitat for the Night Parrot, which consists of spinifex (*Triodia* spp.) hummock grassland.	L02, L03, L04, L05

Design Controls	Impact ID
• Plains Mouse refuge habitat of deep cracking clay gilgais or broad run-on interdune swales throughout the alignment.	
If important habitats for nationally threatened flora and fauna are detected through pre-construction surveys, demarcate the area and creating a 50 m buffer to avoid clearance or disturbance of important habitat, where practicable.	L02, L03, L04, L05
If important habitats for nationally threatened flora and fauna cannot be avoided, develop site-specific mitigation measures in consultation with appropriately experienced ecologist.	L02, L03, L04, L05
Weeds	
Minimising ground disturbance; design will consider use of existing tracks wherever possible, minimising new clearance and associated risk of weed incursions.	L09 L10
Fauna Interaction (Infrastructure)	
Line spacing between phase and ground conductors will be greater than 150 cm.	L17 L18 L19
Transmission line insulation of phase and/or grounds where necessary and use of perch discouragers where necessary.	
Attach bird diverters to transmission line conductors and/or the top-most earth/shield wire at regular intervals to increase visibility of the lines on sections of the alignment adjacent to potential water bird foraging habitat where the level of risk increases beyond that already presented by existing transmission lines.	
Use of ball markers and flappers to reduce bird collisions with the line, where appropriate.	
Light Emissions	
Placement of camps near already disturbed areas where practicable e.g. highway / substation / pastoral infrastructure and utilising lighting type that limits illumination away from the area.	AQ06
Hydrocarbon and Chemical Management	
Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards.	L01

Table 11.16: Summary of Mitigation and Management Controls

Mitigation and Management Controls	Impact ID
Land Clearance	
External land disturbance approvals process; appropriate SEB credit to be established (and not exceeded) prior to land disturbance being undertaken.	L02 L03 L04
Install bunting around potential preferred habitat identified during targeted surveys or pre-disturbance site clearances, where appropriate, to ensure no disturbance beyond the essential vegetation clearance footprint.	
Compliance with the internal land disturbance approval process.	
Land disturbance reconciliation during and after construction.	
GIS system to record / identify clearance areas and status.	
Area-specific and site inductions and training.	
Protection of sensitive habitats and species, when encountered, in accordance with work plans and training.	
Weeds	
Pre-construction inspection to identify any areas of weed infestation requiring specific management measures.	L09 L10
Appropriate disposal of any noxious weeds cleared as part of the project.	
Implement weed hygiene practices such as vehicle wash-downs and inspections during construction as well as post-construction weed surveillance and control programs.	
Weed Red Alert List for quick identification, provided with induction program where relevant and available on site.	
Minimising ground disturbance through restriction of vehicle movements and materials to designated construction zones, laydown areas and tracks.	
Periodic survey (e.g. post completion of construction, after significant rain) to identify and prioritise treatment programs for declared and environmental weeds.	
Feral Animal Management	
Waste Management Plan; implement protocols for management of waste during construction to avoid attracting feral pest animals.	L11 L12 L13
Feral Animal Eradication Program should an increase in the abundance or diversity of feral animals be observed.	
Records of feral animal observations.	
Fauna Interaction (Construction activities and vehicles)	
Traffic Management Plan; including designated speed limits, appropriate constraints on travel at dawn and dusk.	L16
Record native fauna interactions.	
Area-specific and site inductions and training.	
Regularly check any open excavations for trapped fauna and provide measures to allow their escape.	
Temporary fencing used to prevent stock or large fauna entrapment in excavations where appropriate.	

Mitigation and Management Controls	Impact ID
Hydro-carbon and Chemical Management	
Periodic equipment maintenance in accordance with equipment specifications.	L01 L22
Spill and emergency response procedures.	
Maintain contaminated land register.	
Bushfire Management	
All equipment fitted with appropriate firefighting equipment.	L20
Project-based emergency response team.	
Minimisation of ignition risk through operation of vehicles and other equipment with ignition sources within designated construction zones, laydown areas and tracks only.	
Clearance distances between vegetation and transmission lines established and maintained in accordance with the *Electricity (Principles of Vegetation Clearance) Regulations 2010.*	

12 VISUAL AMENITY

12.1 Existing Environment

The information provided in this chapter is based on a visual and landscape desktop assessment undertaken by URBIS (Appendix E), which includes a landscape assessment defining landscape character, scenic quality and landscape absorptive capability and a visual effects assessment using standard methodologies to assess visual modification and sensitivity.

12.1.1 Regional Context

The area is sparsely inhabited and distant from recognised tourist attractions. The main landscape values relate to the region's relatively undisturbed plains, remoteness and scenic attractions such as Lake Torrens and Lake Gairdner National Parks. However, there is scenic value of the landscape to outback travellers and residents.

The Project Area roughly follows the alignment of the Stuart Highway and the Port Augusta to Alice Springs railway line, the route of The Ghan tourist train. North of Woomera, the alignment generally follows the Olympic Dam Highway.

Several existing transmission lines run roughly parallel to the Stuart Highway, Olympic Dam Highway and the railway line throughout much of the length of the proposed transmission line, effectively creating a transport and energy infrastructure corridor character. The proximity of existing transmission lines to the Stuart Highway and the railway line varies from approximately 500 m to 10 km. The existing transmission lines cross the Olympic Dam Highway and remain near and roughly parallel to it for over 20 km (Plate 12.1).

Plate 12.1: Existing Transmission Line Infrastructure Adjacent to Olympic Dam Highway

12.1.2 Landscape Character Types and Scenic Quality

The Study Area can be characterised by a number of identified Landscape Units, which are listed in Table 12.1, and their location is shown in Figure 12.1 and Figure 12.2.

The scenic quality, landscape character and absorptive capability (how well the landscape setting can accommodate change) for each of these Landscape Units is also summarised in Table 12.1. Photographic examples of each of the Landscape Units characterised are provided in Appendix E.

The key factors considered in determining absorptive capability are topography and vegetation. In areas of flatter topography, overlooking is not possible and a low (eye height) and thin band of vegetation is able to screen views to a development from a given viewpoint. In areas of undulating or elevated topography, overlooking can occur and vegetation needs to be higher and denser to achieve effective screening. Intervening undulating topography also has the potential to block views in certain landscapes.

Night time illumination in the region of the Project Area, away from the townships of Olympic Dam, Woomera and the settlement of Pimba, is that of an intrinsically dark landscape.

Table 12.1: Landscape Units, Scenic Quality and Absorptive Capacity

Landscape Unit Area	Scenic Quality	Characteristics/Use	Absorptive Capacity		
			Topography	Vegetation	Overall
Unit 1 – Low Dunes	Low to Moderate	• Diverse vegetation of varying height and density • Broad plain with slight to locally moderate topographic variation • Direction of dunes generally aligned	Moderate to high	Moderate to high	Moderate
Unit 2 – Open Plain	Low	• Very low homogenous vegetation • Broad plain with minimal topographic variation	High	Low	Low
Unit 3 – Undulating Open Plain	Low	• Very low homogenous vegetation • Broad plain with slight topographic variation	High	Low	Low
Unit 4 – Salt Lakes	Moderate to High	• Backdropped by isolated rounded hills • Salt lakes occasionally water filled • Minimal vegetation surrounding lake beds	Low to moderate	Low	Low
Unit 5 – Folded Hills	Low to Moderate	• Moderate degree of topographic variation • Generally homogenous vegetation of a similar height but varying density	Moderate	Low	Low
Unit 6 – Abrupt Hills	Moderate	• Moderate to high degree of topographic variation • Exposed geology and rock formations • Strongly defined patterns resulting from combinations of eucalypt forest and treeless areas	Low	Low	Low
Unit 7 – Shrubland Plain	Low to Moderate	• Minimal to slight topographic variation • Generally homogenous vegetation of a similar height but varying density	High	Low to moderate	Low to moderate

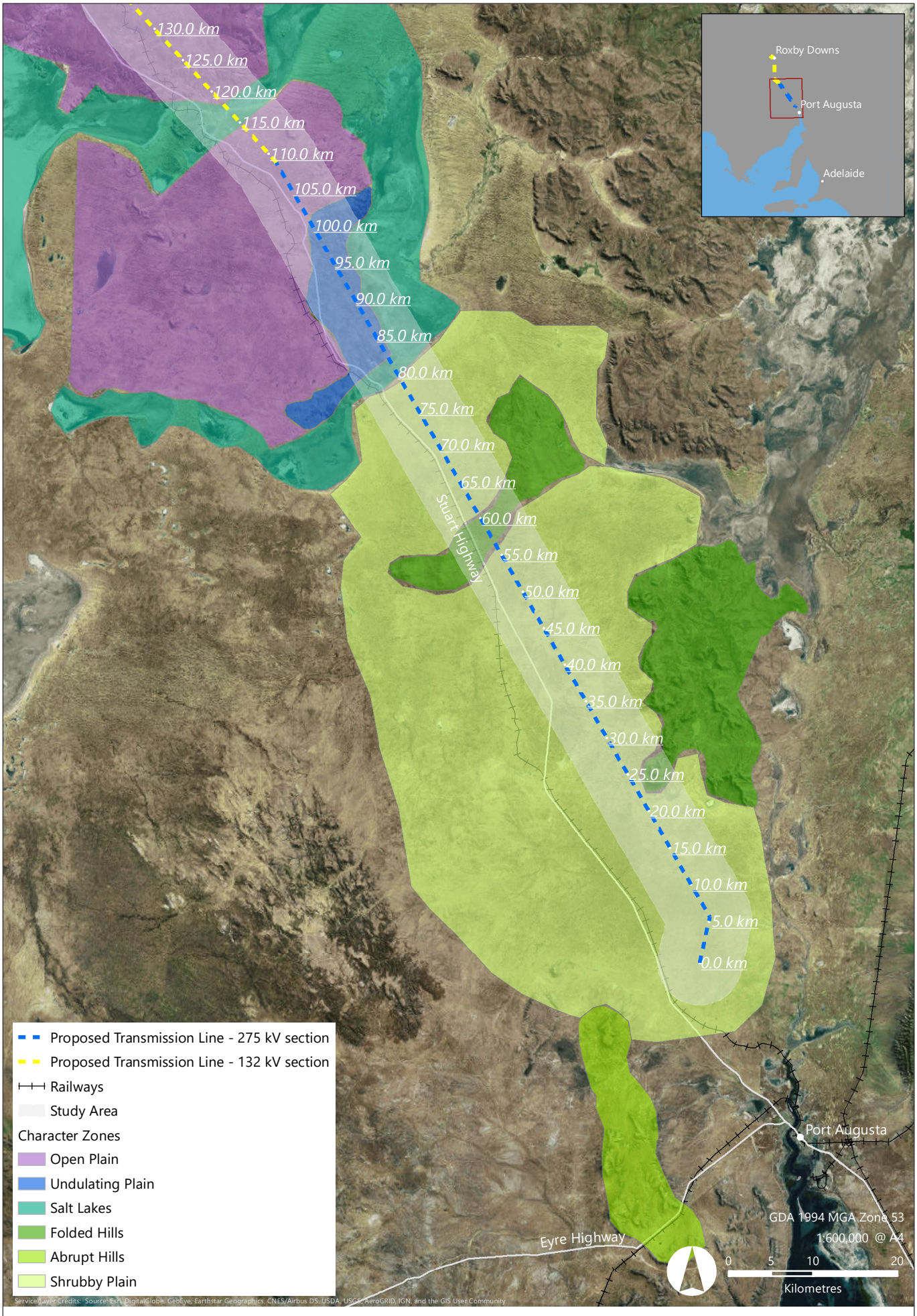

Figure 12.1: Landscape Character Units – 275 kV section

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

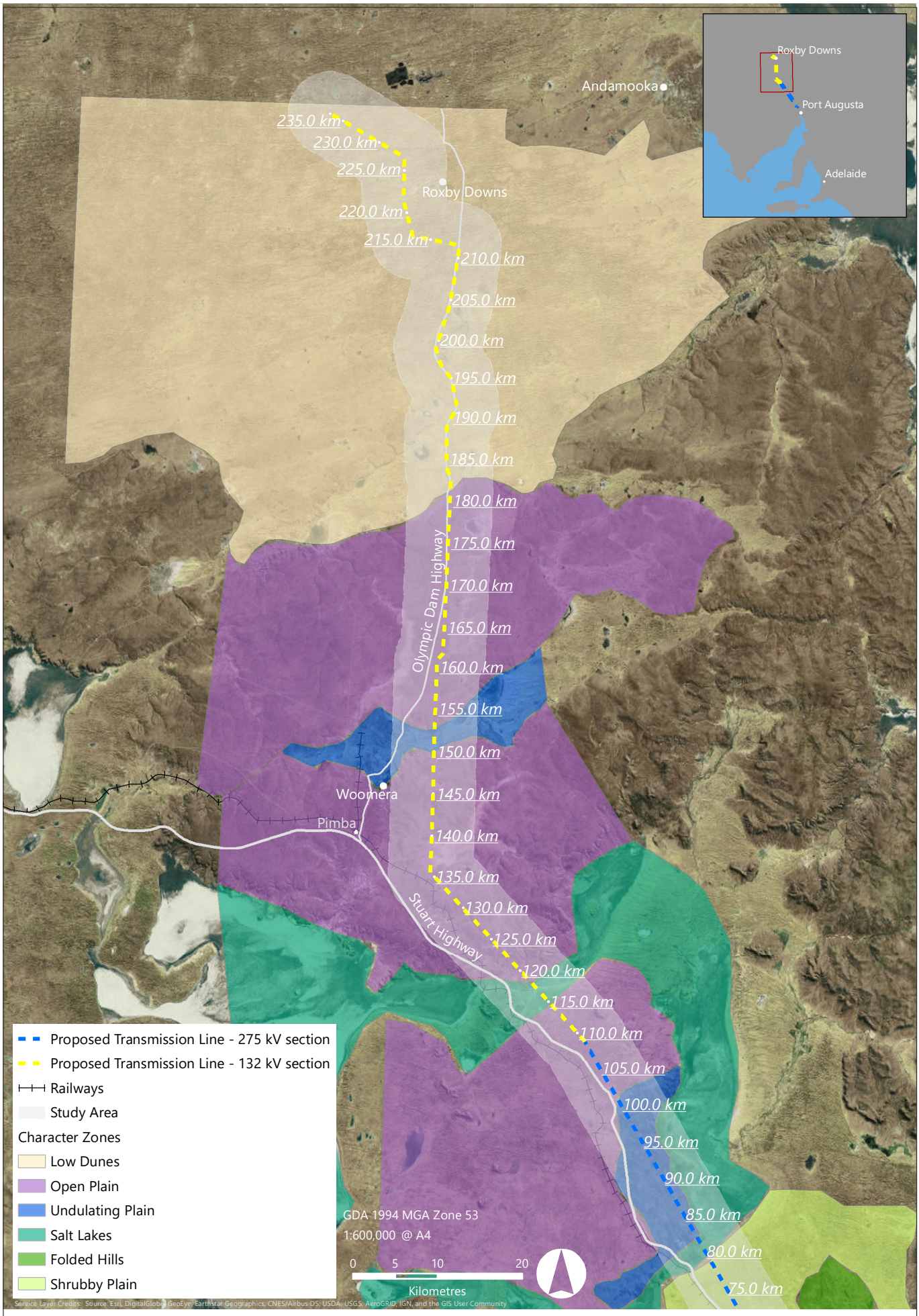

Figure 12.2: Landscape Character Units – 132 kV section

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

12.1.3 Key Vistas

Key vistas of the landscape are afforded from the Stuart Highway, particularly road side rest areas or signed viewing points or lookouts. Key scenic viewpoints identified include Island Lagoon lookout and Ranges View rest area (Plate 12.2).

Of these views, the view from Island Lagoon is to the west, away from the Project Area and existing transmission line infrastructure. Views from Ranges View rest area are to the east of the Project Area. The existing BHP and ElectraNet transmission lines are located within the view from Ranges View rest area (and are approximately 3.5 km to the east). Existing water pipeline infrastructure is visible in the immediate foreground.

Views will also be afforded from The Ghan, although these will be transitionary given the constant movement of the train.

Key features in views of the landscape are rocky outcrops, dune fields and salt lakes, with the salt lakes being attractions both when dry and when occasionally water-filled.

Although the focus of the viewpoints corresponds with landscapes with attributes of higher scenic quality, some viewers will appreciate areas of flat and expansive landscape for their intactness and remoteness, particularly viewers from urban areas who appreciate the concept of a "big sky".

As discussed in Appendix G, the Barngarla and Kokatha People maintain a strong connection to the land and water in the region, and as such, the visual amenity of the landscape is of high cultural value to them.

12.1.4 Sensitive Viewpoints

A range of typical representative sensitive viewpoints in the visual setting of the Project were identified for detailed assessment (see Section 12.2.3). These included lookouts (Island Lagoon lookout and Ranges View rest area), Tourist routes (Stuart Highway and The Ghan), townships (Roxby Downs, Woomera, Pimba) and local access roads (Olympic Dam Highway) and are shown in Figure 12.1 and Figure 12.2.

High sensitivity viewpoints from National Parks (Flinders Ranges, Lake Gairdner and Lake Torrens) are located more than 10 km from the Project Area, and as a result, the visual sensitivity of these areas in relation to the Project is considered to be low.

Island Lagoon Lookout
View to the west from Stuart Highway away from proposed transmission line infrastructure

Ranges View Rest Area
View to the east from Stuart Highway towards proposed transmission line infrastructure

Plate 12.2: Key Vistas from Stuart Highway

12.2 Impact Assessment

12.2.1 Description of Effects

This section describes the interaction of the Project (Section 5) with the baseline visual environment (Section 12.1). The activities that potentially alter the visual environment, which may subsequently have an impact on receptors, are presented in Table 12.2. These effects are discussed further below.

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised below in Section 12.4.

Table 12.2: Visual Amenity Potential Effects

Source	Potential Effect	Receptors	ID
Presence of Infrastructure	Transmission line infrastructure leads to change in visual amenity of the landscape	Aboriginal Communities Local Communities	L14 L15

Presence of Infrastructure

The most significant visual elements of the Project will involve:

- Access track construction
- Clearing of vegetation
- Erection of poles and the stringing of wires.

The Project Area is generally not visible from publicly accessible viewpoints apart from where it approaches or crosses Olympic Dam Highway or approaches the Port Augusta to Alice Springs railway line.

The area of highest visibility, and potentially higher impact, will be confined to within 1 km of the Project Area.

In the typically open landscape with low vegetation, views along, or close to parallel to, the Project Area will be potentially less impacted than views perpendicular to it.

The components of the Project will be visually compatible with the existing electricity infrastructure within the Project Area. Consolidation of alike elements reduces the potential for visual effects. Given the relatively slender form of the components of the Project, consolidation of infrastructure will result in a minimal cumulative effect on the landscape.

12.2.2 Effect S-P-R Linkage

The information provided in Table 12.3 identifies the potential impacts on visual amenity to identified receptors using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor.

OZ Minerals places great value on our relationship with the Barngarla and the Kokatha People and in respecting cultural rights have agreed not to disclose the results of sensitive discussions. For this reason, the impact assessment has been limited to the identification of linkages between source, pathway and receptor only (Table 12.3). A large focus of ongoing efforts during the design phase of the Project is to ensure infrastructure locations are selected in consultation with the Barngarla and Kokatha People. Management of impact significance is achieved respectfully between the Barngarla and Kokatha People and OZ Minerals. A summary of the identified impacts on Aboriginal and non-Indigenous heritage is provided in Section 13.2.

Table 12.3: S-P-R Linkage Summary for Visual Amenity Effects

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Transmission line infrastructure leads to change in visual amenity of the landscape for Aboriginal communities	Yes	The visual amenity will be altered by the construction of the infrastructure, although this change will be incremental due to the presence of infrastructure of a similar visual character.	L14
Transmission line infrastructure leads to change in visual amenity of the landscape for local communities	Yes	The visual amenity will be altered by the construction of the infrastructure, although this change will be incremental due to the presence of infrastructure of a similar visual character.	L15

12.2.3 Impact Significance Assessment

This section discusses the significance of potential impacts where a linkage has been identified between the visual effects of the Project and receptors. An impact assessment using the OZ Minerals Impact Assessment Framework has been carried out for each of these potential impacts. These impact assessments are presented in Appendix I. Supporting discussion is provided below followed by a table summarising the outputs of the Impact Assessment Framework.

In accordance with the Impact Assessment Framework, only those potential impacts that have been identified as having an S-P-R linkage (or are found to be "material") have had an impact significance assessment carried out. Potential impacts where there is no identified S-P-R linkage are discussed above in Table 12.3.

Presence of Infrastructure

A Visual Impact Assessment has been undertaken for the Project (Appendix E), which considered a range of typical representative sensitive viewpoints in the visual setting of the Project as discussed in Section 12.1.4. The results of the assessment are summarised in Table 12.4.

Table 12.4: Results of Visual Impact Assessment

Viewpoint	Distance from Project	Visual Sensitivity	Visual Modification from Project	Visual Effect
1 – Stuart Highway	7.4 km	Low (due to distance)	Very low (proposed line adjacent to existing lines)	Very low
2 – Stuart Highway	4.8 km	Low (due to distance)	Very low (proposed line adjacent to existing lines)	Very low
3 – Ranges View rest area	3.5 km	Low (due to distance)	Low (proposed line adjacent to existing lines)	Low
4 – Stuart Highway	1 km	Moderate (due to tourism use associated with highway)	Very low (proposed line adjacent to existing lines)	Low
5 – Stuart Highway	0.6 km	Moderate (due to tourism use associated with highway)	Low to moderate (proposed line adjacent to existing lines)	Low to moderate
6 – Island Lagoon Lookout	4.6 km	Low (due to distance)	Very low (proposed line adjacent to existing lines)	Very low
7 – Pimba	8.5 km	Low (due to distance)	Very low (due to distance)	Very low
8 – Woomera	6 km	Low (due to distance)	Very low (due to screening effects of rising topography and distance)	Very low
9 – Olympic Dam Highway	100 m	Low (road is primarily local access, not tourism)	Moderate to high (due to enclosure of view from the road)	Low to moderate
10 – Olympic Dam Highway	70 m	Low (road is primarily local access, not tourism)	Moderate (due to partial screening from vegetation and undulations in topography)	Low
11 – Roxby Downs	4.5 km	Low (due to distance)	Very low (due to screening from vegetation and distance)	Very low

Source: Appendix E

The proposed transmission line route is generally located in a setting that has already been subject to modification by development of electricity transmission infrastructure. The co-location of additional infrastructure of a similar visual character will result in incremental change to the character of the landscape setting, rather than a significant change in character.

In these situations, the development may be noticeable, but does not markedly contrast with the existing landscape. This effect will decrease as the distance from the line to various viewing locations increases.

Consolidation of alike elements reduces effects on the landscape. Given the relatively slender form of the components of the Project, consolidation of alignments will result in a minimal cumulative impact on the landscape of the setting.

Much of the route is located away from areas of higher viewer sensitivity but where it is located adjacent to a higher sensitivity viewpoint, the presence of existing infrastructure and modification to the visual and landscape setting often reduces the overall level of effect.

Where the Project is located on the opposite, eastern side of the Olympic Highway from existing transmission line infrastructure to the west of the road, the modification level is greater than it would be if it were co-located.

Overall, the visual effect is reduced due to the distance of the Project from sensitive viewpoints. The impact on visual amenity has been assessed as low.

Table 12.5: Summary of Visual Amenity Impact Significance

Impact ID	Potential Impact Description	Impact Significance				Impact Uncertainty			Overall
		Resilience	Importance	Duration	Significance	Input	Methodology	Sensitivity	
L15	Reduced Visual Amenity impacting Local Communities	1	1	3	3	B	B	C	5 - Low

12.3 Unplanned Events

No unplanned events were identified in relation to visual amenity.

12.4 Summary of Control and Mitigation Strategies

The siting and design of infrastructure provides opportunity to minimise the potential impacts on visual amenity. This has been achieved by locating the new transmission line adjacent to the two existing transmission lines where possible. Efforts will be made to align transmission line structures with the existing structures where possible.

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13 CULTURAL HERITAGE

13.1 Existing Environment

13.1.1 Aboriginal Heritage

The land traversed by the transmission line is subject to two Native Title Determinations. The southern 32 km is within the determined Barngarla Native Title Claim (National Native Title Tribunal (NTTT) Number SCD2016/001) and the remaining area lies within the determined Kokatha People (Part A) Native Title Determination (NNTT Number SCD2014/004). The Barngarla Determination Aboriginal Corporation is the Registered Native Title Body Corporate who acts as an agent for the Barngarla People in relation to their native title rights and interests. The Kokatha Aboriginal Corporation is the Registered Native Title Body Corporate who acts as an agent for the Kokatha People in relation to their native title rights and interests.

OZ Minerals respects the cultural rights of the Barngarla and Kokatha People and will not disclose results of sensitive discussions. For this reason, the Aboriginal heritage summary presented herein is limited to a high-level overview.

Initial heritage clearances for the Project have commenced with the Kokatha People. Heritage clearances for all Project activities will be undertaken in accordance with agreed protocols between OZ Minerals and the Barngarla People, and OZ Minerals and the Kokatha People, with data collected by agreed upon anthropologists and compiled for ownership by all parties. This will be an ongoing process throughout the design phase. The presence of any artefacts within the Study Area will be handled by the respective heritage survey teams in accordance with agreed procedures for heritage management.

Table 13.1: Aboriginal Heritage Summary

Subject	Aboriginal Heritage Summary
Historical Background	The region has a long history of occupation by Aboriginal people and many Aboriginal people maintain a strong association with the land and water in the region. Since the start of European exploration in the 1840s, the histories of Aboriginal and non-Indigenous people have converged. Aboriginal histories became intimately linked with European exploration and the emergence of the pastoral industry. Explorers relied heavily on the navigational and diplomatic skills of Aboriginal guides, and many pastoralists encouraged Aboriginal people to live on their properties to provide labour. Numerous sites of Aboriginal cultural heritage significance are known to exist within the region. These sites tend to focus around surface water features such as creek lines.
Archaeological Landscape	Close to a thousand individual sites have now been identified during studies across the region. Site types found, include: • Surface scatters/campsites • Stone arrangements • Art sites • Burials • Historic sites • Quarries.

13.1.2 Non-Indigenous Heritage

Based on a review of the SA Heritage Places Database, National Heritage List and the Commonwealth Heritage List no sites of non-Indigenous historical significance have been identified within the Project Area.

Table 13.2: Non-Indigenous Heritage Summary

Subject	Summary
Historical Background	The region contains a rich and varied history of non-Indigenous land use. As discussed in Appendix G (Socio-Economic Assessments), most sites throughout the region relate to the development of the pastoral industry, as well as the historical themes of transport, mining, exploration and the Woomera Rocket Range. These places link communities with attitudes and values that have shaped the region.
Survey Results	A search of the SA Heritage Places Database was undertaken as part of the Socio-economic Assessment (Appendix G) to determine the presence of state and local heritage places under the *South Australian Heritage Act 1993* (SA), with data sources including the SA Heritage Register, and contributory items from SA Development Plans. The search identified 50 places within the region, however none within the Project Area. Examples of the non-Indigenous cultural heritage of the region are found at: • Andamooka which continues to reflect its opal mining history, complete with opal miners' cottages from the 1950s and '60s, and historical cemetery. • Port Augusta where the Pichi Richi Railway, built in the 1870s as narrow-gauge railway and the last remaining portion of the original 'Old Ghan' railway line, reflects the area's transport history. • Woomera Interactive Rocket Range Museum has historical displays that demonstrate the pivotal role Woomera plays in the past, present and future history of space exploration and rocket testing in Australia.

Subject	Summary
	• Whyalla where the maritime museum displays the HMAS Whyalla, built in the Whyalla shipyards in 1941, reflects the maritime history of the Upper Spencer Gulf. Based on a review of the National Heritage List and the Commonwealth Heritage List, no sites of non-Indigenous historical significance have been previously identified within the Project Area.

13.2 Impact Assessment

13.2.1 Description of Effects

This section describes the interaction of the Project (Chapter 5) with the baseline cultural heritage environment (Section 13.1). The activities that potentially alter the cultural heritage environment which may subsequently have an impact on receptors are presented in Table 13.3. These effects are discussed further below.

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised below in Section 13.4.

Table 13.3: Cultural Heritage Potential Effects

Source	Potential Effect	Receptors	ID
Land disturbance and rehabilitation	Land disturbance associated with the construction of the Project results in the removal, relocation or damage of artefacts that are of significance to the heritage and culture of the Aboriginal communities (Barngarla and Kokatha People)	Aboriginal Communities	L06
Land disturbance and rehabilitation	The Project results in the disturbance of sites that are of significance to the culture and storylines of Aboriginal communities (Barngarla and Kokatha People)	Aboriginal Communities	L23
Land disturbance and rehabilitation	Land disturbance associated with the construction of Project infrastructure disturbs sites of non-Indigenous heritage (local communities)	Local Communities: Third-party Users Future Users	L07

Aboriginal Heritage

Although the Project has a relatively small and discrete disturbance footprint, land clearing activities may result in the removal, relocation or damage of artefacts that are of significance to the heritage and culture of the Aboriginal communities (Barngarla and Kokatha People).

Land disturbance associated with the Project infrastructure also has the potential to result in disturbance of sites that are of significance to the culture and storylines of Aboriginal communities.

Areas identified for disturbance are surveyed in accordance with the Land Clearance Approval process as agreed between OZ Minerals the Barngarla Determination Aboriginal Corporation and the Kokatha Aboriginal Corporation. OZ Minerals will continue to work with the Barngarla and Kokatha People to ensure all site selections have been undertaken with their approval.

Non-Indigenous Heritage

No sites of non-Indigenous historical significance have been identified within the immediate Project Area or in the Study Area, therefore no link between the Project (source) and a pathway to non-Indigenous heritage has been made.

13.2.2 Effect S-P-R Linkage

The information provided in Table 13.4 identifies the potential impacts related to cultural heritage using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor.

OZ Minerals places great value on our relationship with the Barngarla and the Kokatha People. OZ Minerals and Kokatha Aboriginal Corporation seek to work in partnership to further develop the Partnering Agreement *Nganampa palyanku kanyintjaku* 'Keeping the future good for all of us'. This collaborative agreement encapsulates, recognises and values the ongoing contribution of all partners, and will inform the relationship between Kokatha and OZ Minerals throughout and beyond the development of the Project. For this reason, the Aboriginal Communities Impact Assessment Summary (Table 13.4) has been limited to an identification of linkages between source, pathway and receptor only. Management of impact significance is achieved respectfully between the Barngarla and Kokatha People and OZ Minerals.

A summary of the identified impacts on Aboriginal and non-Indigenous heritage is provided in Table 13.4.

Table 13.4: S-P-R Linkage Summary for Cultural Heritage Effects

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Land disturbance associated with the construction of the Project results in the removal, relocation or damage of artefacts that are of significance to the heritage and culture of the Aboriginal communities. (Barngarla and Kokatha People)	Yes	Construction activities may result in the clearing and disturbance of artefacts where identified by the Barngarla and Kokatha People. Areas identified for disturbance are surveyed in accordance with the Land Clearance Approval process as agreed between OZ Minerals, the Barngarla Determination Aboriginal Corporation and the Kokatha Aboriginal Corporation. OZ Minerals respects the cultural rights of the Barngarla and Kokatha People and will not disclose results of sensitive discussions.	L06
The Project results in the disturbance of sites that are of significance to the culture and storylines of Aboriginal communities. (Barngarla and Kokatha People)	Yes	Construction activities may result in the clearing and disturbance of artefacts where identified by the Barngarla and Kokatha People. Areas identified for disturbance are surveyed in accordance with the Land Clearance Approval process as agreed between OZ Minerals, the Barngarla Determination Aboriginal Corporation and the Kokatha Aboriginal Corporation. OZ Minerals respects the cultural rights of the Barngarla and Kokatha People and will not disclose results of sensitive discussions.	L23
Land disturbance associated with the construction of Project infrastructure disturbs sites of non-Indigenous heritage (local communities)	No	Based on a review of the State Heritage Register, the National Heritage List, Commonwealth Heritage List and the Register of the National Estate, no sites of non-Indigenous historical significance have been identified within the Project Area. There are no sites of non-Indigenous heritage significance that will be disturbed by this activity.	L07

13.3 Unplanned Events

Unplanned events in relation to Aboriginal heritage include unapproved land clearance resulting in removal, relocation or damage of artefacts, and the Project disturbing sites that are of significance to the culture and storylines of Aboriginal communities. Risk assessments are contained in Appendix I and summarised below.

Table 13.5: Aboriginal Heritage Risk Events

Risk Description	Consequence	Likelihood	Risk	Impact ID
Land clearance undertaken without prior approval from the Barngarla and Kokatha People results in the removal, relocation or damage of artefacts	3 -Moderate	D - Unlikely	9 - Moderate	L06
The Project results in the disturbance of sites that are of significance to the culture and storylines of Aboriginal communities. (Barngarla and Kokatha People)	3 - Moderate	D - Unlikely	9 - Moderate	L23

13.4 Summary of Control and Mitigation Strategies

Management of impacts on Aboriginal and Non-Indigenous heritage remains an operational commitment for OZ Minerals. OZ Minerals is committed to a high standard of community engagement and social performance by its employees and contractors. OZ Minerals has a series of social performance standards that will ensure the Project continues to understand community and stakeholder views and management of cultural heritage.

Cultural Heritage Management Plan

OZ Minerals will develop a Cultural Heritage Management Plan as part of its overall Environment and Community Management Plan. This will ensure the ongoing protection of cultural heritage through the development of a cultural heritage management system including measures to be undertaken in the event aboriginal heritage sites are discovered including training, communication and cultural respect.

All activities will be carried out in accordance with the requirements of the *Aboriginal Heritage Act 1988* (SA).

All design and management controls are addressed in Table 13.6 and Table 13.7 to limit or prevent an effect occurring to pathways.

Table 13.6: Summary of Design Controls

Design Controls	Impact ID
Avoidance of sites of cultural heritage significance as determined in consultation with the Barngarla and Kokatha People.	L06, L23

Table 13.7: Summary of Management Controls

Management Controls	Impact ID
Cultural Heritage Assessment with the Barngarla and Kokatha People.	L06, L23
Area-specific and site inductions and training.	L06, L23
GIS system to record/identify clearance areas and status.	L06, L23
Cultural Heritage Management Plan, including new discovery reporting procedures.	L06, L23
Identification and fencing (where appropriate) of sites of cultural heritage significance.	L06, L23
Land disturbance reconciliation during and after construction.	L06, L23

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14 TRAFFIC

The information provided in this chapter is based on a Traffic baseline and assessment of effects desktop study undertaken by GHD (see Appendix F).

14.1 Existing Environment

The National Land Transport Network (road and rail) provides transport links across the nation and connects South Australia with interstate markets and major export ports. The rail network links Adelaide to Darwin and Sydney to Perth, converging at Port Augusta.

The Stuart Highway and Olympic Dam Highway, running between Port Augusta to Alice Springs and Pimba to Roxby Downs respectively, are the major primary roads in the region. The Olympic Dam Highway services the Pimba to Roxby Down/Olympic Dam road freight route.

A number of smaller, sealed and unsealed roads occur throughout the Study Area. An extensive network of unsealed roads and tracks located on private land are maintained by pastoral stations (approximately 10,000 km of roads in the Far North are in unincorporated areas and are unsealed) (DPLG 2010).

The road network is also used by residents, tourists, goods and service providers and other industries.

The proposed transmission line alignment runs to the east of the Stuart Highway and the Olympic Dam Highway. It crosses the Olympic Dam Highway 6 km south of Roxby Downs and also crosses the unsealed Kootaberra Road, Pernatty Road, Bosworth Road, Andamooka Station Road and numerous unsealed pastoral access roads and tracks. Stuart Highway, Olympic Dam Highway, Kootaberra Road, Pernatty Road, Bosworth Road and Andamooka Station Road are all under the control of the Department of Planning, Transport and Infrastructure (DPTI).

Roads of specific interest in the region of the Project Area and traffic volumes on these roads are identified in Table 14.1. Traffic volumes on the roads surrounding the Project Area are relatively low with a high percentage of heavy vehicles. Figure 14.1 and Figure 14.2 show roads of interest.

Table 14.1: Roads of Interest and Traffic Volumes

Location	Annual Average Daily Traffic	Heavy Vehicles (%)	Year of Count
Roads in the Study Area			
Olympic Way Between Olympic Dam Highway and Roxby Downs	430	11.5%	2011
Olympic Dam Highway Between Woomera and Olympic Way	430	24.5%	2014
Olympic Dam Highway Between Pimba and Woomera	700	18.5%	2004
Stuart Highway Between Port Augusta and Pimba	850	28%	2016
Roads used to access the Study Area			
Eyre Highway Between Victoria Parade and Stuart Highway	17,500	7%	2018
Victoria Parade Entire Length	11,800 – 14,600	8.5% – 10%	2018
Augusta Highway Entire Length	3,500 – 11,800	10% – 23%	2015 – 2018
Port Wakefield Highway Entire Length	9,600 – 16,100	15.5% – 18.5%	2014 – 2017
Port Wakefield Road Between Port Wakefield Highway and Salisbury Highway	55,500 – 66,100	13% – 13.5%	2014 – 2017
Salisbury Highway Between Port Wakefield Road and Port River Expressway	67,300	11.5%	2015
Port River Expressway Entire Length	22,500 – 42,200	13.5% – 14%	2015

The DPTI online Restricted Access Vehicles (RAVNet) system identifies a number of roads in the Far North that are gazetted for a range of restricted access vehicles including:

- 53.5 m triple road trains
- 42 m and 36.5 m double road trains
- B-doubles
- Higher Mass Limit vehicles.

Currently the transport route surrounding the Project Area north of Port Augusta is approved for vehicles up to Performance Based Standard (PBS) Level 4A (i.e. 53.5 m triple road trains), which continues past Olympic Dam. South of Port Augusta, the route to the Project Area is approved for Level 3B vehicles (42 m double road trains) north of Two Wells, and Level 3A vehicles (36.5 m double road trains) between Two Wells and Port Adelaide.

Access to the Project Area is along the Stuart Highway through rural towns Pimba, Woomera and Roxby Downs. Most of the road alignment within the region consists of straight roads with a few curved sections. The posted speed limit is 110 km/h which is reduced to 80 km/h and then 60 km/h on the

approach to towns. This area has a high percentage of heavy vehicles utilising the route and a number of overtaking lanes are present throughout.

14.2 Impact Assessment

14.2.1 Description of Effects

This section describes the interaction of the Project (Chapter 5) with the baseline traffic environment (Section 14.1). The activities that potentially alter the traffic environment which may subsequently have an impact on receptors are presented in Table 14.2. These effects are discussed further below. The discussion of effects is based on information contained in the traffic assessment of effects report (Appendix F2) and the socio-economic assessment of effects report (Appendix G2).

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised below in Section 14.4.

Table 14.2: Traffic Potential Effects

Source	Potential Effect	Receptors	ID
Transport	Increased traffic volumes on public roads associated with the movement of construction and operational fleet and materials to and from the Project Area influences travel times for road users.	Local Community	SE01
Transport	Increased traffic on the roads from the Project during construction and operations contributes to the general deterioration of condition of the public roads over time.	Local Community	SE02
Transport	Increased traffic volumes on public roads affects public safety.	Local community	SE03
Transport - Construction traffic	Infrastructure construction works near or on public roads and pastoral tracks influences travel time for road users.	Local Community Third-party Users	SE05
Transport*	Damage to access roads from construction and maintenance activities prevents access by pastoralists.	Third-party Users – Pastoral lease	SE21

*This effect is discussed under Land Use (Section15.2.3).

Traffic Volumes

The construction phase of the Project will result in a temporary increase in traffic volumes on roads near the Project and on transport routes to the area. As summarised in Section 5.5.12, project-related traffic will include a range of vehicles including semi-trailers, concrete trucks, four-wheel drive vehicles and light trucks. Construction equipment (e.g. cranes, dozers, graders and excavators) will also travel (or be transported) on public roads, although they will remain on the transmission line alignment for most of the construction period. Most of the materials for the Project are expected to be transported in semi-trailers, with no or very few oversize loads likely to be required.

The preliminary estimates of construction-related traffic outlined in Section 5.5.12 have been used to investigate increases in traffic volume (see Appendix F2 and Appendix G2), as summarised below.

During the construction phase, the Project is estimated to result in the following increases in traffic volume along the expected vehicle route:

- Port River Expressway, Salisbury Highway, Port Wakefield Road and Port Wakefield Highway: less than 0.1%
- Eyre Highway: 0.1%
- Port Augusta Highway - Port Wakefield to Port Pirie: less than 0.1%
- Port Augusta Highway - Port Pirie to Port Augusta: 0.2%
- Stuart Highway - Port Augusta to Mount Gunson: 12.5%
- Stuart Highway - Mount Gunson to Pimba: 2.8%
- Olympic Dam Highway - Pimba to Woomera: 13.2%
- Olympic Dam Highway - Woomera to Olympic Way: 21.4%
- Olympic Way: 24.2%.

The roads within the Regional Study Area are operating with an Annual Average Daily Traffic (AADT) of approximately 2,410 vehicles per day (vpd). These sealed roads which form part of the National Highway, are currently classified as high capacity roads, meaning the ability of the road to accommodate traffic volumes, the maximum hourly rate at which vehicles can reasonably be expected to cross a point on a roadway during a given time period under prevailing traffic roadway and control condition.

Therefore, the Stuart Highway is capable of carrying up to an estimated 15,000 vpd, in which any estimated additional traffic generated during the construction phase (which is likely to be in the order of 100 to 300 vpd) will have a minimal impact on the existing road network and function.

During the operation phase, Project-related traffic is very low. The Project is predicted to present the following increase in traffic volume along the expected route vehicle route:

- Stuart Highway - Port Augusta to Mount Gunson: 0.5%
- Stuart Highway - Mount Gunson to Pimba: 0.1%
- Olympic Dam Highway - Pimba to Woomera: 0.5%
- Olympic Dam Highway - Woomera to Olympic Way: 0.8%
- Olympic Way: 0.9%.

The increase in traffic volume is expected to have no material effect on travel times during inspection and maintenance operations for the Project.

Travel Delays and Disruptions

The transmission line may include an access track along most of its length, with existing access points off the highway used to access the transmission line along existing access track and pastoral tracks. Use of individual access and pastoral tracks is not likely to be prolonged or involve consistently high volumes of heavy vehicles. Requirements for turning treatments on main road/access track routes would be addressed during detailed design, however it is not expected that turning treatments would be required at existing access points. A rural left turn treatment such as Basic Left Turn treatments (BAL), and Basic Right Turn treatments (BAR) may be required at potential laydown area access/egress points due to the number of movements that could be expected. These requirements will be determined in detailed design in consultation with DPTI. Some short term and intermittent delays to traffic may result due to implementation of traffic management at access points if required.

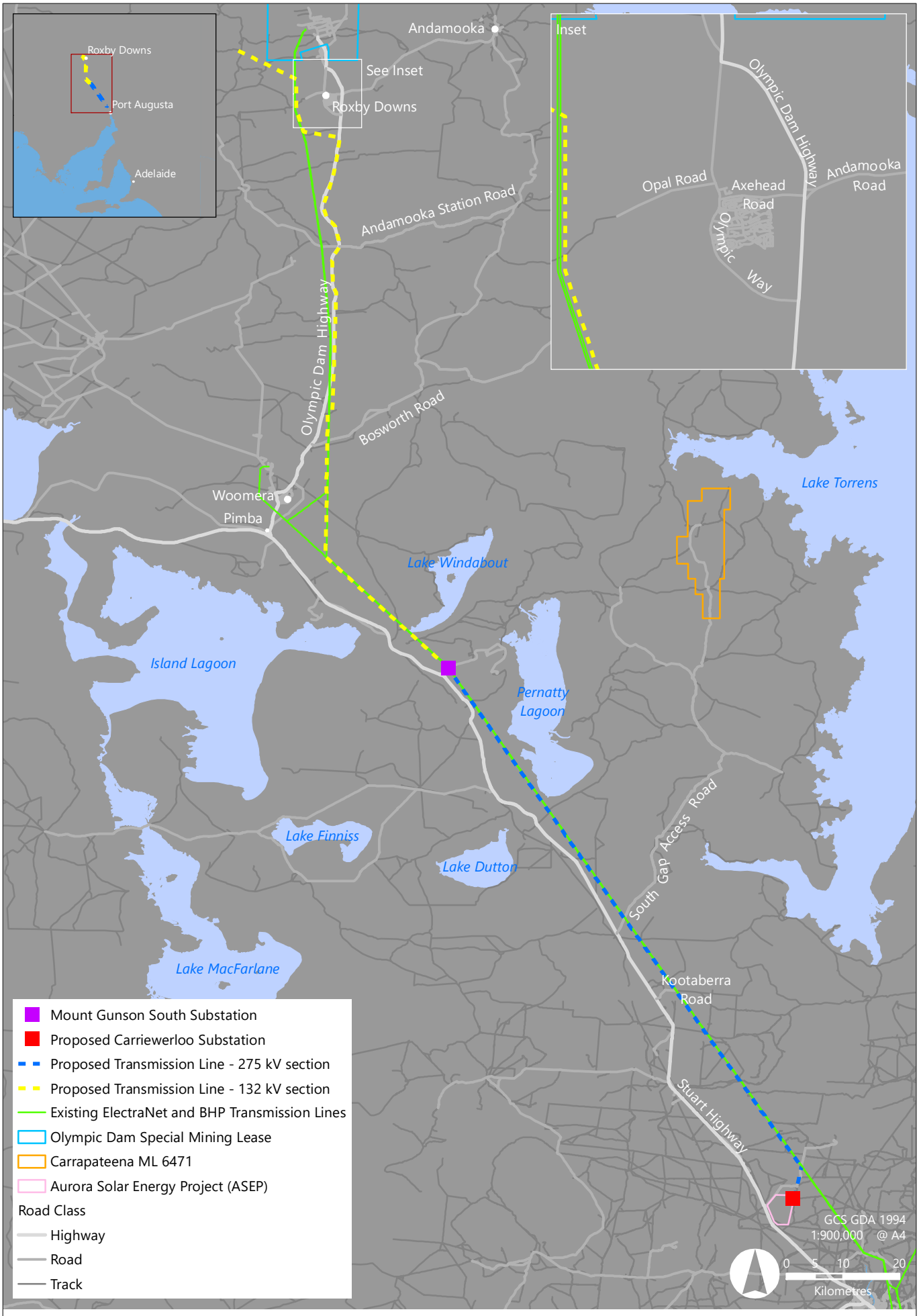

Figure 14.1: Regional Roads

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

Figure 14.2: Major Roads from Port Adelaide to the Project Area

No significant delays due to road closures are expected to result from the Project construction, with the only delays likely to a result of temporary speed limit reductions to 80 km/h (from 110 km/h) at turn out and turn in points along the route. Any delays during key construction activities (e.g. stringing of conductors across roads) would be temporary and of short duration. The increase in traffic volume is expected to have a negligible effect on travel times.

Access during the construction phase will use existing tracks wherever possible, and therefore may result in disruptions to pastoralist activities. Similar to effects to main roads, the expected delay for these travellers would be negligible (estimated to be less than five minutes) per 1 km construction zone.

Road Wear

Road wear due to traffic flows was assessed solely based on heavy vehicle traffic movements. Potential increases in road wear are summarised under the discussion of impacts in Section 14.2.3.

14.2.2 Effect S-P-R Linkage

The information provided in Table 14.3 identifies the potential impacts related to traffic using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor.

Table 14.3: S-P-R Linkage Summary for Traffic Effects

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Increased traffic volumes on public roads associated with the movement of construction and operational fleet and materials to and from the Project Area influences travel times for road users.	Yes	There will be an increase in traffic volumes.	SE01
Increased traffic on the roads from the Project during construction and operations contributes to the general deterioration of condition of the public roads over time.	Yes	Increased heavy vehicle traffic will contribute to general deterioration of road conditions.	SE02
Increased traffic volumes on public roads affects public safety.	No	Road accidents are not a planned event. Any road accidents will be a result of an unplanned risk event (see Section 14.3).	SE03
Infrastructure construction works near or on public roads and pastoral tracks influences travel time for road users.	No	Construction works are not expected to have a material effect on travel times.	SE05

14.2.3 Impact Significance Assessment

This section discusses the significance of potential impacts where a linkage has been identified between the traffic effects of the Project and receptors. An impact assessment using the OZ Minerals Impact Assessment Framework has been carried out for each of these potential impacts. These impact assessments are presented in Appendix I. Supporting discussion is provided below followed by a table summarising the outputs of the Impact Assessment Framework.

In accordance with the Impact Assessment Framework, only those potential impacts that have been identified as having an S-P-R linkage (or are found to be "material") have had an impact significance assessment carried out. Potential impacts where there is no identified S-P-R linkage are discussed above in Table 14.3.

Increased Traffic

Stuart Highway is capable of carrying up to an estimated 15,000 vpd, in which any estimated additional traffic generated during the construction phase will have a minimal impact on the existing road network and function. It is expected that there would be minimal operational requirements for the transmission line and minimal traffic would be generated from this. The increase in Project traffic volumes in both the construction and operation phases is expected to have no material effect on travel times for road users on roads used by Project traffic. The impact has been assessed as low (see Table 14.4).

Road Wear

The construction phase analysis was based on an estimated average of 13 heavy vehicle movements per day distributed along relevant sections of the Project Area and current vehicle volumes (annual average daily traffic) for Port Wakefield Road, Port Augusta Highway, Stuart Highway, Olympic Dam Highway and Olympic Way (DPTI 2015). As no heavy vehicle movements are required to inspect the transmission line, the operational phase is expected to result in no road wear

During the construction phase, the Project represents the following increase in road wear (contributed by heavy vehicle traffic volumes) along the expected vehicle route:

- Port River Expressway, Salisbury Highway, Port Wakefield Road and Port Wakefield Highway: less than or equal to 0.1%
- Port Augusta Highway - Port Wakefield to Port Pirie: 0.1 to 0.2%
- Port Augusta Highway - Port Pirie to Port Augusta: 0.1 to 0.2%
- Stuart Highway - Port Augusta to Mount Gunson: 1.1 to 3.3%
- Stuart Highway - Mount Gunson to Pimba: 0.3 to 1.0%
- Olympic Dam Highway - Pimba to Woomera: 1.4 to 4.5%
- Olympic Dam Highway - Woomera to Project Area to Olympic Way: 1.8 to 5.6%
- Olympic Way: 3.7 to 11.6%.

The impact has been assessed as low (see Table 14.4).

Table 14.4: Summary of Traffic Impact Significance

Impact ID	Potential Impact Description	Impact Significance				Impact Uncertainty			Overall
		Resilience	Importance	Duration	Significance	Input	Methodology	Sensitivity	
SE01	Increased traffic on public roads associated with the movement of construction and operational fleet and materials to and from the Project Area influences travel times for road users.	1	2	1	2	A	A	B	3 Very Low
SE02	Increased traffic on the roads from the Project during construction and operations contributes to the general deterioration of condition of the public roads over time.	1	2	1	2	A	A	B	3 Very Low

14.3 Unplanned Events

Unplanned risk events during the construction phase include:

- Increased traffic on public roads affects public safety.

An unplanned event of road accidents affecting public safety is considered material based on the level of risk. A Road Safety Audit (RSA) is typically undertaken for projects similar to this where the existing conditions of the road will possibly be altered. This is planned to be undertaken for construction activities.

Table 14.5: Traffic Risk Events

Risk Description	Consequence	Likelihood	Risk	Impact ID
Increased traffic volumes on public roads results in serious injury or death.	4 - Major	E - Rare	10 - Moderate	SE03

14.4 Summary of Control and Mitigation Strategies

Table 14.6: Summary of Design Controls

Design Controls	Impact ID
Design and construction of transmission line at crossings of DPTI roads in accordance with DPTI requirements.	SE03
Intersections with the Stuart Highway constructed to appropriate standards established in consultation with DPTI.	SE01, SE03
BAR and BAL treatments (if required) will be designed as per *Austroads Guide to Road Design Part 4: Intersections and Crossings – General, and Part 4A: Unsignalised and Signalised Intersections.*	SE01, SE03

Table 14.7: Summary of Management Controls

Management Controls	Impact ID
Development of a Traffic Management Plan prior to construction. including designated speed limits, appropriate constraints on travel at dawn and dusk, vehicles restricted to tracks, and effective signage where potential ecological constraints exist to raise awareness and further control speeds in these areas.	SE01, SE02, SE03
Area-specific and site inductions and training.	SE01, SE02, SE03
Consultation undertaken prior to construction with the appropriate roads authority regarding works which may affect roads or traffic.	SE01, SE02, SE03
Consultation undertaken with BHP and Roxby Downs Municipality during development of the Traffic Management Plan regarding traffic around Roxby Downs and Olympic Dam.	SE01, SE02, SE03
Procedures for oversize loads.	SE01, SE02, SE03

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15 LAND USE

15.1 Existing Environment

The information provided in this chapter is based on socio-economic baseline and assessment of effects reports undertaken by Econsearch (see Appendix G).

15.1.1 Regional Context

Land uses in the Far North of South Australia include pastoral operations, tourism and conservation, defence (Woomera) and Aboriginal lands. The Far North also hosts more than 70% of South Australia's mining and mineral processing.

The Project Area is contained within the South Australian Arid Lands Natural Resource Management (NRM) Region. This NRM region contains over nine million hectares of formal conservation areas consisting of six national parks, five conservation parks, four regional reserves and one conservation reserve. Lake Torrens National Park is the closest park to the transmission line but it, and the other parks in the region, falls outside of the Project Area (DEWNR 2017b).

15.1.2 Pastoralism

The proposed route alignment intersects a range of land tenures including pastoral leases, freehold land, unalienated Crown land and Crown leases (detailed in Table 2.2). The area is sparsely populated and is predominantly used for grazing.

The Project Area intersects nine pastoral stations:

- Mount Arden
- Carriewerloo
- Kootaberra
- Oakden Hills
- Pernatty
- Arcoona
- Purple Downs
- Roxby Downs
- Andamooka.

The properties operate on pastoral leases managed by the Department for Environment and Water (DEW) under the advice of the Pastoral Board. Under the *Pastoral Land Management and Conservation Act 1989* (SA), pastoral leases provide pastoralists with access to Crown land for the purposes of raising livestock and developing related infrastructure. They are required to manage pastoral land sustainably with the aim of preventing further degradation and, where possible, to improve the condition of the land.

The pastoral properties generally generate their own electricity, source water from local dams and bores and maintain an extensive network of private roads.

Aerial mustering activities are undertaken at large pastoral stations where herding of livestock is required over large areas.

15.1.3 Defence Activities

The Woomera Prohibited Area (WPA) is under the control of the Royal Australian Air Force and regulated by the *Defence Act 1903* (Cth), *Defence Regulation 2016* (Cth) and the *WPA Rule 2014*. The WPA is an extensive area (shown in Figure 15.2) used by Defence for the testing of war materiel. The WPA comprises extensive lands north of the Indian Pacific railway, from north of Watson in the south-west up to its north-west corner in the Great Victoria Desert (that stretches across the South Australia-Western Australia border), across to Coober Pedy, and west of Roxby Downs down to Woomera in the south-east (Department of Defence, 2018).

The Project is situated to the east of WPA boundary, and does not intersect the WPA; however, OZ Minerals will continue to consult with the Department of Defence as required during construction and maintenance activities due to the proximity of the Project Area to the WPA.

15.1.4 Mining and Energy

Mineral resources contribute approximately $4.0 billion (11.3%) of South Australia's total exports. Mining in the Far North generates around 40% of the region's economic output and 60% of South Australia's total mining output (EconSearch 2017). Approximately 400,000 km^2 of the Far North is held under exploration licence (RESA 2013), and the area hosts more than 40% of South Australia's current mineral projects.

The region has a long and diverse history of mining operations, such as OZ Minerals' existing Prominent Hill copper-gold operation and Carrapateena copper-gold project, the Tarcoola goldfield, copper mining throughout the Flinders Ranges, opal mining at Coober Pedy and Andamooka, the BHP Olympic Dam copper-gold-uranium mine, and the recently ceased coal mining at Leigh Creek.

The Project traverses 15 mineral exploration licences held by eight different companies (one of which is an OZ Minerals entity) and several petroleum exploration licence applications. OZ Minerals will contact each of the holders/applicants prior to construction to ensure that the alignment will not inadvertently sterilise a mineral or petroleum resource.

Energy Infrastructure

Electricity is supplied to Port Augusta, Roxby Downs and Woomera from the National Electricity Market (NEM) via the interconnected electricity system, administered by the Australian Energy Market Operator (AEMO).

South Australia's domestic electricity supply comes from a range of renewable and non-renewable sources, the three main electricity generators being gas-fired generation, wind energy and rooftop photovoltaics systems. The Far North Region, Port Augusta, Woomera, Roxby Downs and some towns

along the transmission line to Leigh Creek are connected to the national electricity grid. Most outback communities however, rely on diesel generators to provide electricity, particularly the small remote towns across the region.

The OZ Minerals Prominent Hill mine currently shares BHP's 275 kV transmission line from Davenport to Olympic Dam. OZ Minerals owns the 132 kV transmission line from Olympic Dam to Prominent Hill.

As discussed, other notable transmission infrastructure in the region includes the ElectraNet-owned and operated 132 kV transmission line from Davenport to Pimba and Woomera, and the BHP 132 kV transmission line from Pimba to Olympic Dam.

More recently, the region has experienced an emphasis on renewable energy, with a number of solar and wind energy projects in various stages of development.

15.1.5 Airstrips

Around 75 airstrips are located in towns and remote areas of South Australia and are used for medical services, Royal Flying Doctor Service (RFDS), policing, education, mine access, charter traffic and basic community access. As mentioned in Section 15.1.5, there are three commercial airports operating in the Far North (Port Augusta, Olympic Dam and Coober Pedy), and a number of privately operated airstrips associated with pastoral stations (generally consisting of graded earth and with no other services or infrastructure). The airports and their proximity to the proposed transmission line are shown in Table 15.1.

The closest airstrips to the proposed transmission line include Olympic Dam airport (6.1 km to the north of the line) and Mount Gunson private airstrip (6.8 km to the east of the line).

Table 15.1: Airport Near the Project

Air Strip	Air Strip Ownership	Distance to Proposed Transmission Line
Airports with Scheduled Air Services		
Port Augusta – Sharp Airlines and Regional Express	Council	23.3 km
Olympic Dam – Alliance Airlines	BHP	6.1 km
Coober Pedy – Regional Express	Council	253.5 km
Defence Airports		
Woomera	Australian Government	8.5 km
Private Airstrips within 50 km		
Mount Gunson		6.8 km
Roxby Downs Station		13.3 km
Andamooka		29.7 km
Parakylia		35.8 km
Yalymboo		39.8 km

According to RDAFN (2013), aviation firms and pilots have been attracted to the Far North region in recent years, with an increase in air traffic due to:

- Flooding of Lake Eyre, the world's biggest salt lake, which can bring more than 50 aircraft per week into remote areas such as William Creek and challenges for commercial operators
- Mining's fly-in-fly-out operations across the region which has increased pressure on regional airports. One of the main issues is the upgrading of security, for which options are currently being investigated.

15.1.6 Conservation Areas

There are no protected areas near the corridor. The nearest protected areas are Lake Torrens National Park and Lake Gairdner National Park, the closest points of which are located approximately 15 km east and 72 km west of the proposed route alignment respectively.

There is a private Heritage Agreement (HA 1572) 30 km south west of Pimba.

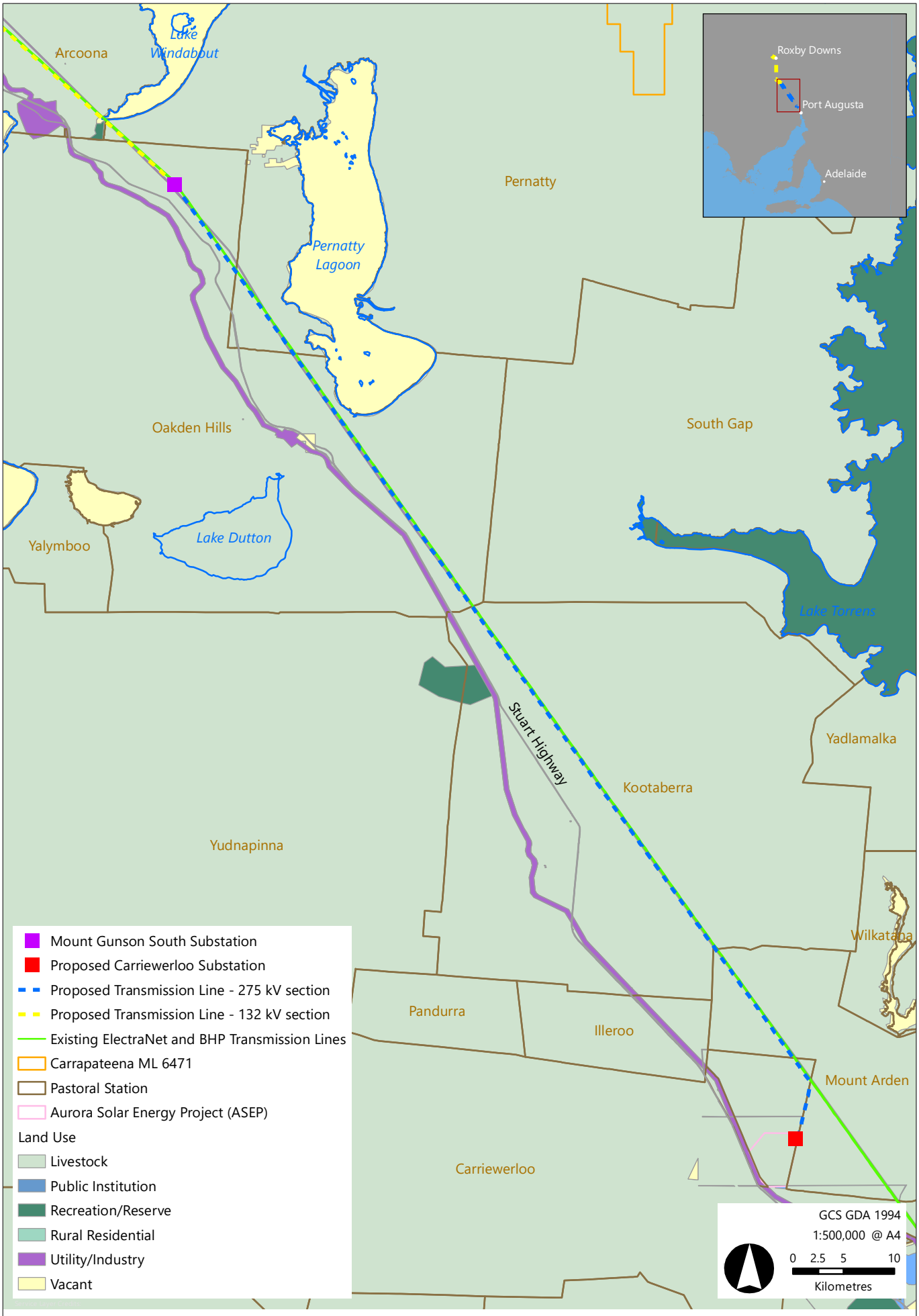

Figure 15.1: Existing Land Use of the Proposed Transmission Line 275 kV section

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

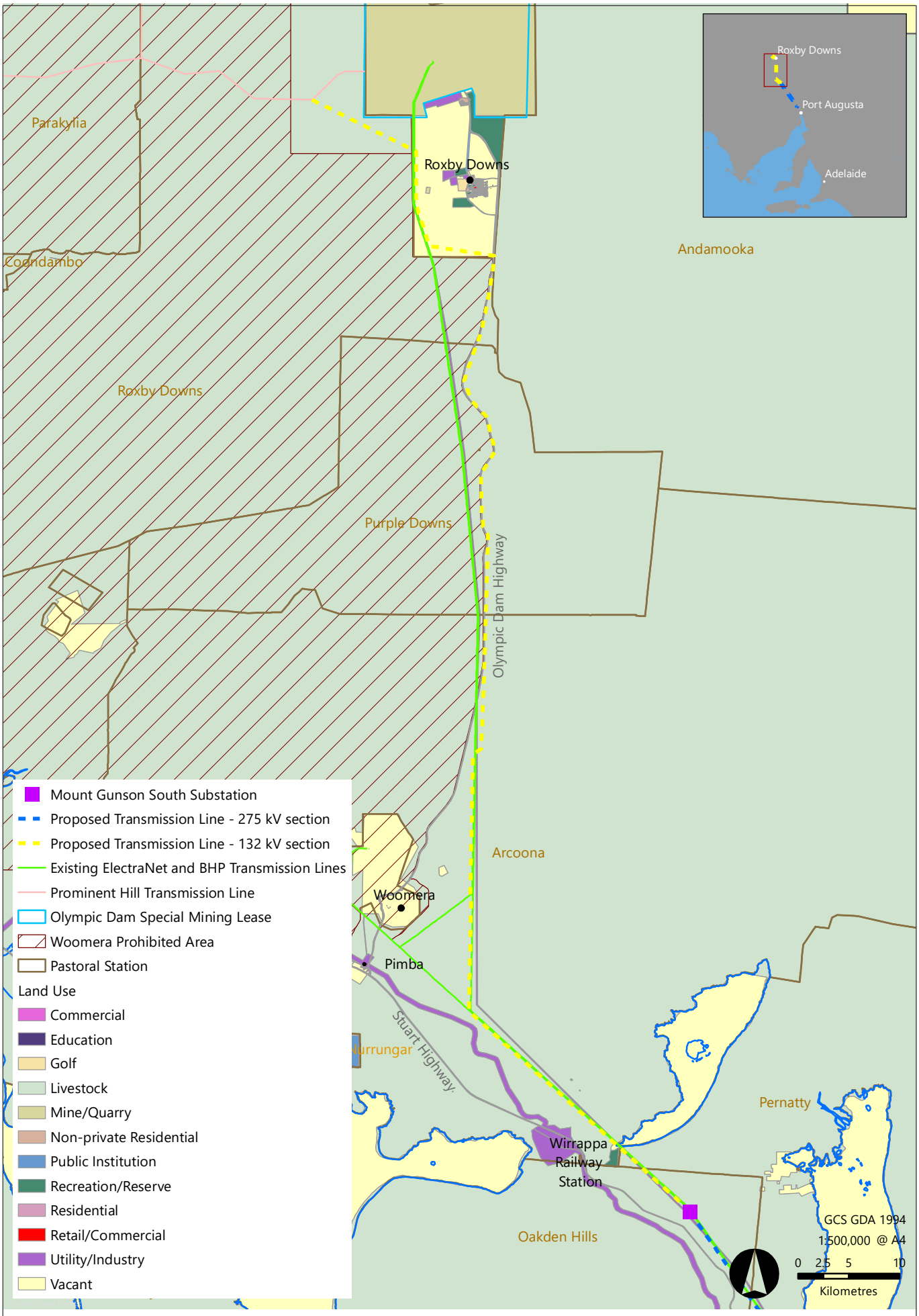

Figure 15.2: Existing Land Use of the Proposed Transmission Line 132 kV section

15.2 Impact Assessment

15.2.1 Description of Effects

This section describes the interaction of the Project (Chapter 5) with the baseline Land Use environment (Section 15.1). The activities that potentially alter the land use environment that may subsequently have an impact on receptors are presented in Table 15.2. These effects are discussed further below.

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised below in Section 15.4.

Table 15.2: Land Use Potential Effects

Source	Potential Effect	Receptors	ID
Construction activities	Damage to other infrastructure (e.g. pipelines and transmission lines)	Local community and Third-party users	SE06
Project infrastructure and land clearance	Value of pastoral stations – permanent loss of land	Third-party Users – Pastoral lease	SE13
Project infrastructure and land clearance	Value of pastoral stations – land fragmentation	Third-party Users – Pastoral lease	SE14
Project infrastructure and land clearance	Value of pastoral stations – future development	Third-party Users – Pastoral lease	SE15
Project infrastructure and land clearance	Effects on pastoralists' activities – access roads	Third-party Users – Pastoral lease	SE16
Project infrastructure	Effects on pastoralists' activities – restricted height operations	Third-party Users – Pastoral lease	SE17
Project infrastructure	Effects on pastoralists' activities – restricted height operations	Third-party Users – Pastoral lease	SE18
Project infrastructure	Transmission line affects air access, e.g. flying doctor, local airstrips	Third-party users	SE19
Project infrastructure	Access to the transmission line area by the general public results in serious injury or death	Local communities	SE20
Project infrastructure and land clearance	Effects on pastoralists' activities – damage to access roads	Third-party Users – Pastoral lease	SE21
Illumination	Illumination at night from camp and construction areas	Local community (amenity)	AQ07
Accidental spills	The transport, storage and handling of hydrocarbons and chemicals may result in an accidental spill, which if uncontained, contaminates land leading to a decrease in soil quality impacting on the income and business viability of pastoral stations	Third-party users	D104

Third-party Users

The Project will intersect or is immediately adjacent to the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs and Andamooka.

Reduced Pastoral Land

The permanent clearance of areas along the transmission line for infrastructure and access will reduce areas available for pastoral production. Pastoral leases intersected by the proposed alignment are estimated to lose less than 0.1% of their pastoral lease area.

The Project may also bisect paddocks or other structures relevant to pastoral lease activities, which may restrict access and constrain pastoralists' activities.

Changes in existing levels of fragmentation are unlikely for the pastoral stations intersected by the Project due to the existence of existing transmission line infrastructure. The presence of the transmission line would not prohibit pastoral access such as grazing or access.

The potential development restriction footprint for each pastoral lease ranges from 0.1 km^2 to 2.0 km^2 (0.01% to 0.19%). On this basis, pastoral leases transected by the proposed transmission line are unlikely to have future developments constrained by the Project.

Effects on Pastoralist and Third-party User Activities

Access during the construction phase will use existing tracks wherever possible, and therefore may result in disruptions to pastoralist activities. The expected delay for pastoralists would be negligible (estimated to be less than five minutes) per 1 km of construction zone, however delays may be longer depending on requirements for traffic stoppages during construction works.

The Project may affect the condition of unsealed pastoral access tracks through road wear from additional traffic and through unplanned events leading to damage to the roads.

Road wear may be brought about by increased Project traffic during the construction period. The level of wear will be an interaction between Project-influenced factors and the characteristics of the track (i.e. quality of materials, construction and maintenance, weather conditions and terrain).

Damage to pastoral access tracks could also occur from unplanned events resulting from the Project activities, for example road accidents and bogging of Project vehicles.

These effects, if they occur, are likely to result in nuisance to pastoralists (e.g. discomfort from using tracks in poor condition, time delays or the need to use alternative routes if access tracks become unusable/impassable).

The height of the transmission line has the potential to disrupt some pastoral operations (e.g., vehicle access below the line, aerial mustering) and/or the flight path of small, low flying aircraft (e.g., flying doctor, local airstrips, aerial spraying/baiting).

Where the transmission line route does not run adjacent to existing transmission lines (i.e. when it traverses Purple Downs and Roxby Downs), there is potential for pastoral operations to be affected if

oversize vehicles (greater than 4.3 m in height) are required to move across these properties and there is potential for aerial mustering operations to be affected when they occur near the Project transmission line route.

For the remaining pastoral stations along the transmission line route (i.e. Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty and Arcoona), the transmission line runs adjacent to existing transmission lines and the Project is unlikely to change existing limitations on pastoral operations in this regard.

Illumination

The Project will introduce temporary artificial sources of light to the environment via the construction camps. Nightworks at construction sites are not expected to occur.

Distances to sensitive receptors will be considered during the design of lighting and camp facilities. Several construction camps are expected to be on location for 12 to 18 months during the construction period.

There are six potential dwellings within 5 km of the proposed transmission line, however at the time of submission, only one of these is known to be occupied (Kootaberra Homestead 1.8 km west of the transmission line). Construction camps are expected to be set up in remote locations as far from sensitive receptors as reasonably practicable.

It is expected that other than near the Olympic Dam airport where aviation warning lights may be required, the Project infrastructure will not be illuminated. As a result, there will be no night time lighting effects from the operation of the Project.

The potential disturbance effect to the local community is temporary, minor and localised.

Accidental Spills

The transport, storage and handling of hydrocarbons and chemicals may result in an accidental spill, which if uncontained, could contaminate land, leading to a decrease in soil quality impacting on the income and business viability of pastoral stations. This has been assessed as an unplanned event in Section 15.3.

15.2.2 Effect S-P-R Linkage

The information provided in Table 15.3 identifies the potential impacts related to Land Use using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor.

Table 15.3: S-P-R Linkage Summary for Land Use Effects

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Construction activities result in damage to other infrastructure	No	Damage to infrastructure is not a planned event. Any damage will be a result of an unplanned	SE06

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
(e.g, pipelines and transmission lines).		risk event which has been assessed in Section 15.3 and in Appendix I.	
Permanent loss of land as a result of Project activities may be perceived to, or may actually constrain pastoralists' activities in conducting their agricultural businesses.	Yes	The permanent clearance of areas along the Project transmission line for the transmission line structures and associated access will reduce areas available for pastoral production.	SE13
Project activities may be perceived to, or may actually constrain pastoralists' activities (as a result of land fragmentation) in conducting their agricultural businesses.	No	The transmission line will run adjacent to the existing transmission line through seven of the Pastoral stations and adjacent to the existing highway through two Pastoral stations, therefore not increasing land fragmentation and not adding addition constraint to pastoralists activities.	SE14
Project activities may be perceived to, or may actually constrain pastoralists' activities in conducting their businesses with respect to future developments.	Yes	The Project may lead to restriction of some pastoral activities for pastoral leases within the Project Area, this may, in turn, lead to an actual or perceived constraint on future developments by pastoral enterprises.	SE15
Access to transmission line disrupts pastoral operations, e.g. use of pastoralist roads.	Yes	Access during construction phase will use existing tracks wherever possible, and therefore may result in short term and local disruptions to pastoralist activities.	SE16
Transmission line clearance requirements disrupts pastoral operations by limiting vehicle access below the transmission line.	Yes	The transmission line route does not run adjacent to existing transmission lines when it traverses Purple Downs and Roxby Downs. On these properties there is potential for pastoral operations to be locally affected when oversize vehicles (greater than 4.3 m in height) are required to move across these properties.	SE17
Presence of transmission line disrupts pastoral operations by affecting aerial mustering near the transmission line.	Yes	The transmission line route does not run adjacent to existing transmission lines when it traverses Purple Downs and Roxby Downs. On these properties there is potential for aerial mustering operations to be affected when they occur near the transmission line route.	SE18
Height of the transmission line affects air access, e.g. flying doctor, local airstrips.	No	Existing transmission line infrastructure in the area has pre-established the requirements for awareness of transmission line infrastructure for flight path planning. The proposed transmission line design, predominantly, remains within the foot print of existing infrastructure.	SE19
Access to the transmission line area by the general public results in serious injury or death.	No	Accidents as a result of unauthorised access are not a planned event. Any accidents will be a result of an unplanned risk event, which has been further assessed in Section 15.3.	SE20
Damage to access roads from construction and maintenance	Yes	Access during the construction phase will use existing tracks wherever possible, and therefore	SE21

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
activities prevents access by pastoralists.		may result in short term and local disruptions to pastoralist activities. The Project could affect the condition of unsealed pastoral access tracks through unplanned events (e.g. Project vehicle accidents or bogging) leading to damage to the tracks.	
Illumination at night from camp areas impacts on the amenity of the local community.	No	Temporary construction camps are expected to be set up in remote locations, distant from sensitive receptors as reasonably practical. It is expected that other than in close proximity to the Olympic Dam airport, where aviation warning lights may be required, the Project infrastructure will not be illuminated. As a result, there will be no night time lighting effects from the operation of the Project.	AQ07
The transport, storage and handling of hydrocarbons and chemicals may result in an accidental spill, which if uncontained, contaminates land leading to a decrease in soil quality impacting on the income and business viability of pastoral stations.	No	Accidents as a result of uncontrolled release of hydrocarbons or chemicals that contaminated land are not a planned event. Any accidents will be a result of an unplanned risk event, which has been further assessed in Section 15.3.	D104

15.2.3 Impact Significance Assessment

This section discusses the significance of potential impacts where a linkage has been identified between the effects of the Project and Land Use. An impact assessment using the OZ Minerals Impact Assessment Framework has been carried out for each of these potential impacts. These impact assessments are presented in Appendix I. Supporting discussion is provided below followed by a table summarising the outputs of the Impact Assessment Framework.

In accordance with the Impact Assessment Framework, only those potential impacts that have been identified as having an S-P-R linkage (or are found to be "material") have had an impact significance assessment carried out. Potential impacts where there is no identified S-P-R linkage are discussed above in Table 15.3.

Value of Pastoral Stations – Permanent Loss of Land

The reduction in area is unlikely to require a reduction in stocking rates and is unlikely to reduce the value of pastoral leases. Each pastoral lease may be affected differently, but impact is less than 0.1% of each pastoral lease area. The impact has been assessed as very low.

Value of Pastoral Stations – Future Development

The Project has a relatively small footprint within each pastoral lease and this reduces the likelihood of actual development constraints occurring. Most potential development restrictions would apply to less than 0.5% of each pastoral lease area within the Project Area. The impact has been assessed as very low.

Pastoralists' Activities – Access Roads

The effect from loss of access to pastoral areas is expected to be insignificant, given the limited extent of works to be performed at a given location. Each pastoral lease maybe affected differently, however construction access across each pastoral site will be short term. The impact has been assessed as very low.

Pastoralists' Activities – Restricted Height Operations

Restrictions on movement of oversized vehicles is not a new effect to pastoralists based on the existing transmission line infrastructure. Oversized vehicles between 4.3 m and 4.9 m travelling on roads are required to confirm their route with SA Power Networks and ElectraNet, because of potential transmission line clearance restrictions. Effects are specific to pastoralists in which the transmission line does not run adjacent to pre-existing infrastructure. The impact has been assessed as low.

Pastoralists' Activities – Aerial Mustering Operations

The potential impact of disruption to aerial mustering is not material as any aerial mustering activities must be undertaken under existing civil aviation safety legislation. Aerial mustering operations which occur near transmission lines will need to modify their operations (e.g. be limited to stock spotting) to minimise the risk of wire strike. This requirement is not a new effect to pastoralists based on the existing transmission line infrastructure and effects are specific to pastoralists in which the transmission line does not run adjacent to pre-existing infrastructure. The impact has been assessed as low.

Pastoralists' Activities – Damage to Access Roads

Local community and third-party users will be adaptable to Project-related time delays. OZ Minerals will provide notice to pastoralists for any specific delays that will directly impact them. It is expected that, through this process, the Project will identify pastoral access tracks that are at risk of deterioration due to Project transport activities and will undertake measures to mitigate the effect (e.g., but not limited to, identifying alternative routes, upgrading access tracks prior to Project use, repairing access tracks during and after Project use, managing driver behaviour of Project contractors). The impact has been assessed as low.

Table 15.4: Summary of Land Use Impact Significance

Impact ID	Potential Impact Description	Impact Significance				Impact Uncertainty			Overall
		Resilience	Importance	Duration	Significance	Input	Methodology	Sensitivity	
SE13	Permanent loss of land as a result of Project activities may be perceived to, or may actually constrain pastoralists' activities in conducting their agricultural businesses.	1	1	3	3	C	A	A	4- Very Low
SE15	Project activities may be perceived to, or may actually constrain pastoralists' activities in conducting their agricultural businesses with respect to future developments.	1	1	3	3	B	B	A	4- Very Low
SE16	Access to transmission line disrupts pastoral operations, e.g. use of pastoralist roads.	1	1	1	1	C	C	C	2- Very Low
SE17	Transmission line clearance requirements disrupts pastoral operations by limiting vehicle access below the transmission line.	1	1	3	3	C	B	C	5- Low
SE18	Presence of transmission line disrupts pastoral operations by affecting aerial mustering near the transmission line.	1	1	3	3	C	B	C	5- Low
SE21	Damage to access roads from construction and maintenance activities prevents access by pastoralists.	1	2	3	6	C	C	B	11- Low

15.3 Unplanned Events

15.3.1 Damage to Existing Infrastructure

Construction activities may result in damage to other infrastructure through accidental incidents from heavy machinery use and / or damage to underground pipelines. The risk associated with these events has been assessed as low.

15.3.2 Unauthorised Access

Unauthorised access to the project site or infrastructure by members of the public may result in serious injury or death. The likelihood of unauthorised access is rare, the consequence is considered to be major and therefore the risk assessed as moderate. Although unauthorised access is unlikely along the alignment, measures to respond to this situation would be included in the construction and operational management plans.

15.3.3 Damage to Access Tracks

The Project could affect the condition of unsealed pastoral access tracks through unplanned events (e.g. Project vehicle accidents or bogging) leading to damage to access tracks. preventing access by pastoralists. The risk of damage to access tracks have been assessed as low. Appropriate management controls will be implemented.

15.3.4 Accidental Spills

The transport, storage and handling of hydrocarbons and chemicals may result in an accidental spill, which if uncontained, can contaminate land leading to a decrease in soil quality impacting on the income and business viability of pastoral stations. Although spills events are unlikely along the alignment, measures to respond to this situation would be included in the Construction Environmental Management Plan (CEMP).

The risk from accidental spills during construction leading to a decrease in soil quality and impacting on the income and business viability of pastoral stations has been assessed as low. The risk of contamination in the operational phase is considered negligible based on the infrequent site visits and very low volumes of hydrocarbon or chemical inventories of maintenance and inspection vehicles.

Table 15.5: Land Use Risk Events

Risk Description	Consequence	Likelihood	Risk	Impact ID
Civil works damage underground pipeline	2 - Minor	E - Rare	3 – Very Low	SE06
Heavy machinery accident results in damage to nearby infrastructure	2 - Minor	D - Unlikely	5 - Low	SE06
Unauthorised access to the Project site or infrastructure by members of the public results in serious injury or death	4 - Major	E - Rare	10 - Moderate	SE20
The Project could affect the condition of unsealed pastoral access tracks through unplanned events (e.g. Project vehicle accidents or bogging) leading to damage to the tracks	2 - Minor	D - Unlikely	5 - Low	SE21
The transport, storage and handling of hydrocarbons and chemicals contaminates land leading to a decrease in soil quality impacting on the income and business viability of pastoral stations	2 - Minor	D - Unlikely	5 -Low	L22

15.4 Summary of Control and Mitigation Strategies

Table 15.6: Summary of Design Controls

Design Controls	Impact ID
Third-party infrastructure identified during detailed design and addressed in construction documentation as appropriate.	SE06
Restrict the Project footprint to the minimum necessary.	SE21, L22
Hydrocarbon and chemical storage facilities will be designed in accordance with Australian Standards. Storage and transport of chemicals and hydrocarbons will be in accordance with relevant Australian Standards and bunded in accordance with EPA Bunding Guidelines.	L22
Distances to sensitive receptors considered during the design of lighting and camp facilities.	AQ06, AQ07
Placement of camps near already disturbed areas such as highways or pastoral infrastructure.	AQ06, AQ07
Avoiding light spill by using directional lighting as much as practical.	AQ06, AQ07
A Right of Way (ROW) will be designed to provide a safety clearance margin between the high voltage transmission lines and surrounding structures and vegetation.	SE17
Tower design and lighting in accordance with Civil Aviation Safety Authority (CASA) requirements.	SE19

Table 15.7: Summary of Management Controls

Management Controls	Impact ID
The CEMP outlines responsibilities for the adherence to appropriate construction practices.	SE06
Development of a Traffic Management Plan prior to construction.	SE21
Maintenance of unsealed roads.	SE21
Ongoing consultation with landowners regarding activities.	SE16, SE21
Site security and access control measures where appropriate (e.g. signage and/or fencing of high-risk areas).	SE20
Appropriate signage on infrastructure and key access points.	SE20, SE21
Traffic Management Plan and CEMP include traffic management and speed limits.	SE20, SE21
Contractor vehicle maintenance.	SE20, SE21
Complaints register and corrective action program.	AQ07, AQ08
Community consultation process.	ALL
Accidental Spill management controls: • Equipment maintenance • Spill and emergency response procedures • SA EPA Licensed transporters • Contaminated land register • Regular inspection programs of construction sites where bunding, either temporary or permanent, is installed to ensure appropriate use, placement of spill kits, clean up procedures and handling procedures • Induction contains process for bringing chemicals and hydrocarbons onsite including requirements for storage, handling and disposal • Contracts contain conditions relevant to design, management of the storage and handling of chemicals and hydrocarbons • All commercial or industrial waste is disposed of in an EPA licensed facility • Establishment of Chemical Database including copies of SDS and storage, handling and disposal requirements.	L22

16 SOCIO-ECONOMIC

16.1 Existing Environment

This section summarises the socio-economic pathways receptors in the relation to the Project Area. The information presented is derived from an independent Socio-economic Assessment, prepared by EconSearch (Appendix G1).

Ongoing stakeholder participation has improved OZ Minerals' understanding of the local community and what they consider important. Further detail regarding the approach to engagement can be found in Chapter 17.

16.1.1 Regional Context

The broader Far North region of South Australia comprises almost 800,000 km^2 and accounts for approximately 80% of the South Australia's land mass (RDAFN, 2013). It is the largest and least populated area of South Australia but forms a link between the remote outback of central Australia, specifically Coober Pedy in South Australia and Alice Springs in Northern Territory, with the mining centre of Roxby Downs in South Australia. It has a long history of exploration, pastoralism, tourism, government services and mining and links transport between Australia's eastern and western states and the Northern Territory.

As a region, the Far North has a population of around 26,000 people; major towns include Port Augusta (13,808 residents) and Roxby Downs (3,884 residents) (ABS, 2017).

The largest population centres near the Project, which constitute the socio-economic Study Area, are Port Augusta, Roxby Downs, Woomera, and Pimba. Grazing is the most extensive industry (in terms of area), however, mining provides the main source of revenue (Appendix G1).

16.1.2 Population Centres

Port Augusta

Established as a natural harbour in 1852, Port Augusta became one of South Australia's largest regional cities and a major service centre for the region. Port Augusta is an important stop on both the Indian Pacific and The Ghan railway services.

Until recently, Port Augusta provided a large proportion of South Australia's base load electricity, using coal supplied from the Leigh Creek coal mine. Both the power station and mine closed in 2016, and there is a new emphasis on renewable energy. Port Augusta is an important starting point for ecotourism ventures into the Flinders Ranges, which attract more than 600,000 visitors each year. Tourist attractions include the Pichi Richi Railway, Wadlata Outback Centre, and the Australian Arid Lands Botanic Gardens (PACC, 2018).

Horticulture is an expanding industry in Port Augusta, particularly with the development of the Sundrop Farms 20 ha commercial greenhouse complex. The facility became operational in 2010, with a significant expansion project completed in 2016 (Sundrop, 2016).

Port Augusta has recently experienced a lot of interest from the renewable energy sector, with 13 projects surrounding the town at various stages of development. This includes the Bungala solar power plant, Lincoln Gap wind farm, and the Aurora Solar Energy Project.

Notwithstanding recent developments in Port Augusta, the 2016 ABS Census data suggests some degree of economic decline. In particular, the labour force size has decreased over the last decade (down 190 people) coupled with an increase in the unemployment rate (9.7%).

Roxby Downs

Roxby Downs is the largest town in South Australia, north of Port Augusta. Roxby Downs has grown steadily since the Olympic Dam operation started (in 1988) to support a population of over 3,800 residents (see Table 16.1). The township also provides services for neighbouring communities and pastoralists.

Roxby Downs has modern, well maintained infrastructure. At the time of the 2016 national census, the-then level of mining activity resulted in very low unemployment and very high incomes (see Table 16.1).

Woomera

The township of Woomera was established in 1947 to accommodate the joint Australian and British project to test weapons and rockets at the Woomera Rocket Range. Until 1982, Woomera was classified as a military base with restricted public access. The Department of Defence continues to support and invest in the Woomera community, which has developed into a well-maintained and serviced remote township. The population fluctuated from 3,000 to 6,000 in the 1960s when the testing program was at its peak and had reduced to 146 people at the time of the 2016 census.

While the housing is ageing, Woomera has some good infrastructure that could support a much larger population. At the time of the 2016 census, Woomera had no unemployment, high incomes and a majority of working age residents, many with young families (see Table 16.1). Woomera has a range of community and recreation facilities including the aircraft and missile park, two museums, school, hospital, theatre, heritage centre, swimming pool, ten pin bowling alley, fitness centre and golf course.

The Woomera Board and the Outback Communities Authority (OCA) represent the town, however, Defence is the key stakeholder within the community. The population of Woomera remains controlled by Defence and most of the housing in Woomera is owned and managed by Defence, with only a small number of houses available for rent or purchase (BHP Billiton, 2013). The Royal Australian Air Force (RAAF) Woomera Airfield is approximately 5 km north of Woomera town. It is controlled by the RAAF and civilian aircraft are generally not permitted to use the airfield (Department of Defence, 2007).

Pimba

Pimba is a small settlement located at the junction of the Stuart Highway to Alice Springs and the road to Woomera and Roxby Downs. Pimba had a very small population of 63 in the 2016 census. It was

established originally as a workers' camp during the construction of the transcontinental railway to Western Australia at the end of World War I and retained as a railway siding once the track became operational. Both The Ghan and the Indian Pacific trains pass through Pimba. Pimba has one roadhouse that provides a rest, accommodation, food and fuel stop for passing motorists and serves as a starting point to access the remote northern region. There were no community or sporting organisations, infrastructure, aged care or disability services identified in Pimba (see Appendix G1).

16.1.3 Demographic Summary

Demographic indicators across the region are shown in Table 16.1. Key findings include:

- A notable gender imbalance across Woomera and Pimba, with 35.7% and 37.4% of the respective populations being female. Across the region, community populations are dominated by males.
- Port Augusta and Pimba have a significantly higher proportion of persons identifying as Aboriginal (18.3% and 12.7%, respectively) relative to South Australia (2.0%).
- The median age in Woomera of 48 years old is significantly older than the rest of the Study Area (ranging from 30 at Roxby Downs to 39 in Pimba), or South Australia (40).
- Median weekly individual incomes range from $604 in Port Augusta to $1,547 at Roxby Downs.
- In Roxby Downs more than two-thirds of household types are families, while lone households are greatest in Woomera (around 61%).
- Unemployment is highest in Port Augusta (9.7%) and lowest at Roxby Downs (3.5%).

Table 16.1: Demographic Indicators Summary

	Port Augusta	Roxby Downs	Woomera	Pimba	South Australia
Person Characteristics					
Population (no.)	13,808	3,884	146	63	1,676,653
Male %	51.0	57.1	64.3	62.7	49.3
Female %	49.0	42.9	35.7	37.3	50.7
Aboriginal origin %	18.3	3.0	0	12.7	2.0
Age					
Median age	39	30	48	39	40
Median Weekly Individual Income					
($)	604	1,547	1,179	1,342	600
Dwelling Characteristics					
Family households %	58.7	67.7	38.9	40.0	64.9
Lone person households %	28.1	19.7	61.1	20.0	26.6
Employment (population aged 15 years and over)					

	Port Augusta	Roxby Downs	Woomera	Pimba	South Australia
Unemployed %	9.7	3.5	0	0	7.5

Source: ABS (2017)

16.1.4 Infrastructure

Electricity Supply

Electricity is supplied to Port Augusta, Roxby Downs, Woomera from the National Electricity Market (NEM) via the interconnected power system (sourced from the existing ElectraNet and BHP lines), administered by the Australian Energy Market Operator. The BHP line provides the electricity to Roxby Downs, with electricity distribution being the responsibility of Roxby Power, a business run by the Roxby Council.

Other towns and pastoral stations in the Far North that are not connected to the NEM, as an example, Pimba is supplied by diesel generators. Some towns have been exploring the use of small-scale hybrid plants based on renewable energy and gas or diesel (SC Lennon & Associates, 2016).

Water Supply

Port Augusta, Woomera and Pimba are supplied by reticulated water from the River Murray via the Morgan-Whyalla pipeline. Woomera and Pimba access this water via the Port Augusta-Woomera pipeline (SA Water, 2018). The Port Augusta – Woomera pipeline is owned by the Department of Defence at Woomera and is the only mains water supply north of Port Augusta. Third-party access to this pipeline is available subject to agreement from the Department of Defence (or the Woomera administrator), and some pastoralists use it currently.

Roxby Downs is supplied by desalinated water drawn from the Great Artesian Basin (GAB) that is pumped 200 km to BHP's mining lease where it is cooled and stored. Roxby Water purchases and distributes this water from BHP throughout the town. Other communities rely on community-maintained bores and rain water.

As discussed in Section 8.1.2, the highly saline nature of the regional groundwater means it has no beneficial use, apart from industrial, without treatment. As such, pastoralists in the area obtain their water from a number of other sources, including surface water dams through modification to river/creek lines, rainwater catchment into tanks, abstraction from perched aquifers (which are disconnected from regional groundwater flow systems and are generally less saline). Surface water and groundwater users are described in Sections 7.1.4 and 8.1.3 respectively.

Health

Health services are located at Andamooka, Roxby Downs, Woomera, Whyalla and Port Augusta, either by GP / Nurse day services or with hospitals at Port Augusta (55 beds, 24-hour accident and emergency, two operating theatres), Whyalla (73 inpatient beds, 20-day surgery beds, 24-hour emergency, two operating theatres) and Roxby Downs (accident and emergency, attendant nurse, doctor on call).

The Royal Flying Doctor Service (RFDS) has a base in Port Augusta and provides emergency medical services as well as routine clinics to people in remote and isolated areas of South Australia (DTEI 2010).

Although most communities have some form of health service, improving access to appropriate care, medical specialists and emergency services is an ongoing priority for remote communities. Patients are often required to travel to Adelaide for specialist medical services, (DTEI, 2010).

Pika Wiya Health Service Aboriginal Corporation is located at Port Augusta and is the centre for Aboriginal health services in the Far North region.

Housing and Accommodation

Across all locations, the proportion of unoccupied houses are above both the state and national averages (12.6% and 11.2%). In Woomera and Andamooka over 70% of dwellings were unoccupied at the last census and in Coober Pedy approximately 40% of dwellings were unoccupied.

Median rents across the region are lower than the state and national equivalents. Likewise, the proportion of households whose rent repayments are more than 30% of household income across the region are lower than the state and national equivalents.

Median mortgage repayments across the region are lower than the state and national equivalents, with the exception of Roxby Downs.

Road and Rail Infrastructure

A network of sealed and unsealed roads, which vary in quality and purpose, service the Project Area and surrounds. The Stuart Highway, a sealed, two-lane highway maintained by the Department of Transport, Energy and Infrastructure, is the major road in the region and runs between Port Augusta and Alice Springs in the Northern Territory.

Other key road routes for freight and tourist movement include the Pimba to Roxby Down/Olympic Dam freight route; Port Augusta to Moomba via Leigh Creek freight route; Peterborough to Port Augusta and Hawker freight route; Leigh Creek to Marree route; and the Birdsville, Oodnadatta and Strzelecki tracks. Olympic Way (between Woomera and Olympic Dam) has a flow of 430 AADT, of which 105 (24.5%) are heavy vehicles.

Other roads in the region include Port Wakefield Road, Port Augusta Highway, Olympic Dam Highway, and South Gap Road.

An extensive network of unsealed roads and tracks located on private land are maintained by pastoral stations and used for farming and private purposes (approximately 10,000 km of roads in the Far North are in unincorporated areas and are unsealed) (DPLG, 2010).

Railway infrastructure in the Far North comprises mainly standard gauge line. A short narrow-gauge segment services Whyalla port from the west (Deloitte, 2013). Rail networks in proximity to the Project Area are shown in Figure 6.2 and Figure 6.3. The network comprises:

- Narrow gauge rail link between Iron Knob and Iron Baron and Whyalla
- Standard gauge rail link between Port Augusta and Whyalla and between Port Augusta and Tarcoola
- Standard gauge rail link between Tarcoola and Northern Territory
- Standard gauge rail link between Leigh Creek and Port Augusta.

16.1.5 Economic Contribution

Regional South Australia, including the Far North, contributes approximately $25 billion (26%) of Gross State Product (GSP) (EconSearch, 2017). Mining is the greatest contributor to the economy in the Far North region, along with electricity, gas, water and waste, and construction.

Metal ore mining as one of the largest employment industries for the regional study area, as well as correctional and detention services, hospitals, education and construction, as shown in Table 16.2.

Table 16.2: Industries of Employment

	Port Augusta	Roxby Downs	Woomera	South Australia
Highest % ↓ Lowest %	Correctional and Detention Services (4.6%)	Copper Ore Mining (30.4%)	Other Heavy and Civil Engineering Construction (43.1%)	Hospitals (4.1%)
	Hospitals (4.1%)	Other Metal Ore Mining (10.9%)	Defence (32.3%)	Aged Care Residential Services (3.0%)
	Primary Education (4.0%)	Building and Other Industrial Cleaning Services (3.7%)	Beef Cattle Farming (6.2%)	Supermarket and Grocery Stores (2.9%)
	Supermarket and Grocery Stores (3.6%)	Gold Ore Mining (2.9%)	Sheep Farming (4.6%)	Primary Education (2.2%)
	Takeaway Food Services (3.0%)	Primary and Secondary Education (2.6%)	Sheep-Beef Cattle Farming (4.6%)	Cafes and Restaurants (2.1%)

Source: 2016 Census (ABS, 2017).

16.2 Impact Assessment

16.2.1 Description of Effects

This section describes the interaction of the Project (Chapter 5) with the baseline socio-economic environment (Section 16.1) and is supported by a Socio-Economic Assessment of Effects report prepared by EconSearch (see Appendix G2). The activities that potentially alter the socio-economic environment (e.g., economy, health, social infrastructure) which may subsequently have an impact on receptors are presented in Table 16.3. The assessment of effects presented in this section indicates that there are negligible changes to the baseline socio-economic environment.

Control measures, which are important when undertaking an assessment of effects as they may limit the magnitude and/or extent of the effect that occurs, are summarised in Section 16.4.

Table 16.3: Socio-Economic Potential Effects

Source	Potential Effect	Receptors	ID
Social interaction - workforce demand	Increased competition for Labour	Local communities	SE04
Social interaction - workforce demand	In-migration - Social disruption.	Local communities	SE07
Social interaction - workforce demand	In-migration – Pressure on local services	Local communities	SE08
Social interaction - workforce demand	In-migration – Pressures on local businesses	Local communities	SE09
Social interaction - workforce demand	In-migration – Housing pressures	Local communities	SE10
Social interaction - workforce demand	Local Price Inflation.	Local communities	SE11
Social interaction - workforce Presence	Increased Access to Pastoral Stations	Third-party users	SE12

Labour Competition

Project job creation is not predicted to reduce the availability of labour for existing businesses in the region, with the majority of towns retaining an unemployment rate well above 5%. The exception to this is Pimba and Woomera, which have workforces too small to statistically assess, and Roxby Downs. Roxby Downs currently has a very low unemployment rate (1.6%), which is expected to decrease further due to Project job creation (to 0.8%) and will likely increase competition for labour. However, as the town houses a transient population dependent on work availability, and the construction phase is limited to a one-year period, any increase in labour competition is likely to be short in duration.

In-migration

The Project will create approximately 200 short-term jobs for the construction of the line. Workers may be required from further afield (e.g. Interstate, Port Augusta, Adelaide).

The construction camps are expected to house between 80 and 100 workers each and will likely be located well outside of the residential centres in the Project Area (at least 30 kilometres from any towns).

Permanent in-migration for employment opportunities is expected to be unlikely due to the temporary period for employment and procurement. A small amount of in-migration was modelled for Pimba, Woomera and Roxby Downs (ranging from one to six workers) (Appendix G2). Each of these towns experienced a decrease in population over the five years prior to 2016 and the increase in population due to the Project is smaller than the average annual decrease for each. This in-migration, therefore, only moderates a trend of population decrease in these towns and will not put pressure on local services and businesses.

Housing Availability and Affordability

No detrimental effect on housing availability or affordability is expected in the region, with the exception of Roxby Downs. As discussed in Section 16.1.4, housing availability in Roxby Downs is uncommonly low. Should temporary accommodation at Roxby Downs be required for the Project, this may further decrease availability. The estimated in-migration of six workers to Roxby Downs represents a decrease in housing vacancies (1.7%) at a time of already unusually low residential vacancies.

Inflation

No local price inflation is expected any of the residential centres in the region, as the proportion of labour force employed by the Project is relatively small and temporary.

16.2.2 Effect S-P-R Linkage

The information provided in Table 16.4 identifies the potential impacts to socio-economic receptors using a Source-Pathway-Receptor (S-P-R) linkage assessment. This linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor.

Table 16.4: S-P-R Linkage Summary for Effects on the Socio-Economic Environment

Effects Assessed at Receptors	S-P-R Linkage Confirmed	Linkage Summary	Impact ID
Job creation in the region during construction and operation reduces the availability of labour for existing businesses which could lead to a short-term increase in wage costs or shortage of specific skills.	No	No notable increase in competition for labour is expected for the construction stage of the Project. No effect is expected during the operation phase as the labour associated with maintenance is negligible.	SE04
The in-migration of construction workers to residential centres and construction camps in the region has the potential to cause social disruption in local communities.	No	Social disruption by construction crews is not a planned event. Any disruption would be a result of an unplanned risk event which has been further assessed in Section 16.3 and Appendix I.	SE07
In-migration of construction workers to residential centres in the region has the potential to put strain on local services (such as social and medical services), reducing their availability to the local communities.	No	In-migration due to the Project only moderates a trend of population decrease in these towns and will not put additional pressure on local services.	SE08
In-migration of construction workers to residential centres in the Regional Study Area has the potential to put strain on local business which may cause shortages of basic services to these communities (for example retail and recreation).	No	In-migration due to the Project only moderates a trend of population decrease in these towns and will not put additional pressure on local businesses.	SE09
Construction activity encourages people to move to nearby communities, influencing housing availability and/or affordability.	Yes	The estimated in-migration of workers to Roxby Downs in the short term is expected to decrease housing vacancies by around 1.7% during construction. This decrease in availability has the potential to marginally decrease affordability for residents over a short period of time.	SE10
The establishment of a relatively highly paid workforce within regional townships influences inflation of prices for goods and services creating an impact on local communities.	No	No local price inflation is expected in any of the residential centers in the regional as the number of employees expected to be based in each is small and temporary.	SE11
Increased access by construction personnel to Project construction sites and camps located within pastoral stations during construction has the potential to cause social disruption.	No	Social disruption by construction crews is not a planned event. Any disruption would be a result of an unplanned risk event which has been further assessed in Section 16.3 and Appendix I.	SE12
Construction activities result in damage to other infrastructure (e.g. pipelines and transmission lines).	No	Damage to infrastructure is not a planned event. Any damage would be a result of an unplanned risk event which has been further assessed in Section 16.3 and Appendix I.	SE06

16.2.3 Impact Significance Assessment

This section discusses the significance of potential impacts where a linkage has been identified between the effects of the Project and socio-economic receptors. An impact assessment using the OZ Minerals Impact Assessment Framework has been carried out for each of these potential impacts. These impact assessments are presented in Appendix I. Supporting discussion is provided below followed by a table summarising the outputs of the Impact Assessment Framework.

In accordance with the Impact Assessment Framework, only those potential impacts that have been identified as having an S-P-R linkage (or are found to be "material") have had an impact significance assessment carried out. Potential impacts where there is no identified S-P-R linkage are discussed above in Table 16.4.

In-migration – Housing Pressure

Permanent in-migration for employment opportunities is expected to be unlikely due to the temporary period for employment and procurement. The estimated in-migration of workers to Roxby Downs is expected to decrease housing vacancies by around 1.7%. This decrease in availability has the potential to marginally decrease affordability for residents. The impact has been assessed as very low (see Table 16.5).

Table 16.5: Summary of Socio-Economic Impact Significance

Impact ID	Potential Impact Description	Impact Significance				Impact Uncertainty			Overall
		Resilience	Importance	Duration	Significance	Input	Methodology	Sensitivity	
SE10	Construction activity encourages people to move to nearby communities, influencing housing availability and/or affordability.	1	2	1	2	B	B	B	3 Very low

16.3 Unplanned Events

16.3.1 Social Disruption

The in-migration of construction workers to residential centres and construction camps in the region, and the increased access by construction personnel to Project construction sites located within pastoral stations, has the potential to cause social disruption to local communities and pastoralists.

No social disruption is expected in any of local townships (Port Augusta, Whyalla, Port Pirie, Pimba, Woomera, Andamooka, Coober Pedy), as in-migration is expected to be either zero or small, or because the existing workforce is similar to the in-migrants (Roxby Downs). As such, any social disruption will be a result of an unplanned risk event.

Table 16.6: Socio-Economic Risk Events

Risk Description	Consequence	Likelihood	Risk	Impact ID
In-migration of construction workers to residential centres and construction camps in the region has the potential to cause social disruption in local communities.	2 - Minor	D - Unlikely	5- Low	SE07
Increased access by construction personnel to Project construction sites and camps located within pastoral stations during construction has the potential to cause social disruption.	2 - Minor	D - Unlikely	5- Low	SE12

16.4 Summary of Control and Mitigation Strategies

Contractors and employees will complete site specific inductions and follow appropriate construction practices, as outlined in the Project CEMP and in Table 16.7, including:

- Fitness for Work Standard
- Health and Wellbeing Performance Standard
- Contractor selection.
- Contractor management.

Table 16.7: Summary of Management Controls

Management Controls	Impact ID
To prevent social disruption in the local area of the construction camps, contractors and employees will receive locally sensitive inductions and will be held to performance standards that prevent drug and alcohol abuse and anti-social behaviour.	SE07, SE12
OZ Minerals Health and Wellbeing Performance Standards, including Fitness for Work Standard. Contractor selection. Contractor management.	SE07, SE12
Construction camps will also be sited at distance from sensitive receptors.	SE07, SE12
Community engagement and sponsorship.	SE07, SE12

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17 PROJECT ENGAGEMENT

OZ Minerals has drawn on its proven stakeholder engagement methodology to enable meaningful stakeholder participation in the Electricity Transmission Line Project. For the purposes of this document, the term engagement rather than consultation has been used as it aligns with leading practice.

Engagement: "A means of describing a broader, more inclusive and continuous process between a company and those potentially impacted that encompasses a range of activities and approaches, and spans the entire life of a project (IFC, 2007)."

17.1 OZ Minerals Approach

The OZ Minerals engagement approach combines lessons learned from local histories, local experience and the development of the Prominent Hill and Carrapateena Mines, together with international and Australian leading practice to facilitate genuine stakeholder participation in a culturally appropriate manner. The approach is defined and monitored under the OZ Minerals governance structure, which includes Social Performance Standards. These Standards describe the minimum requirements for managing threats associated with specific activities or tasks, and to identify opportunities that have the potential to drive value creation for both OZ Minerals and the communities in which OZ Minerals operate.

As defined in the OZ Minerals Social Performance Standards "we seek to deliver long-term benefits to local communities and other stakeholders by engaging and collaborating with local communities, understanding the social (and other) impacts of our activities, and reducing the negative effects of our activities (OZ Minerals, 2017)". This means ensuring what is important to stakeholders underpins engagement and value creation across the Project lifecycle and forms part of the ongoing management capability (Chapter 18).

The OZ Minerals approach is underpinned by its 'How we work together' principles, which articulate behaviours expected of OZ Minerals employees, contractors and suppliers. These principles include four key behaviours that underpin the overarching principle of Acting with integrity and engaging with our stakeholders, and have been reflected in our approach to engagement for this Project.

Assessment Framework: Importantly, the approach to engagement has been informed by, and has informed the design of, the Assessment Framework for the Development Approval (DA). Gaining feedback specifically for input to the Assessment Framework has been an important focus.

OZ Minerals measures and reports externally on how it engages with stakeholders as part of organisation-wide sustainability performance reporting under the GRI Sustainability Reporting

Standards (GRI 2018). The OZ Minerals Sustainability Report is prepared annually and is audited by an accredited, independent third-party. Engagement has been ongoing, with a range of activities tailored to consider potential levels of impact, affect and interest, the diversity of stakeholders, their needs and expectations, and to enable genuine input into the impact assessment process. Engagement has also been undertaken to inform OZ Minerals approach to value creation across the Project life-cycle. Further information regarding engagement activities undertaken can be found in Table 17.2.

Engagement and Development Application Assessment Framework

OZ Minerals has used stakeholder feedback as an important input into the Assessment Framework for the DA. Understanding what is most important to stakeholders about their community and any challenges that may currently exist in these communities has been critical for OZ Minerals. The feedback received has been used by OZ Minerals to inform a range of key decision points, from development of the DA through to Project value creation, planning, employment and procurement. The feedback described in Section 17.4 has been used as direct input into the assessment framework inputs process for the Project. Importantly feedback has been essential in the identification and understanding of potential pathways, receptors and the materiality of impacts. For each specific impact identified and presented in the Impact Assessment Framework Tables in Appendix I, a materiality assessment is required to capture results of any consultation undertaken about the impact, or the source, pathway or receptor.

Materiality: The instance when particular impacts are considered to be significant on the basis of perception or stakeholder consultation (Section 4.1).

As discussed in Section 3.2, engaging with stakeholders regarding materiality entailed OZ Minerals recording perceived potential impacts where these were raised during discussions with stakeholders. OZ Minerals also provided opportunities for discussion and further information to ensure the perceived impact was understood. It is important to OZ Minerals that engagement is maintained with stakeholders who may have raised these concerns and or have a specific interest in potential outcomes, and this forms a part of the ongoing management capability (Chapter 18) and how engagement is approached across the Project.

17.2 Who has OZ Minerals Engaged?

Based on an initial stakeholder analysis, OZ Minerals has identified the stakeholders listed in Table 17.1. This list is likely to evolve during the Project and will be updated on an on-going basis as engagement continues.

Table 17.1: Project Stakeholders Groups

Stakeholder Group	Description
Pastoral station lessees	• Mount Arden • Carriewerloo • Kootaberra • Oakden Hills • Pernatty • Arcoona • Purple Downs • Roxby Downs • Andamooka Station
Landowners	• Other landowners within the Project footprint (e.g. freehold landowners, the Crown, other Crown lessees)
Project Site Traditional Owners	• Kokatha People • Kokatha Aboriginal Corporation • Barngarla People • Barngarla Determination Aboriginal Corporation
Indigenous Community Members	• Kotkatha Mula Nations Land Council • Nukunu Native Title claimants
Local Community Members	• Community members in Port Augusta, Woomera, Roxby Downs, Andamooka, Port Pirie and Whyalla
Local Councils and Representative of Unincorporated Areas	• Municipal Council of Roxby Downs • Port Augusta City Council • Woomera Prohibited Area Advisory Board • South Australian Arid Lands Natural Resources Management Board • Outback Communities Authority • Regional Development Australia – Far North
Local Business Community and Industry	• Local businesses in Port Augusta, Woomera, Roxby Downs, Pimba • BHP Billiton Olympic Dam Corporation Pty Ltd • ElectraNet • Solar Reserve (Aurora Project) • Global Maintenance Upper Spencer Gulf • Australian Rail Track Corporation
Government of South Australia	• Department for Planning, Transport and Infrastructure (Planning and Transport divisions) • Environment Protection Authority • Aboriginal Affairs and Reconciliation (situated within the Department of State Development) • Mineral Resources Division within the Department for Energy and Mining (formerly within the Department of the Premier and Cabinet) • Department of Environment and Water (formerly Department of Environment Water and Natural Resources) • Native Vegetation Council • Office of the Technical Regulator
Local/Regional Service Providers	• Local community organisations

Stakeholder Group	Description
Commonwealth Government	• Department of the Environment and Energy • Department of Defence • Australian Energy Market Operator
OZ Minerals Limited and OZ Minerals Prominent Hill Operations Pty Ltd	• Employees, contractors
Non-Government Organisations	• Conservation Council of SA
Service Providers	• Providers of services such as water, electricity and telecommunications
OZ Minerals Limited and OZ Minerals Prominent Hill Operations Pty Ltd	• Employees, contractors
South Australian Business Community	• South Australian based service providers • South Australian Chamber of Mines and Energy • Business SA
Other Community Members	• General public
Media	• Television, print, radio, digital, social

17.2.1 How has OZ Minerals Ensured Opportunities for Engagement?

The engagement approach outlined in Section 17.1 has enabled OZ Minerals to engage in a manner that is tailored to consider the diversity of stakeholders, their needs and expectations and to enable genuine input into the impact assessment process.

OZ Minerals recognises the specific regulatory requirements regarding consultation with directly impacted stakeholders. Deeper and more targeted engagement has occurred with Pastoral Lease Owners within the proposed transmission line footprint, and Native Title Holders.

Where OZ Minerals has identified that stakeholders have not been able to be consulted during specific activities, if these are directly and indirectly impacted stakeholders, OZ Minerals has followed up with them directly through email, phone-calls and one-on-one meetings. Where OZ Minerals has identified that stakeholders who are not directly impacted have not been able to participate in events (e.g. community information sessions) relevant information, such as presentations, fact sheets and animations, has been provided on the website, through social media and other media communications channels, to ensure that all stakeholders have access to information and awareness of upcoming activities in which they can participate.

If OZ Minerals has been contacted directly by stakeholders requiring further information, this has been provided. Project information is also available to stakeholders through the Government of South Australia's SA Planning Portal website.

Opportunities for further engagement will also be provided to all stakeholders through the formal statutory public consultation process required under Section 49(7d) of the Development Act, and

through other formal regulatory communication mechanisms (e.g. circulation of information to stakeholders as required under legislation via local and state media channels). Where stakeholders are directly affected, OZ Minerals has and will personally provide information regarding this Development Application document and work through any concerns, issues or opportunities they may have.

17.3 What Engagement has Been Undertaken?

OZ Minerals is committed to creating value in the communities in which it works and to developing the Project in a manner that reflects what is important to stakeholders. The Company is also committed to maintaining engagement with stakeholders, particularly those who may have raised specific concerns about the Project. This forms part of OZ Minerals' ongoing management capability (Chapter 18).

OZ Minerals has engaged with the following stakeholders who have a direct interest in the land required for the Project, and continues to work with these parties in relation to a range of matters including land access negotiations:

- All directly impacted landowners (freehold owners, the Crown, Crown Lessees and pastoralists)
- The Barngarla People, being the native title holders in the southern part of the Project Area
- The Kokatha People, being native title holders in the northern part of the Project Area.

In addition, negotiations for the granting of easements over portions of the land titles set out in Chapter 2 are ongoing with all relevant landowners and include compensation discussions.

OZ Minerals has also held a series of meetings and sessions to provide opportunities for all interested community members and stakeholders to hear about the Project and to ask questions. These sessions were held during the period 13 – 14 June 2018 and 18 – 19 June 2018 in the towns of Port Augusta, Roxby Downs, Woomera, Andamooka, Whyalla, Port Pirie and Adelaide.

In all, 127 people attended one of the public sessions held during June 2018 and 40 of those completed a stakeholder survey.

Details of the engagement activities and the feedback obtained are set out in Section 17.4.2 below.

Going forward, opportunities to obtain more information from OZ Minerals will be provided to all stakeholders during the public consultation process required under the Development Act, and through other formal regulatory communication mechanisms (e.g. circulation of information to stakeholders as required under legislation and reported by local and state media channels such as radio, television, the internet and print media).

OZ Minerals is committed to working through any concerns, issues or opportunities with community members and in creating value for stakeholders.

Engagement for the local, regional and broader South Australian community regarding Project opportunities, such as procurement, will be delivered by OZ Minerals separately to this process.

Table 17.2: Engagement with Project Stakeholder Groups

Stakeholder Group	Description of Engagement

Pastoral station lessees	• Ongoing one-on-one, face-to-face meetings and station visits focused on:
	  ○ Providing Project information
	  ○ Understanding pastoral activities and the site
	  ○ Understanding and gaining feedback on design considerations
	  ○ Understanding potential pathways, receptors, materiality and outcomes
	  ○ Understanding how stakeholders would like to be engaged.
	• Ongoing communication regarding aspects such as Project updates, ongoing discussion regarding potential issues and opportunities, operational matters including access to site, relevant Project activities etc.
	• Access and compensation agreements.
	• Stakeholder Feedback Survey in June 2018.
	• Formal Development Application public consultation period (to be undertaken as part of formal assessment after submission of this Development Application).

Landowners	• Ongoing one-on-one, fact-to-face meetings focused on:
	  ○ Providing Project information
	  ○ Understanding farming activities and the site
	  ○ Understanding and gaining feedback on design considerations
	  ○ Understanding potential pathways, receptors, materiality and outcomes
	  ○ Understanding how stakeholders would like to be engaged.
	• Ongoing communication regarding aspects such as Project updates, ongoing discussion regarding potential issues and opportunities, operational matters including access to site, relevant Project activities etc.
	• Access and compensation agreements.
	• Stakeholder Feedback Survey in June 2018.
	• Formal Development Application public consultation period (to be undertaken as part of formal assessment after submission of this Development Application).

Project Site Traditional Owners	• Face-to-face meetings with the Kokatha Aboriginal Corporation. • Face to Face meetings with Barngarla Determination Aboriginal Corporation. • Cultural Heritage Requests and Surveys. • Project information provided at Kokatha Aboriginal Corporation Offices. • Kokatha Group Committee Meetings – OZ Minerals Representation at occasional Group meetings as required. • One-on-one, face-to-face meetings to provide Project information and understand local environmental, social and economic values, potential concerns and opportunities, and how Kokatha community members prefer to be engaged. • Complete Personnel/ Kokatha JV - labour hire (as required). • Stakeholder Feedback Survey in September to October 2016 and May 2017. • Formal Development Application public consultation period (to be undertaken as part of formal assessment after submission of this Development Application).
Indigenous Community Members Local Community Members	• Community briefing sessions (Port Augusta, Woomera, Roxby Downs, Andamooka, Whyalla, Port Pirie and Adelaide). • Community presentations (Port Augusta, Woomera, Roxby Downs, Andamooka, Whyalla, Port Pirie and Adelaide). • One-on-one meetings and communication via phone and email based on specific community member enquiries.

Stakeholder Group	Description of Engagement
	• Stakeholder Feedback Survey in June 2018. • Formal Development Application public consultation period (to be undertaken as part of formal assessment after submission of this Development Application). • On-going communication in local media, via OZ Minerals website.
Local Councils and Representative of Unincorporated Areas	• Group and one-on-one briefings/feedback-focused meetings for individual councils/Outback Communities Authority, representative bodies. • Presentations and attendance at Upper Spencer Gulf Common Purpose Group meetings. • One-on-one meetings and communication via phone and email based on a range of specific themes including consideration of environmental values, maximisation of positive social and economic benefits for the region. • Stakeholder Feedback Survey in June 2018. • Formal Development Application public consultation period (to be undertaken as part of formal assessment after submission of this Development Application).
Local Business Community and Industry Local/Regional Service Providers	• Community and business community/industry briefing sessions (Port Augusta, Woomera, Roxby Downs). • Community presentations (Port Augusta, Woomera, Roxby Downs). • ICN SA Portal. On-going communication in local media, via OZ Minerals website. • Stakeholder Feedback Survey in June 2018. • Formal Development Application public consultation period (to be undertaken as part of formal assessment after submission of this Development Application). • One-on-one meetings and communication via phone and email based on specific community member enquiries.
Government of South Australia	• On-going meetings with relevant agencies regarding Project updates and, technical findings. • Formal Development Application public consultation period.
Commonwealth Government	• Meetings with relevant agencies regarding Project updates and technical findings (as required). • Communication related to regulatory requirements and approvals processes, in particular regarding Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) considerations. • Formal Development Application public consultation period (to be undertaken as part of formal assessment after submission of this Development Application).
South Australian Business Community	• Briefing sessions and presentations (Adelaide). • ICN SA Portal. • One-on-one meetings and communication via phone and email based on specific business community member enquiries. • Ongoing communication in local media, via OZ Minerals website.
Other Community Members Media Non-Government Organisations Investment Community	• Website updates. • Media releases. • ASX releases. • Formal Development Application public consultation period (to be undertaken as part of formal assessment after submission of this Development Application). • One-on-one meetings and communication via phone and email based on specific enquiries.

17.4 Stakeholder Feedback

Throughout the engagement activities discussed in Section 17.3, stakeholders were asked for feedback including what was important to them about their communities, their potential concerns and suggestions for opportunities regarding the Project, and their view regarding the importance of how a wide range of environmental values are considered.

OZ Minerals undertook a formal Stakeholder Feedback Survey in local and regional communities in June 2018 that sought these inputs and a summary of key results are outlined in Figure 17.1.

17.4.1 How OZ Minerals has Responded to Feedback

OZ Minerals has sought to respond to issues raised by stakeholders through commissioning detailed technical assessments, and ongoing stakeholder engagement where required. Following meetings with relevant Government agencies, OZ Minerals has responded to feedback either via the provision of further information directly to the Government agency or through additional technical work and clarifications made to the Development Application. Where further information has been required based on stakeholder feedback, OZ Minerals has gone back to relevant stakeholders to discuss potential concerns, questions, issues, or opportunities raised.

17.4.2 What was Important to Stakeholders?

The results of the formal Stakeholder Feedback Survey (June 2018) revealed the top three matters of importance to members of the local and regional communities were:

- Employment and training (37%)
- Prosperous, stable community and economy (29%)
- Business development opportunities (17%)

The others, in order of importance, were:

- Location and lifestyle (7%)
- Engagement (5%)
- Environment (3%)
- Health and Safety (2%)

Stakeholders were also asked to comment on values, opportunities the Project could bring to the region and potential negative impacts. Stakeholder values were noted as including local employment and enterprise, communication and engagement, social, and various environmental matters such as water and air quality.

Opportunities arising from the development of the Project were identified by community members as being training and employment (45%), a prosperous and stable community and economy (17%), increased community participation (15%), local procurement opportunities (13%) and infrastructure and technology (6%).

Three potential negative impacts were raised by the survey participants:

- Social (47%)
- Environmental (29%)
- Impact on infrastructure facilities (24%).

Overall, community members are supportive of the Project due to the opportunities that are expected to arise from its development such as employment, training and the use of local businesses and services providers.

17.4.3 Incorporating What is Important to Stakeholders into the Project

The feedback obtained throughout OZ Minerals stakeholder engagement activities with all parties has been considered and, where relevant, included in the development application. For example, OZ Minerals commissioned numerous environmental technical studies for the Project, all of which have been summarised in the Development Application (e.g. noise, air quality, groundwater and surface water) with clear linkages to S-P-R. Interested parties will be able to review these during the public consultation process to ensure that their concerns have been adequately addressed, and they will be given the opportunity to seek further information from OZ Minerals.

Matters raised by the landowners with whom OZ Minerals is negotiating land access have also been considered by inserting relevant clauses in the commercial agreements between the parties. This approach has been taken as the agreements are confidential in nature and include matters that are unique to the underlying land.

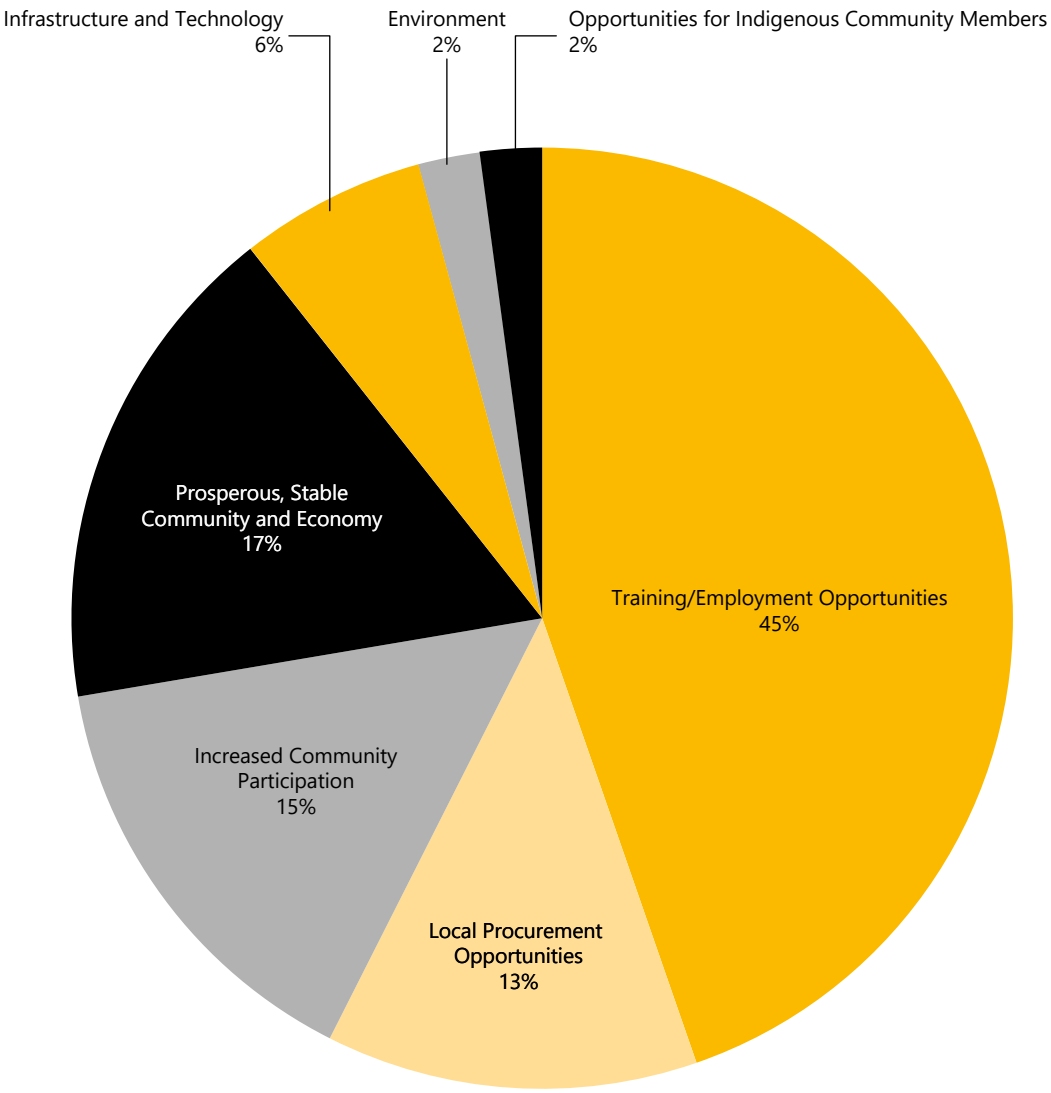

Figure 17.1: Opportunities Raised by Stakeholders (June 2018 Stakeholder Feedback Survey)

18 MANAGEMENT CAPABILITY

18.1 OZ Minerals Corporate Governance

The OZ Minerals approach to corporate governance is to have a set of values and behaviours that ensure transparency and fair dealing to protect stakeholder interests. The Board is committed to following the corporate governance guidelines and recommendations set out by the ASX Corporate Governance Principles and Recommendations. This is underpinned by 10 policies covering the following aspects:

- Diversity and Inclusion
- Environment and Community
- Ethics and Human Rights
- Exploration and Resource Development
- Finance and Accounting
- Governance and Risk
- Health and Safety
- Market and Dividend
- Operations and Asset Management
- Whistleblower.

The Environment and Community Policy is illustrated in Figure 18.1. All policies are available on the OZ Minerals website.

ENVIRONMENT AND COMMUNITY POLICY

OZ Minerals Limited (**OZ Minerals**) is an Australian modern mining company listed on the Australian Securities Exchange (**ASX**) which specialises in exploring for, developing and operating copper, gold and base metal projects. OZ Minerals continually strives to be a global market leader and a partner of choice in the resource sector with a clear strategy and effective governance that support value creation for all our stakeholders.

Objective

The objective of this Environment and Community Policy is to ensure OZ Minerals delivers sound environmental outcomes whilst supporting the creation of shared value for the communities in which we operate.

Scope and Implementation

This policy applies to all employees, directors, officers, consultants and contractors of OZ Minerals and its subsidiaries (**Employees and Contractors**). Complete and consistent implementation of this policy and its supporting standards and procedures are required across all of OZ Minerals' assets. Adherence will be verified through regular audit and review processes.

Commitment

To meet the objective of this Environment and Community Policy OZ Minerals will:

- integrate the principle of shared value into the way we work ensuring our standards and procedures foster a culture that values mutually beneficial outcomes, including for Aboriginal and Indigenous communities
- minimise environmental impact by using robust scientific process and impact assessments
- ensure effective stewardship of natural resources by minimising our environmental footprint, reducing waste and using energy, water and other raw materials efficiently
- ensure safe transport of our product through the logistics chain
- plan for mine closure and ensure adequate financial provisions exist
- ensure obligations and commitments are met and communicated to our Employees and Contractors
- build trusting relationships by engaging openly and honestly with our host communities and other key stakeholders throughout the lifecycle of our projects
- consider the economic, social and environmental needs of the communities in which we operate
- consider the views of stakeholders in management decisions
- encourage economic prosperity in our communities during and subsequent to mining operations
- embed sustainable development considerations as part of project planning and decision making
- monitor, maintain and improve, where required, environment and community risks through the use of robust systems, governance and assurance processes
- use this policy as the basis for developing new, and maintaining existing, standards and procedures which relate to this policy
- make our Employees and Contractors aware of this policy.

Andrew Cole
Managing Director and Chief Executive Officer
February 2016

Figure 18.1: OZ Minerals Environment and Community Policy

18.2 OZ Minerals Performance Standards

The OZ Minerals Performance Standards are a comprehensive set of standards for the management of the Safety Performance, Health and Wellbeing Performance, Environmental Performance and Social performance aspects of OZ Minerals' businesses. These standards apply to all OZ Minerals activities and are subject to periodic review to ensure they continue to meet the needs of the Company.

All performance standards are available on the OZ Minerals website.

Major OZ Minerals contractors have requirements in their contracts consistent with the OZ Minerals Code of Conduct and Performance Standards.

18.3 Safety, Health, Environment and Community (SHEC) Governance

The Safety, Health, Environment and Community (SHEC) model has four tiers, which are 'Leadership', 'Risk Management', 'Safe Workplace' and 'Safe Behaviour' as illustrated in Table 18.1. The effectiveness of each tier is dependent on the effectiveness of the underlying tier and is supported in continuous improvement by the process of Plan – Do – Check – Act.

Table 18.1: Safety, Health, Environment and Community Model

Aspect	Description
Leadership	Strong leadership is the foundation for a positive culture at OZ Minerals and is best demonstrated through living the OZ Minerals Core Values.
Risk Management	Risk Management is critical to minimise potential harm to people, the environment or equipment. All risks must be identified, evaluated and managed to minimise all identified actual and potential adverse impacts.
Safe Workplace	We have a duty of care to provide a safe workplace to our employees by ensuring that plant and equipment is fit for purpose, people are adequately trained and that systems of work are effective.
Safe Behaviour	Safe behaviour of all workers and awareness of environment and community is a culture that we want to develop by coaching and rewarding people and providing them with appropriate safe work instructions.

Contractors have the discretion to establish specific procedures and training packages where OZ Minerals Standards, guidelines and procedures do not cover areas specific to their business or where their SHEC systems provide an equivalent or greater level of protection for their workers, the environment or the community. Where OZ Minerals does not have operational control but has an equity stake where significant OZ Minerals assets are involved, or the activity is deemed to be a 'monitored activity', the OZ Minerals Performance Standards will form the basis for the appropriate level of due diligence to be applied. Operational management of the four tiers is established through implementation of the Environment and Community Management Plan, discussed further in Section 18.3.1.

18.3.1 Stakeholder Engagement

OZ Minerals captures stakeholder engagement activities and feedback on an on-going basis through a stakeholder management system database. The existing monitoring and evaluation mechanisms will be applied and, where required, tailored to enable the ongoing, effective delivery of OZ Minerals engagement activities and the incorporation of, and response to, stakeholder feedback.

OZ Minerals maintains a program of on-going engagement with stakeholders, as identified in Chapter 17 and this will continue over the life of the Project. OZ Minerals will continue to work with stakeholders to ensure engagement activities are meaningful, transparent and occur in a manner that facilitates genuine stakeholder participation.

18.3.2 Secondary Permitting Requirements

OZ Minerals is required to comply with all State and Commonwealth legislation and regulations applicable to the activities undertaken as a part of the construction and operation of the transmission line.

OZ Minerals will comply with all applicable State and Commonwealth legislation and regulations and obtain all necessary approvals prior to activities commencing.

The legislative framework for the Project was described in Chapter 2.2.2. In addition to the primary approval under the Development Act, a number of secondary approvals will also be necessary. Key secondary approvals expected to be required for the Project are summarised in Table 18.2.

Table 18.2: Secondary Approvals Applicable to the Project

Legislation	Agency	Approval
Aboriginal Heritage Act 1988 (SA)	Aboriginal Affairs and Reconciliation	Authorisation to damage / disturb Aboriginal site or object (if required)
Crown Land Management Act 2009 (SA) Pastoral Land Management and Conservation Act 1989 (SA)	Department of Environment and Water (DEW)	Granting of land tenure (easements, licences) over Crown land and pastoral leases
Development Act 1993 (SA)	Department of Planning, Transport and Infrastructure (DPTI) (Planning)	Conditions of consent e.g. Submission of detailed plans, Construction Environmental Management Plan, Traffic Management Plan, Fire and Emergency Management Plan
Electricity Act 1996 (SA)	Essential Services Commission of South Australia (ESCOSA)	Electricity Act licensing / connection agreement
Environment Protection Act 1993 (SA)	Environmental Protection Agency (EPA)	EPA licence(s) Mobile concrete batching Mobile RO batch plant (potable water for construction)

Legislation	Agency	Approval
Fire and Emergency Services Act 2005 (SA)	Country Fire Service (CFS) / approved persons	Hot work permits (fire ban days)
Native Vegetation Act 1991 (SA) and *Native Vegetation Regulations 2017*	DEW, Native Vegetation Council (NVC)	Native vegetation clearance approval (Reg 16 and Schedule 1 Part 6, clause 34)
Natural Resources Management Act 2004 (SA)	DEW	Well permits for drilling wells for construction water (if required)
Natural Resources Management Act 2004 (SA)	DEW, South Australia Arid Lands National Resources Management (SAALNRM)	Water affecting activities permit (if required – not necessary if covered by Development Act approval)
Road Traffic Act 1961 (SA)	DPTI (Traffic)	Works impacting DPTI roads
South Australian Public Health Act 2011 and *South Australian Public Health (Wastewater) regulations 2013*	Department for Health and Wellbeing	Other camp-related approvals e.g. wastewater treatment under SA Public Health (Wastewater) regulations

18.4 Construction Environmental Management Plan

A CEMP will be developed prior to construction. This plan will capture the mitigation and management measures summarised in the assessment Chapters 6 to 16 of this document and any relevant conditions of approval. The CEMP will cover:

- Environmental policy
- Environmental objectives
- Environmental management measures and procedures
- Roles and responsibilities
- Induction and training
- Monitoring and auditing
- Reporting.

A number of other plans will operate in parallel to the CEMP as part of the overall Project management framework. These will provide detailed guidance on specific aspects such as stakeholder communication and emergency response.

All personnel and contractors will be required to comply with the requirements of the CEMP. Periodic audits and inspections will be undertaken during construction to assess compliance with the CEMP and approval requirements.

A draft CEMP is provided in Appendix H. The CEMP will be updated post-approval (and prior to construction) and submitted to the Minister for Planning.

18.5 Operational Environmental Management Plan

Operational management measures mentioned throughout the Development Application will be captured in operational environmental management plans and procedures. Their principal focus will be to ensure that the management measures are being implemented and are effective. They will include adaptive management mechanisms to encourage continuous improvement.

The operational management plans and procedures will cover the elements identified for the CEMP.

18.6 Emergency Response Plan

Emergency response plans (ERPs) will be developed for construction and operation of the Project to guide actions that must be taken to minimise the impacts of accidents and incidents. ERPs will be reviewed and updated on a regular basis to incorporate new information arising from any incidents, near misses and hazards and emergency response simulation training sessions. These plans will also include the facilitation of fire danger season restrictions and requirements.

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20 ABBREVIATIONS AND GLOSSARY

Acronyms

Acronym	Expansion
AADT	Annual Average Daily Traffic
AASS	Actual Acid Sulphate Soils
ABS	Australian Bureau of Statistics
AEMO	Australia Energy Market Operator
AIAA	Americal Institution of Aeronautics and Astronautics
AHD	Australian Height Datum
ASS	Acid Sulphate Soils
BAL	Basic Left Turn Teatment
BAR	Basic Right Turn Treatment
BDBSA	Biological Database of South Australia
BoM	Bureau of Meteorology
CE	Critically Endangered
CEMP	Construction Environment Management Plan
CFS	Country Fire Service
Cth	Commonwealth
DA	Development Application
dBLAeq	Equivalent Continuous Sound Level ????
DEE	Australian Government, Department of the Environment and Energy
DEM	Department for Energy and Mining
DEW	Government of South Australia, Department for Environment and Water (formerly DEWNR, Department of Environment, Water and Natural Resources)
DENWR	Department of Environment, Water and Natural Resources
DOTE	Australian Government, Department of the Environment (Now Department of the Environment and Energy (DEE)).
DPC	Government of South Australia, Department of the Premier and Cabinet (now Department for Energy and Mining)
DPTI	Government of South Australia, Department of Planning, Transport and Infrastructure
DSD-AAR	Department of State Development Aboriginal Affairs and Reconciliation
DSTO	Defence Science and Technology Organisation
DTEI	Department for Transport, Energy and Infrastructure. Now Department of Planning, Transport and Infrastucture (DPTI).
E	Endangered

Acronym	Expansion
ECMP	Environment and Community Management Plan
EIS	Environmental Impact Statement
EPA	Government of South Australia, Environment Protection Authority
ERP	Emergency Response Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EN	Endangered
GAB	Great Artesian Basin
GHG	Greenhouse gas
GIS	Geographic Information System
GSP	Gross State Product
IAF	Impact Assessment Framework
IBRA	Interim Biogeographic Regionalisation for Australia
IDs	Identification numbers
ILUA	Indigenous Land Use Agreement
ISO	International Organisation for Standardization
JV	Joint Venture
LDPs	Land Disturbance Permits
LIDAR	Light Imaging Detection and Ranging
LM	Listed Marine
MM	Migratory Marine
MT	Migratory Terrestrial
MW	Migratory Wetland
MNES	Matters of National Environmental Significance
NEM	National Electricity Market
NNTT	National Native Title Tribunal
No.	Number
NPW Act	*National Parks and Wildlife Act 1972*
NRM	National Resources Management
NRM Act	*Natural Resources Management Act 2004*
NVC	Native Vegetation Council
OCA	Outback Communites Authority
PASS	Potential Acid Sulphate Soils
PLSCADD	Power Line Systems – Computer Aided Design and Drafting
PMST	Protected Matters Search Tool
PV	Photovoltaic
R	Rare
RAAF	The Royal Australian Air Force

Acronym	Expansion
RAM	Rangelands Assessment Method
RFDS	Royal Flying Doctors Service
RO	Reverse Osmosis
ROW	Right of Way
SA	South Australia
SAAL	South Australian Arid Lands
SCAP	State Commission Assessment Panel
SDS	Safety Data Sheets
SEB	Significant Environmental Benefit
SEDMP	Soil Erosion and Drainage Management Plan
SHEC	Safety, Health, Environment and Community
SIC	Southern Infrastructure Corridor
S-P-R	Source- Pathway-Receptor
TSS	Total Suspended Solids
UHF	Ultra High frequency
vpd	Vehicles per day
VU	Vulnerable
V	Vulnerable
WPA	Woomera Prohibited Area

Definition of Terms

Term	Definition
Approval	The act of formally confirming, sanctioning, ratifying or agreeing to something. Approval must be obtained from an appropriate person with accountability or delegated authority.
Aspect	An element of an organisation's activities or products or services that can interact with the environment.
Effect	An effect can occur on a pathway as a result of an aspect/source. It is a deviation from the expected and can be positive and/or negative.
Impact	Any certain and defined change to a receptor, whether adverse or beneficial, wholly or partially resulting from an aspects/source. Note, an impact is not a risk as it is deemed to be certain.
Internal audit	Systematic reviewing of process undertaken internally by experts in specific disciplines.
Linkage	Source-pathway-receptor linkage. A linkage is confirmed where a source affects a pathway and ultimately leads to an impact on an identified receptor. The linkage can be broken by the application of a control strategy or inherent nature of location, e.g., distance to sensitive receptors.
Monitoring	Collection and analysis of environmental data.
Monitoring locations	Monitoring locations are used to demonstrate compliance with the Mineral Lease conditions, outcomes and operational performance.
Project Area	The Project Area has been defined throughout this report as a 500 m wide corridor along the transmission line alignment.
Pathway	The means by which material originating from the source reaches a receptor.
Receptor	A discrete, identifiable attribute or associated entity that is measurably impacted by an effect to a pathway.
Risk	'The impact of uncertainty on objectives' (ISO 31000:2009). It consists of two components—the consequence and its likelihood.
Sensitive receptor	A discrete, identifiable attribute or associated entity that is measurably impacted by an effect to a pathway. Examples of a sensitive receptor are a third party, workers, or a particular species or assemblage of a species.
Source	A natural entity, a specific location or infrastructure component of a project.
Study Area	The term used in specialist reports, which is defined as a 10 km wide corridor along the transmission line alignment.

Units of Measure

Abbreviation	Expansion of Unit
CO_2	Carbon dioxide
d	day
dB	decibel
g	gram(s)
ha	hectare
hr/h	hour
kg	kilogram(s)
km	kilometre(s)
km^2	square kilometre(s)
kV	kilovolt
L	Litres
m	metre(s)
m^2	square metre(s)
m^3	cubic metre(s)
mBGL	metres below ground level
mg	milligram
ML	Mega Litre(s)
Mt	Metric tonne
MW	Megawatt
pa	per annum (per year)
t	tonne(s)
µg	microgram
W	watts

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Appendix A. Section 49 Endorsement

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Government of South Australia
Department of the Premier and Cabinet

GPO Box 2343
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B134060

17 January 2018

Ms Katie Hulmes
Group Manager, Technical Services
OZ Minerals Prominent Hill Operations Pty Ltd
162 Greenhill Rd
PARKSIDE SA 5063

Dear Ms Hulmes

CROWN SPONSORSHIP FOR OZ MINERALS ELECTRICITY TRANSMISSION LINE DEVELOPMENT

Thank you for your letter of 4 January 2018 requesting Crown sponsorship under section 49 of the *Development Act 1993* to assist with the OZ Minerals Port Augusta to Olympic Dam electricity transmission line development.

This project has been considered within the Department of the Premier and Cabinet (DPC) and the Department of Planning, Transport and Infrastructure. In principle, the proposal is supported, recognising the possible environmental and community issues will need to be addressed through the development assessment process.

On balance, the development of the Port Augusta to Olympic Dam electricity transmission line has the potential to benefit South Australia and can be considered public infrastructure. Accordingly, I, as the Chief Executive of DPC, will support the development and specifically endorse the development application to construct the 275 / 132 kVa electricity transmission line project as a development of public infrastructure as required by section 49 of the *Development Act 1993* (the Act).

It is the responsibility of OZ Minerals to prepare all documentation as required by section 49 of the Act. Lodgement of the development application should be through my office to the Development Assessment Commission. All costs in the preparation of the development application, lodgement of the application and any other subsequent action in relation to this application are the responsibility of OZ Minerals.

Note that under section 49 of the Act, any additional documents or information requested by the Development Assessment Commission for the purpose of considering the application for approval must be provided through my office.

In addition the following must be understood:

- I make no representations and give no warranties as to the outcome of the application nor the time taken to secure the outcome;
- I will undertake my obligations as set out in section 49 of the Act at your expense;
- I will pass on to you any approval or refusal to approve the proposed development as may be determined pursuant to section 49 of the Act; and
- I make no commitment that the state will provide any funding to the project or assist in the augmentation of the distribution and transmission network.

In addition, it will be your responsibility to ensure that you obtain all appropriate approvals, licence and connection agreements with the relevant authorities for your project.

A development application must be lodged with the Development Assessment Commission on or prior to 30 June 2019.

If you have any questions regarding the preparation of the material to support this section 49 application, please contact Mr Michael Smith on (08) 8463 3082.

Yours sincerely

Dr Don Russell
CHIEF EXECUTIVE

Appendix B. Preliminary Plans of the Alignment for the Proposed Transmission Line

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CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

Preliminary Plans of the Alignment for the Proposed Electricity Transmission Line

July 2018

DISCLAIMER

This document has been prepared for submission to the South Australian State Commission Assessment Panel under the *Development Act 1993* (SA). No one other than the South Australian Minister for Planning should rely on the information contained in the Development Application to make, or refrain from making, any decision.

In preparing the document, OZ Minerals Prominent Hill Operations Pty Ltd has relied on information provided by specialist consultants, government agencies and other third parties. OZ Minerals Prominent Hill Operations Pty Ltd has not fully verified the accuracy or completeness of that information, except where expressly acknowledged in the Development Application.

The document has been prepared for information purposes only and, to the full extent permitted by law, OZ Minerals Prominent Hill Operations Pty Ltd, in respect of all persons other than the South Australian Minister for Planning:

- Makes no representation and give no warranty or undertaking, express or implied, in respect to the information contained herein; and
- Does not accept responsibility and is not liable for any loss or liability whatsoever arising as a result of any person acting, or refraining from acting, on any information contained in this document.

NOTE ON CURRENCY

Where possible, the information contained in this document are up to date as at July 2018. This was not possible where parts of the document were prepared from information provided by third parties (as discussed in in the second paragraph above) prior to the document being finalised.

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LIST OF FIGURES

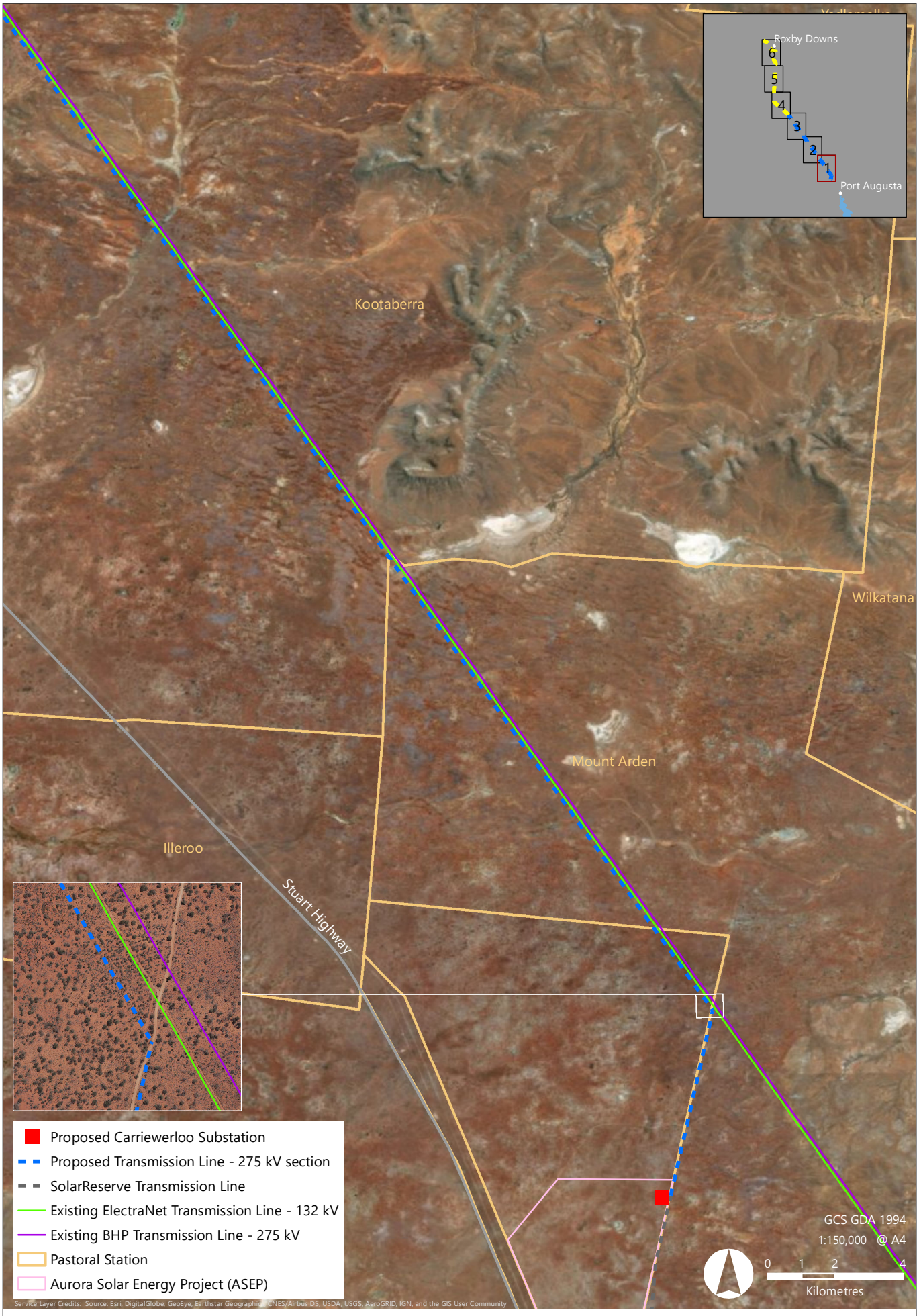

Figure B.1: Preliminary Plans of the Proposed Transmission Line - 1

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

Figure B.2: Preliminary Plans of the Proposed Transmission Line - 2

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

Figure B.3: Preliminary Plans of the Proposed Transmission Line - 3

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

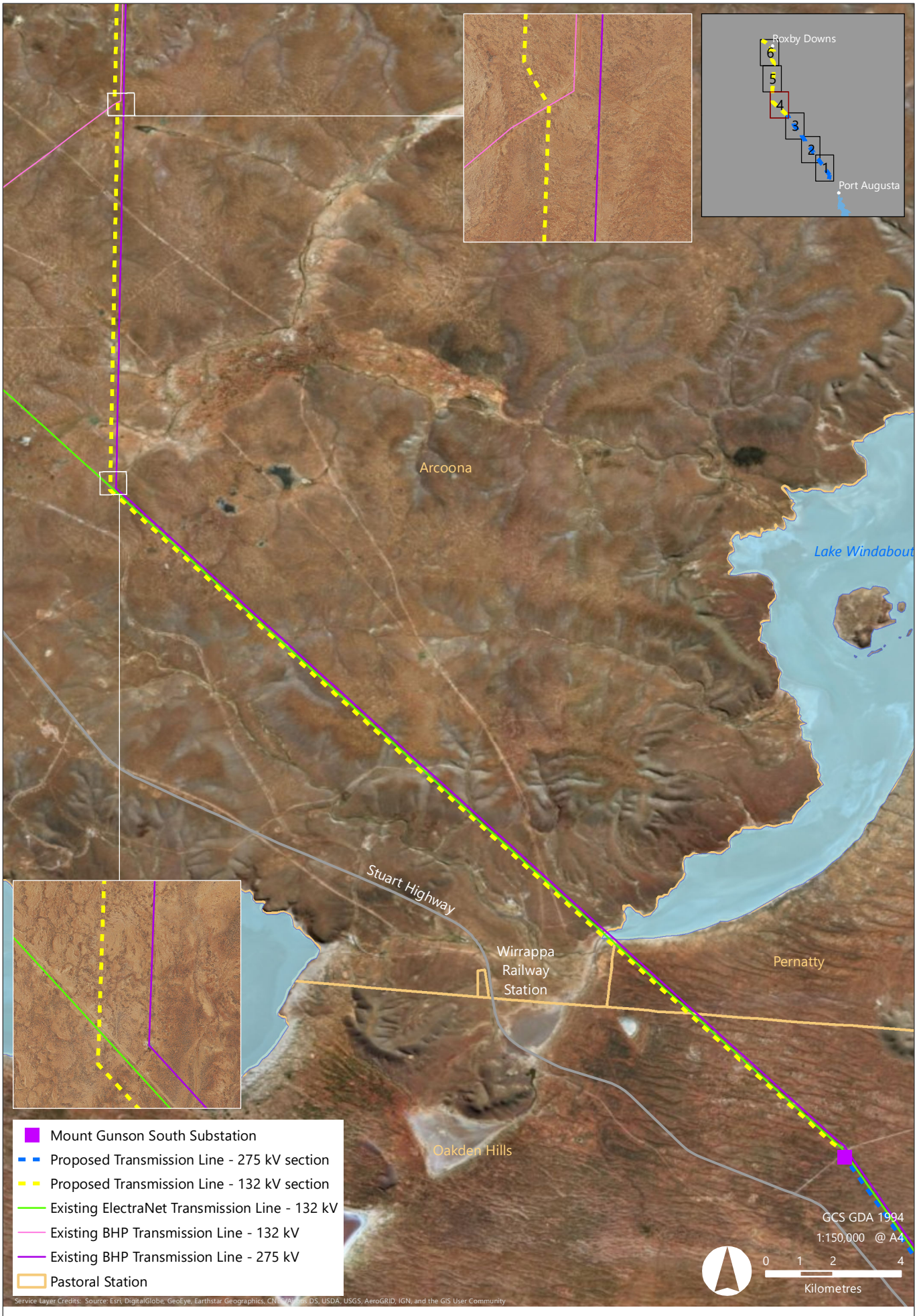

Figure B.4: Preliminary Plans of the Proposed Transmission Line - 4

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

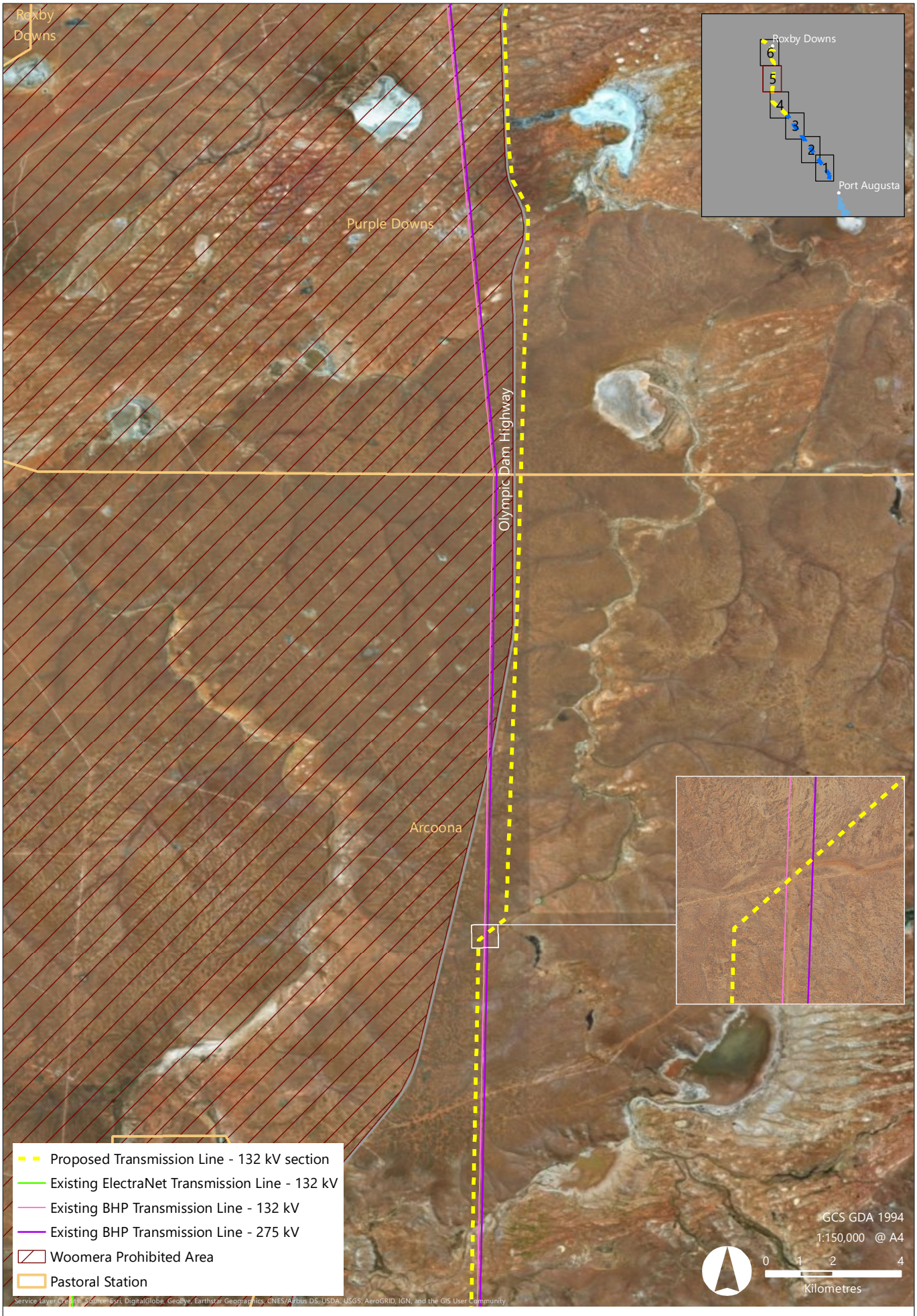

Figure B.5: Preliminary Plans of the Proposed Transmission Line - 5

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

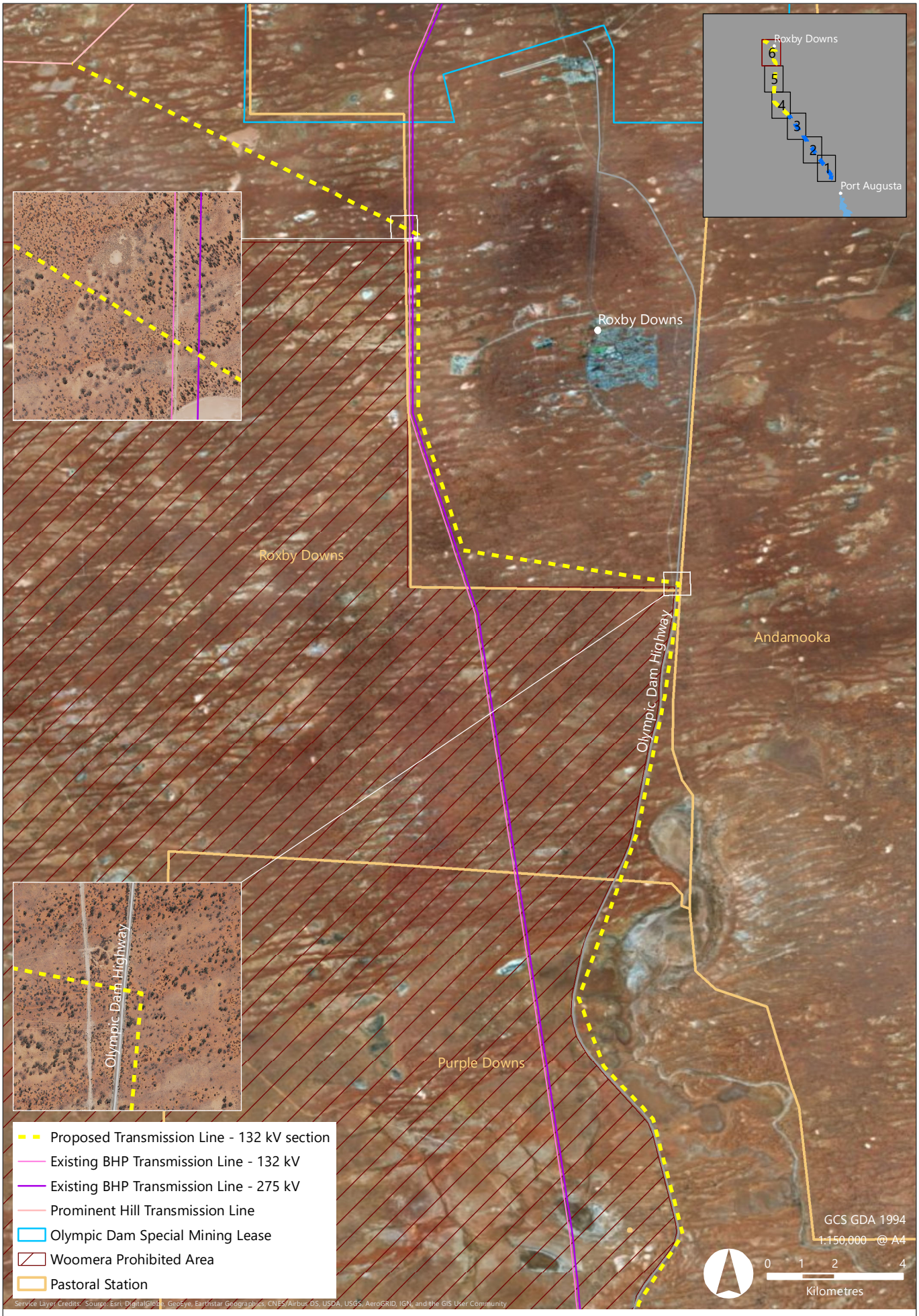

Figure B.6: Preliminary Plans of the Proposed Transmission Line - 6

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE


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Appendix C. Development Plan Assessment

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CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

Development Plan Assessment

July 2018

ACKNOWLEDGEMENT

OZ Minerals recognises that the sense of place and belonging of the Kokatha People and the Barngarla People is linked to their identity, creation stories, travel, trade, ceremonies, family and places held sacred. We recognise the deep and ongoing feelings of relationship and attachment they hold for their lands.

OZ Minerals acknowledges both the Kokatha and Barngarla connection to 'country', the contribution of Traditional Owners to their region and the enduring importance of values, cultural authority, cultural norms and customary laws.

The Far North region of South Australia also has a long and rich history of pastoralism. The proposed Electricity Transmission Line Project is located on a number of Pastoral Stations. OZ Minerals recognises the importance of the land to its owners and their operations and acknowledges their cooperation in developing the Project.

OZ Minerals places great value on our relationships with all stakeholders and seek to work in partnership, to create value wherever possible.

DISCLAIMER

This Report has been prepared for submission to the South Australian State Commission Assessment Panel under the *Development Act 1993* (SA). No one other than the South Australian Minister for Planning should rely on the information contained in this Report to make, or refrain from making, any decision.

In preparing this Report, OZ Minerals Prominent Hill Operations Pty Ltd has relied on information provided by specialist consultants, government agencies and other third parties. OZ Minerals Prominent Hill Operations Pty Ltd has not fully verified the accuracy or completeness of that information, except where expressly acknowledged in this report.

This Report has been prepared for information purposes only and, to the full extent permitted by law, OZ Minerals Prominent Hill Operations Pty Ltd, in respect of all persons other than the South Australian Minister for Planning:

- Makes no representation and give no warranty or undertaking, express or implied, in respect to the information contained herein; and
- Does not accept responsibility and is not liable for any loss or liability whatsoever arising as a result of any person acting, or refraining from acting, on any information contained in this Report.

NOTE ON CURRENCY

Where possible, the information contained in this Report are up to date as at July 2018. This was not possible where parts of this Report were prepared from information provided by third parties (as discussed in in the second paragraph above) prior to this Report being finalised.

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1 OVERVIEW

This Appendix provides an assessment of the Project against the relevant Development Plans established under the *Development Act 1993* (SA).

The transmission line alignment traverses three Development Plan areas:

- Land Not Within a Council Area (Flinders)
- Land Not Within a Council Area Eyre, Far North, Riverland and Whyalla (specifically 'Far North')
- Roxby Downs (Municipality) Development Plan

Compliance with these plans is discussed below and in more detail in Chapter 2. Of note is that construction and operation of the transmission line will:

- Require minimal clearing of vegetation. Laydown and other construction areas will be revegetated following construction. An offset will also be provided to ensure a significant environmental benefit. As vegetation along the alignment consists of low woodland and shrubland, extensive trimming of vegetation for fire protection is unlikely to be required. This means permanent loss of vegetation is only expected to occur for the tower footings and access track.
- Have negligible effect on other natural processes. The small and dispersed footings for the towers will not affect surface water movement. Construction areas will be stabilised and revegetated. The transmission line is unlikely to result in erosion and sedimentation.
- Avoid disturbance to areas of heritage sensitivity. Based on the results of the background research, initial field surveys and planned detailed survey and avoidance measures, the alignment will not affect sites of significance to Aboriginal archaeology, anthropology, history or tradition. No sites of historical significance have been identified along the alignment.
- Result in some changes to visual amenity along the alignment. It is acknowledged that the transmission line will be a visual feature in the landscape, particularly where the alignment runs alongside the Olympic Dam Highway. While this impact is not ideal, the necessity of this infrastructure to support other key objectives for the region is acknowledged in all three the Development Plans and the key scenic values of the landscape will not be undermined. Transmission lines and other 'service' infrastructure are already a common feature in this rural landscape and the proposed development will be no more perceptible than these existing structures. Visual impacts are discussed in detail in Section 12 of the Development Application.
- Have no other significant impacts on the biophysical or social environment.

Environmental impacts will be managed through a Construction Environmental Management Plan and an Operational Environmental Management Plan.

1.1 Land Not Within a Council Area (Flinders) Development Plan

This Development Plan sets out objectives and principles of development control for the Flinders Region and Council-wide. Of most relevance are those objectives and principles addressing conservation and scenic values. As noted above, environmental impacts are expected to be minimal, including visual amenity impacts as the alignment in this area is four to six kilometres from the Stuart Highway and for the most part parallels existing transmission lines.

1.1.1 Pastoral Zone

The southern 25 km of the 275 kV section of the transmission line traverses land within the 'Flinders' Development Plan. The alignment is wholly within the Pastoral Zone. Relevant objectives of this zone are:

- the preservation of the natural environment and character of the zone
- predominant activities are those that relate to the grazing of livestock.

Other than very limited visual impacts, the transmission line preserves the natural environment and character of the zone. Further, the land beneath the proposed transmission lines will not be fenced and therefore livestock grazing can continue on and under this infrastructure with minimal impact on stock movement.

The transmission line is not considered to be at variance with this Development Plan.

1.2 Land Not Within a Council Area Eyre, Far North, Riverland and Whyalla

This Development Plan includes a section on the State Strategic Setting which notes the importance of mining development within this area and the need for strategic infrastructure assets. The Development Plan also includes a Regional Strategic Setting, with the Far North section covering much of the transmission line alignment. As the Far North area is considered to be environmentally sensitive due to its aridity, developments should take care not to significantly interfere with natural processes.

1.2.1 Remote Areas Zone

The vast majority of the proposed transmission line traverses the 'Far North' Development Plan, specifically 84 km of the 275 kV section of the transmission line and 113 km of the 132 kV section. The full extent of the infrastructure falls within the Remote Areas Zone under this Development Plan. The objectives include the development of the zone to reflect sustained growth in mining and petroleum exploration and other activities and to accommodate petroleum and mining related settlements and

infrastructure in areas that are not in sensitive (from either an environmental or cultural perspective), subject to hazards or close to towns.

The Principles of Development Control include forms of development envisaged within the zone, such as industry in association with mining. The transmission line is consistent with that principle as it is infrastructure that will support OZ Minerals' mining operation in the region. A further principle states that the 'natural features and scenic beauty of the zone should be protected'. The development is generally consistent with that principle in that it is not located in any sensitive or hazardous areas and the main impact is of visual amenity from sections of the Olympic Dam Highway, where the view is already affected due to the existing transmission lines.

As discussed above, the transmission line presents a low risk to the environment.

The transmission line does not introduce a new element into the landscape and is not considered to be at variance with this Development Plan.

1.3 Roxby Downs (Municipality) Development Plan

This Development Plan sets out Council-wide objectives and principles of development control, including the recognition of the importance of exploration and mining. The region contains many areas which have the potential for major mineral discoveries which would likely result in further development. To support this, one of the objectives is that economic resources need to be developed in a matter that benefits the community, socially, economically and environmentally and that cultural interests of the Aboriginal communities are protected.

Further, this Development Plan notes that the Far North is dependent on growth in mining, tourism and their related service industries and that due to the dry, arid nature of the environment and the distance from markets, expansion of other industries is unlikely.

Objectives also include that, where possible, development should benefit settlements and should meet adequate standards for public safety, convenience, economy and amenity.

One of the Principles of Development Control states that where a development is taking place outside of a settlement, it must be demonstrated that there is good reason to do so and that the development will contribute positively to the economic development of the region

The transmission line presents a low risk to the environment and notable impacts are restricted to those of visual amenity. The transmission line is vital to the ongoing mining operations at Prominent Hill, which in turn provide royalties to the Crown for the benefit of all communities.

The development is therefore broadly consistent with the objectives and principles of this Development Plan.

The 132 kV section of the transmission line crosses two zones under this Development Plan, the Buffer Zone and the Rural Landscape Zone, for approximately 11 km and 5 km respectively. Existing 275 kV and 132 kV transmission lines also traverse both of these zones. The presence of the Woomera Prohibited Area to the south of the Buffer Zone (and the alignment of the existing transmission lines) means that these zones cannot be avoided.

1.3.1 Buffer Zone

As implied by its title, the Buffer Zone acts as a physical separation between the 'special uses' mining activities which occur in Roxby Downs and ensures unsuitable forms of development do not occur within proximity of the town's mining activities. While buildings and land uses, other than retention of the existing open vegetated landscape are not encouraged, Map Rox/1 (Overlay 1) within the Development Plan identifies a 'services corridor' through the Zone, an acknowledgement that infrastructure such as transmission lines may traverse the Zone. An extract of this Map is illustrated below.

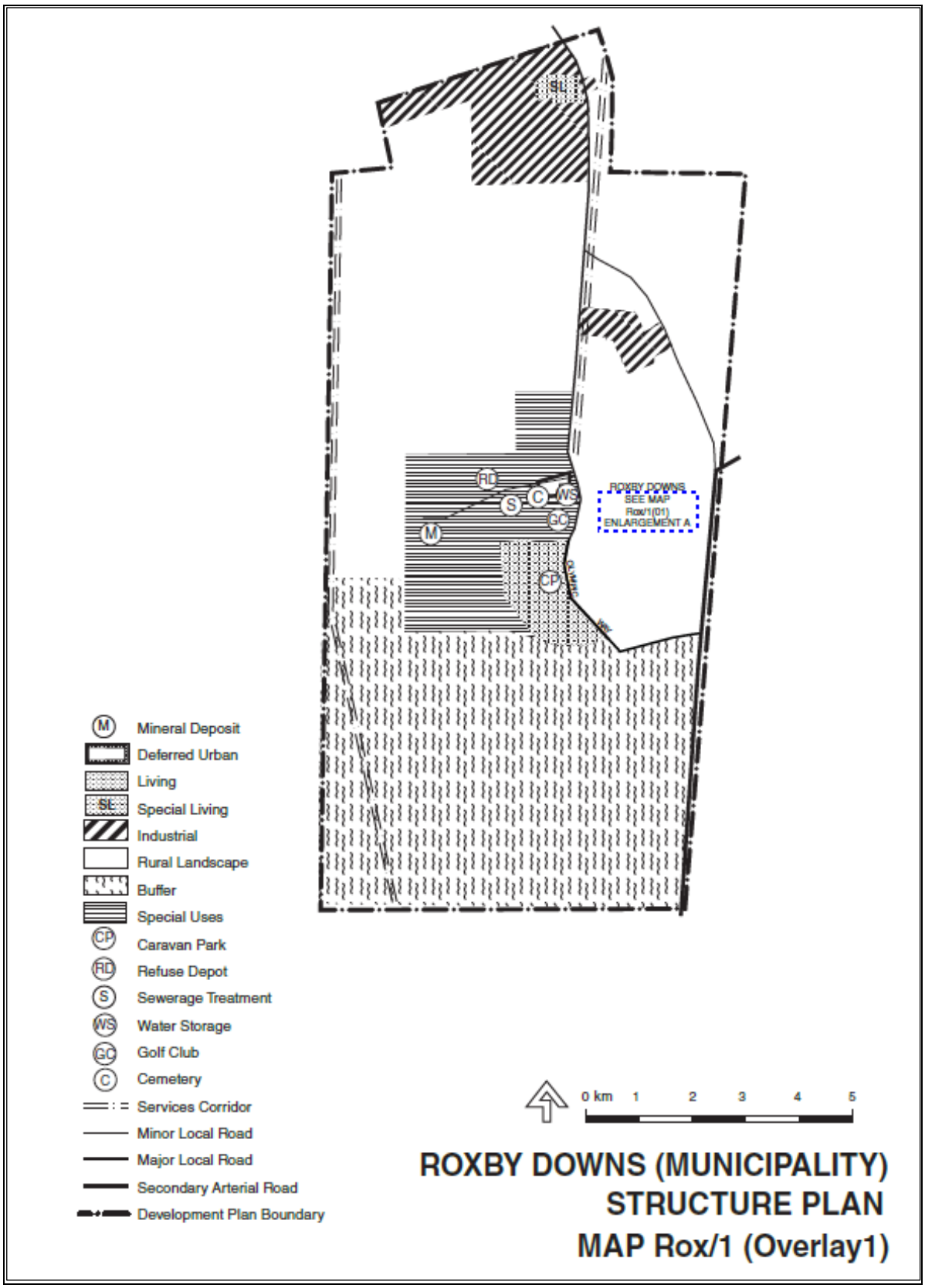

Figure 1.1: Roxby Downs (Municipality) Development Plan Map Rox/1 (Overlay 1)

A key objective of the Buffer Zone is to preserve the 'natural open character of the zone and the regeneration of the natural vegetation'. Further, the Principles of Development Control of the Zone state that 'Development undertaken in the zone should comprise only those uses that contribute to natural regeneration or the use of the zone for passive recreation'. All forms of development are 'non-complying' within this zone with the exception of public toilets and shelters.

Notwithstanding the discouragement of most forms of development, installation of the transmission line will maintain the natural open character of the surrounding landscape, albeit with some additional visual impacts. This will be minimised by the placement of the transmission line adjoining the existing BHP transmission lines in part of the zone. Installation of the proposed transmission line within (or in close proximity to) the identified 'services corridor' is suitable and consistent with the implied intention of the zone.

1.3.2 Rural Landscape Zone

The objective of the Rural Landscape Zone is: 'The preservation of the natural open character of the zone and the regeneration of the natural vegetation, with recreational uses occurring in suitable parts of the zone'. The Principles of Development Control note that development in the zone 'should only comprise those uses that contribute to the natural regeneration of the area or are necessary for community recreation'.

While the proposed infrastructure is not specifically envisaged in the Zone, Map Rox/1 (Overlay 1) previously illustrated references a 'services corridor' for the placement of infrastructure along the far west boundary of the Rural Landscape Zone. The proposed transmission line will follow this corridor alignment as closely as possible (as it does in the Buffer Zone) and as such, has minimal protrusion into the Rural Landscape Zone. This alignment is also adjacent the existing transmission lines on the western boundary of this zone, ensuring suitable co-location of infrastructure to minimize its impact.

Furthermore, all areas disturbed for construction will be revegetated and the proposed transmission line will not compromise regeneration of natural vegetation.

While the placement of the structure will have some impact on the open character of the landscape, the visual influence will be localised, and the uniformity and repetitive pattern of this infrastructure will make it less evident in the landscape, with the lines no more perceptible than the existing transmission towers. This is true within both of the Roxby Downs Development Plan Zones.

While not necessarily an envisaged form of development in either zone, the installation of the transmission lines appears to be somewhat anticipated due to the identified 'services corridor' and will not compromise the achievement of the Development Plan's overall objectives and principles for either of these two zones.

2 ASSESSMENT AGAINST DEVELOPMENT PLANS

The following tables provide a detailed assessment against the Objectives and Principles of Development Control of the relevant Development Plans.

2.1 Land Not Within a Council Area (Flinders) Development Plan

Objective/Principle	Assessment
Flinders – Objectives	
Form of development	The location of the transmission line in the Pastoral Zone does not compromise the orderly development of the Council area.
Centres and shops	Not relevant to this development.
Movement of people and goods	The transmission line does not affect the operation of the road or any transport network.
Mining	No mining is proposed in the Council area.
Conservation	The transmission line does not affect areas recognised as having significant environmental value and visual significance. The alignment proposed is four to six kilometres from the Stuart Highway and for the most part, parallels existing transmission lines. Laydown and other areas disturbed for construction activities will be rehabilitated and revegetated at the completion of construction. The limited removal of vegetation required for the towers, maintenance road and laydown areas will have a negligible impact on other environmental values such as soils, water and fauna.
Open space	The transmission line does not affect any parks and reserves.
Appearance of land and buildings	While the lines will be a new visual element in the landscape, the alignment of the transmission line seeks to minimise visual impacts by locating in proximity of other similar infrastructure.
Rural development	The transmission line is not in Class A or B environmental areas.
Country townships, Outdoor advertisements, Coastal areas	Not relevant to this development.
Flinders – Principles of development control	
Centres and shops, Outdoor advertisements	Not relevant to this development

Objective/Principle	Assessment
Council wide – Objectives	
Coastal development, Telecommunication facilities, Renewable energy facilities	Not relevant to this development
Council wide – Principles of development control	
Form of development	The transmission line does not involve residential or commercial development. Areas disturbed for construction will be rehabilitated and revegetated. The CEMP will include measures to minimise soil erosion and sedimentation. The small footprint for the towers will have negligible impact on surface water movement. Vegetation along the alignment consists of low woodland and shrubland. Such vegetation is unlikely to come into contact with the conductors and, therefore, bushfire risk is low. The CEMP will include measures to reduce fire risk during construction activities, including limiting of activities on days of high fire danger.
Land division	No subdivision of land is proposed
Movement of people and goods	The transmission line does not affect the operation of the road or any transport network
Public utilities	The transmission line alignment minimises adverse environmental impacts. It avoids environmentally sensitive areas.
Mining	No mining is proposed in the Council area.
Conservation	The transmission line does not affect areas recognised as having visual significance. Laydown and other areas disturbed for construction activities will be rehabilitated and revegetated at the completion of construction. The limited removal of vegetation required for the towers, maintenance road and laydown areas will have a negligible impact on other environmental values such as soils, water and fauna.
Appearance of land and buildings	The alignment for the transmission line minimises visual impacts within the Council area.
Coastal areas	Not relevant to this development
Environmental protection	The small footprint for the towers for the transmission line will have a negligible impact on natural drainage systems. The transmission line will not impact groundwater.
Preservation of scenic, heritage and other values	The alignment for the transmission line minimises visual impacts within the Council area and the alignment in this area is four to six kilometres from the Stuart Highway and for the most part parallels existing transmission lines. The alignment does not affect any sites of significance.
Maintenance of public access	Not relevant to this development
Hazard risk minimisation	Flood events that would be hazardous to the transmission line are unlikely to occur along the alignment.
Protection of physical and economic resources	The transmission line does not affect coastal areas.

Objective/Principle	Assessment
Settlement, tourist facilities, marinas and other development in appropriate zones, No premature development, Redevelopment of unsatisfactory areas, telecommunication facilities, Renewable energy facilities	Not relevant to this development.
Pastoral Zone	
Objectives	The development will have a limited visual impact, similar to other existing transmission lines in the Pastoral Zone. Otherwise, it will not affect the natural environment of the zone.
Principles of development control	The primary function of the zone for livestock grazing will not be compromised by the proposed installation of the transmission line. Further, the development will have a nominal visual impact as it is similar to existing transmission lines in the Pastoral Zone. The natural or scenic features of the zone will not be affected to such a degree that the proposed essential infrastructure should not be supported.

2.2 Land Not Within a Council Area Eyre, Far North, Riverland and Whyalla Development Plan

Objective/Principle	Assessment
State Strategic Setting	This section notes the importance of mining development within this area Far North area and the need for strategic infrastructure assets.
Regional Strategic Setting – Far North section	The Regional Strategic Setting covers much of the transmission line alignment. As the area is considered environmentally sensitive due to its aridity, development must take care not to significantly interfere with natural processes.
Hazards	The transmission line alignment is not in an area with a significant risk from natural hazards. The alignment is not subject to hazardous flooding events. Broadly, in the northern section of the alignment the low gradients and nature of terminal drainage features (i.e. clay pans and salt lakes) of the Roxby and Arcoona land systems leads to the pooling of water following rainfall events. The highly permeable sandy soils of the Hesso land system in the southern section of the route alignment (south of Pernatty Lagoon to Port Augusta) allow rapid infiltration surface waters, and surface ponding occurs only after significant storm events. However, the flat terrain can lead to widespread ponding when such events occur. These are low energy events that will not affect the tower footings. Vegetation along the alignment consists of low woodland and shrubland. Such vegetation is unlikely to come into contact with the conductors and, therefore, bushfire risk is low. The CEMP will include measures to reduce fire risk during construction activities, including limiting of activities on days of high fire danger. Areas disturbed for construction will be rehabilitated and revegetated. The CEMP will include measures to minimise soil erosion and sedimentation. The current and past land uses on the transmission line alignment are unlikely to have resulted in site contamination. Measures will be included in the CEMP in case any site contamination is encountered. Potential acid sulfate soils may be encountered on the alignment near salt lakes. Generally, towers can be located outside these areas. The CEMP will include measures to manage any potential acid sulfate soils are disturbed during construction activities, they will be managed
Heritage conservation and places	The proposed alignment avoids disturbance to areas of heritage sensitivity. Based on the results of the background research, initial field survey and planned detailed survey and avoidance measures, the alignment will not affect sites of significance to Aboriginal archaeology, anthropology, history or tradition. No sites of historical significance have been identified along the alignment. The CEMP will include measures to appropriately manage any unexpected finds. The alignment does not impact on any place listed in Table LNWCA/3 – State Heritage Places.
Infrastructure	Installation of the infrastructure is economically sensitive and will be managed in an environmentally sensitive manner. Development of the proposed alignment has considered a range of planning requirements including:

Objective/Principle	Assessment
	• Environmental constraints analysis (e.g., important habitat and surface water features) • Social constraints analysis (e.g., heritage, buildings, receptors, land uses) • Infrastructure constraints analysis (e.g., roads, pipelines, power infrastructure) • Access restrictions posed by Defence in the Woomera Prohibited Area • Future planned infrastructure • Prescribed centreline clearance distances for buildings and structures and infrastructure (as per the *Electricity (General) Regulations 2012*).
Interface between land uses	The transmission line has been aligned to minimise impacts of other land uses and will not impact community health. Construction noise, traffic and other impacts will be managed through the CEMP.
Natural resources	The transmission line requires minimal clearing. Laydown and other construction areas will be revegetated following construction. An offset will also be provided to ensure a significant environmental benefit. Soil erosion, stormwater and vegetation impacts will be managed through a CEMP.
Open space and recreation	The transmission line will not affect areas designated for open space and recreation.
Siting and visibility	While the transmission line will be visually apparent from the Olympic Dam Highway and, at times, from the Stuart Highway, the uniformity and repetitive pattern of this infrastructure will make it less evident in the landscape and the lines will be no more perceptible than existing transmission towers within the locality.
Remote Areas Zone	
Objectives	The transmission zone reflects the objectives of this zone as it is an infrastructure development that will support envisaged (and encouraged) mining operations in the region and is not located within sensitive environmental, cultural or hazardous areas or close to towns. Where relevant grazing activities can continue in proximity to the infrastructure. The key objectives for the zone are directly supported through the provision of the transmission lines.
Principles of development control	The transmission line is generally consistent with the Land Use principle of development control as it is infrastructure that will support OZ Minerals' mining in the region which in turn benefits the community. The development is not in any sensitive or hazardous areas and the most notable impact is restricted to localised visual amenity, with the most visible location being from the Olympic Dam Highway which is already affected by the existing BHP transmission lines. The defined corridor proposed for the development work ensures that the natural features and scenic beauty of the zone are not compromised by the proposal.

2.3 Roxby Downs (Municipality) Development Plan

Objective/Principle	Assessment
Far North - Objectives	
Form of development	The proposed alignment for the electricity transmission line avoids residential and other sensitive land uses. The alignment is placed to minimise disturbance to existing land use. The transmission line will be visually apparent from the Olympic Dam Highway at the southern boundary of the buffer area but it then traverses to the west to meet the BHP lines and follows them through most of the Development Plan area. Based on the results of the background research and initial field survey and planned detailed survey and avoidance measures, the alignment will not affect sites of significance to Aboriginal archaeology, anthropology, history or tradition. The transmission line will allow mining to continue at Prominent Hill to the benefit of the community. The objectives of this Development Plan recognise the importance of mining to the region, note the high potential for mineral discoveries and encourage related service industries and infrastructure to facilitate these outcomes including the provision of electricity.
Conservation	The proposed alignment avoids disturbance to areas of heritage value or environmental significance. The limited removal of vegetation required for the towers, maintenance road and laydown areas will have a negligible impact on other environmental values such as soils, water and fauna. Laydowns and other areas disturbed for construction activities will be rehabilitated and revegetated at the completion of construction.
Outdoor advertisements	No outdoor advertisements are proposed.
Far North – Principles of Development Control	
Form of development	The transmission line does not involve any new urban development or settlements. The land is considered suitable for the proposed use taking into account environmental, social and economic matters. Installation of the transmission lines will contribute positively to the economic development of the region by supporting ongoing mining operations at the Prominent Hill mine, to the benefit of the community and the State.
Movement of people and goods	The transmission line will not affect the movement of people and goods. The existing road network will not be altered by the infrastructure and neither will access into adjoining land holdings.
Commercial development	The transmission line does not involve commercial development.
Mining	The transmission line enables ongoing mining and rehabilitation at Prominent Hill.
Conservation	The proposed alignment avoids disturbance to areas of environmental or heritage sensitivity. Laydown and other areas disturbed for construction activities will be rehabilitated and revegetated at the completion of construction. The limited removal of vegetation required for the towers, maintenance road and laydown areas will have a negligible impact on other environmental values such as soils, water and fauna.
Appearance of land and buildings	No roadside advertising is proposed.

Objective/Principle	Assessment
Outdoor advertisements	No outdoor advertisements are proposed
Non- complying development	The transmission line does not involve advertisements.
Council Wide – Objectives	
Form of development	The transmission line does not involve any new urban development or settlements. It will not affect any transport networks, recreation or community facilities or have any impact on community health. Visual amenity impacts will be minimised through placing the transmission line alongside the existing BHP lines where this is practicable.
Waste disposal (landfill)	The transmission line will not require the creation of any new landfills.
Telecommunication facilities	The transmission line will not affect any telecommunication facilities.
Hazards	The current and past land use on the transmission line alignment is unlikely to have resulted in site contamination. Measures will be included in the Construction Environmental Management Plan (CEMP) in the event that any site contamination is encountered.
Interface between land uses	The transmission line will allow existing land uses to continue.
Water sensitive urban design	Not relevant to this development.
Sustainable development	The transmission line does not involve new residential, commercial or industrial buildings.
Energy efficiency	Not relevant to this development.
Native vegetation	The alignment minimises impacts on native vegetation and avoids areas of significance. A vegetation offset will be provided to ensure a significant environmental benefit.
Renewable energy facilities	Not relevant to this development
Council Wide – Principles of Development Control	
Form of development	The transmission line does not involve urban development.
Residential development	The transmission line does not involve residential development.
Garages, carports and outbuildings	Not relevant to this development.
Street and boundary setbacks	Not relevant to this development.
Car-parking and access	Appropriate car parking will be provided for construction activities. Operation will only require occasional maintenance vehicles.

Objective/Principle	Assessment
Site coverage; Private open space; Site facilities and storage; Visual privacy; Dependent accommodation; Swimming pools and outdoor spas; Building near airfields; Crime prevention; Centres and shops	Not relevant to this development
Movement of people and goods	OZ Minerals is in discussion to determine whether BHP's access tracks may be used where possible to minimise construction of new tracks. During construction, there will be a minor increase in traffic on the adjacent roads. Consultation will be undertaken before construction with the appropriate roads authority regarding works which may affect roads or traffic. A Traffic Management Plan will be developed prior to construction.
Development in industry zones	Not relevant to this development.
Noise and air quality	Construction activities are not anticipated to generate significant quantities of dust as ground disturbance along the corridor will be short-term and limited in extent. A CEMP will be prepared prior to construction which will detail standard measures to minimise dust emissions. The transmission line is not expected to have any significant air quality impacts, primarily based on the transient nature and limited-scale of construction along the corridor, the separation distance to sensitive receivers, and the implementation of standard construction dust control measures. Noise impacts are also expected to be minimal due to the distance to receptors. Noise management will be addressed in the CEMP prior to construction. Noise-control measures would involve controls on noise sources, including mufflers and maintenance of machinery, as well as appropriate timing of noisy activities.
Interface between land uses	The transmission line will not generate significant noise or air pollution.
Land division	The transmission line does not involve land division.
Waste disposal (landfill)	The transmission line does not include a landfill.
Open space and recreation	The transmission line does not affect any areas of public open space.
Conservation	The proposed alignment avoids disturbance to areas of environmental or heritage sensitivity. Laydown and other areas disturbed for construction activities will be rehabilitated and revegetated at the completion of construction. The limited removal of vegetation required for the towers, maintenance road and laydown areas will have a negligible impact on other environmental values such as soils, water and fauna.
Water sensitive design	Not relevant to this development.
Appearance of land and buildings	Areas disturbed for construction activities will be rehabilitated and revegetated following construction. No new buildings are proposed in the Development Plan area.

Objective/Principle	Assessment
Residential parks and caravan and tourist parks; Telecommunication facilities	Not relevant to this development.
Site contamination	The current and past land use on the transmission line alignment is unlikely to have resulted in site contamination. Measures will be included in the CEMP in case any site contamination is encountered.
Renewable energy facilities	Not relevant to this development.
Buffer Zone	
Objectives	The transmission line will maintain the natural open character of the Buffer Zone albeit with some visual impacts. This will be minimised by the placement of the transmission line within (or as close as possible to) the identified 'services corridor' and adjoining the existing BHP lines. The transmission line will not prevent regeneration of vegetation within the Buffer Zone.
Principles of development control	The transmission line will not prevent natural regeneration of the zone or its use for passive recreation. While virtually all forms of development are listed as non-complying within this Zone, the identified 'services corridor' on Development Plan Map Rox/1 (Overlay 1) identifies that the installation of key service infrastructure required for the successful operation of valuable land use activities such as mining, is anticipated and supported. Accordingly, the proposal is broadly supported by the Zones policy provisions.
Rural landscape zone	
Objective	The transmission line will maintain the natural open character of the Buffer Zone albeit with some visual impacts. This will be minimised by the placement of the transmission line within (or as close as possible to) the identified 'services corridor' and adjoining the BHP lines in this zone. The transmission line will not prevent regeneration of vegetation within the Buffer Zone.
Principles of development control	While transmission lines are not an envisaged form of development, their construction will not compromise the natural regeneration of the area and their placement along the far western boundary of the zone ensure that encouraged activities (e.g. community recreation) can occur with minimal interruption. Other principles in the Zone are achieved, including that all areas disturbed for construction will be revegetated. Measures to manage erosion and minimise impacts on vegetation will be included in the CEMP.

Appendix D. Ecology Assessment

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Appendix D1. Ecology Baseline Assessment

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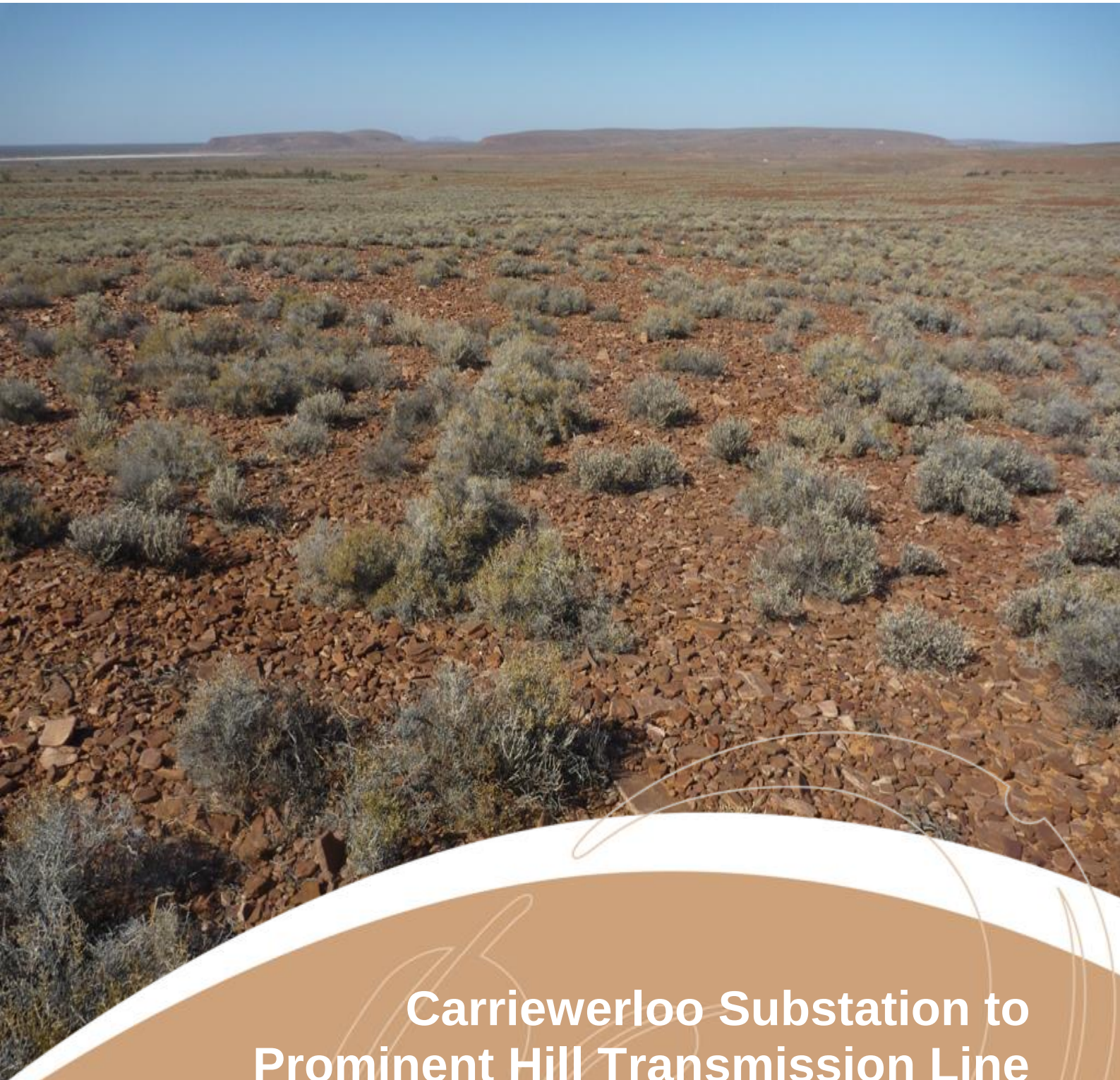

Carriewerloo Substation to Prominent Hill Transmission Line

Ecological Baseline Assessment

Carriewerloo Substation to Prominent Hill Transmission Line Ecological Baseline Assessment

12 June 2018

Prepared by EBS Ecology for OZ Minerals

EBS Ecology Project Number: E80110

CITATION: OZ Minerals (2018) Carriewerloo Substation to Prominent Hill Electricity Transmission Line Development Application, Appendix D1 Ecology Baseline Assessment. Developed by EBS Ecology for OZ Minerals. June 2018. Adelaide.

Cover photograph: *Atriplex vesicaria* / *Tecticornia medullosa* Low Open Shrubland.

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GLOSSARY AND ABBREVIATION OF TERMS

ALA	Atlas of Living Australia
BDBSA	Biological Database of South Australia (maintained by DEW)
DEW	Department of Environment and Water (formly known as DEWNR)
DPTI	Department of Planning Transport and Infrastructure
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
DotEE	Department of the Environment and Energy (formerly DSEWPC)
EBS	EBS Ecology
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
IBRA	Interim Biogeographic Regionalisation for Australia
NPW Act	*National Parks and Wildlife Act 1972*
NV Act	*Native Vegetation Act 1991*
NVC	Native Vegetation Council
PMST	Protected Matters Search Tool (under the EPBC Act, maintained by DotEE)
Project	The proposed Carriewerloo Substation to Prominent Hill transmission line
Project Area	The proposed transmission line corridor (500 m, 250 m either side of the existing transmission line)
RAM	Rangelands Assessment Method
Regional Study Area	Area External to the Study Area
SEB	Significant Environmental Benefit
SIC	Southern Infrastructure Corridor – assessed in the Olympic Dam Expansion EIS
Study Area	Area surrounding the Project Area with a 5km buffer each side
TEC	Threatened Ecological Community

EXECUTIVE SUMMARY

EBS Ecology was contracted by OZ Minerals to conduct an ecological baseline assessment for the proposed Carriewerloo Substation to Prominent Hill Electricity Transmission Line Project (the Project). The assessment comprised of a desktop study and field survey to determine how matters of Commonwealth and state environmental significance may be impacted by the proposed development. The Project Area consists of the 500 m transmission line corridor, which includes the proposed alignment and a 250 m buffer either side. The Study Area for the desktop component of the ecological baseline assessment (i.e. database searches, review of existing biological surveys, data and mapping) included a 5 km buffer along both sides of the proposed transmission line alignment (i.e. 10 km corridor).

The desktop study used data accessed via the Protected Matters Search Tool (PMST) to identify nationally threatened species potentially occurring in the Project Area, as well as other matters of national environmental significance protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Biological Database of South Australia (BDBSA) was also used to identify records of any threatened species listed under the *National Parks and Wildlife Act 1972* (NPW Act) and the EPBC Act within the Project Area.

The key results of the desktop study when integrated with the survey results include:

- The PMST identified one nationally threatened flora species and 8 nationally threatened fauna species as potentially occurring within the Study Area. One species was considered likely to occur within the Project Area;
- The BDBSA identified 282 fauna species with historical records from within the Study Area. This included two amphibian species, 177 avian species (including 6 exotic species), 26 mammal species (including eight exotic species) and 77 reptile species. Of these, 24 birds, one mammal and two reptiles were threatened at national or state level.
- The BDBSA identified 469 flora species as having records from within the Study Area. Of these, eight species were threatened at state level. One species was known from the Project Area being observed during the field survey, Sandalwood (*Santalum spicatum*). Three species were considered likely to be present within the Project Area; Australian Broomrape (*Orobanche cernua var. australiana*), *Ophioglossum polyphyllum* (Large Adders Tongue) and *Gratwickia monochaeta*.

The field survey included (1) a vegetation survey performed by accredited ecologists in accordance with the Rangelands Assessment Method (RAM) devised by the Native Vegetation Council, and (2) an opportunistic fauna assessment concurrently with the vegetation survey.

The key results of the field survey include:

- The key habitats identified in the Project Area were sand/low plains, dunes and swales, stony tablelands, the Arcoona plateau, salt lakes and ephemeral claypans, and ephemeral creeklines;
- Twenty vegetation associations were identified and mapped along the length of the Project Area. Accurate mapping was difficult due highly variable transitional areas in several associations and many changes were based on co-dominant species presence/absence;
- No threatened or protected flora or fauna species listed under the EPBC Act were observed;

- Sandalwood (*Santalum spicatum*), which is listed as rare under the NPW Act was observed within the *Acacia aneura* Mixed Woodland vegetation association;
- No threatened fauna listed under the NPW Act were observed; and
- Annual weeds such as *Carrichtera annua* (Wards Weed), were observed in sparse and moderate covers intermittently throughout the Study Area, despite very little rain since the beginning of 2018 and exceptionally dry conditions present at the time of the assessment. Other weeds observed were common Mediterranean species largely considered as naturalised within the rangelands, including *Carthamus lanatus* (Star Thistle), *Sonchus oleraceus* (Sow Thistle), *Malvastrum americanum* (Malvastrum) and *Brassica tournefortii* (Wild Turnip).

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1 INTRODUCTION

EBS Ecology (EBS) was contracted by OZ Minerals to conduct an ecological baseline assessment for the proposed Carriewerloo Substation to Prominent Hill Electricity Transmission Line Project (the Project).

The ecological baseline assessment comprised a desktop study and field survey. The desktop study involved searching Commonwealth and State databases to identify threatened species potentially occurring in the proposed development site, as well as relevant matters of national environmental significance and other matters protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *National Parks and Wildlife Act 1972* (NPW Act). Previous baseline and monitoring reports from other projects in the region were also used as part of the literature review for this project.

The ecological field survey included a vegetation survey performed in accordance with the Rangelands Assessment Method (RAM) devised by the Native Vegetation Council (NVC) of the Department of Environment and Water (DEW) (NVC 2017). Opportunistic fauna observations were also conducted during the vegetation survey.

1.1 Objectives

The specific objectives of the ecological baseline assessment were to:

- Identify ecological values and constraints which would inform refinement of the transmission line corridor and route alignment;
- Conduct database searches to identify matters of national and state environmental significance (EPBC Act Protected Matters database via the online Protected Matters Search Tool (PMST) and Biological Database of South Australia (BDBSA));
- Review existing biological surveys, data and literature (e.g. Olympic Dam Expansion Environmental Impact Statement (EIS)) for the area to highlight data gaps and key issues;
- Review existing mapping data (e.g. vegetation communities, vegetation condition and aerial photographs);
- Identify areas where significant ecological constraints may occur and provide preliminary spatial data to describe these areas;
- Ground truth and confirm the outcomes and findings of the desktop study by conducting a field assessment;
- Target areas where there was a high likelihood of *Frankenia plicata* present
- Confirm previous assessments remain valid and re-survey key areas under the new Rangelands Assessment method implemented by the Native Vegetation Council, which have been in effect from 1 July 2017;
- Collect vegetation data dependent on vegetation type and as required to fulfil legislative requirements under relevant Commonwealth and State Acts;

- Identify any flora species of national or state conservation significance known to or likely to occur in the area;
- Identify any declared plants under the *Natural Resources Management Act 2004* (NRM Act) that may be significant in relation to the Project activities;
- Conduct an opportunistic fauna assessment (during the vegetation survey) to determine if any native fauna or fauna habitat may be impacted upon by the proposed transmission line, with specific consideration of fauna of conservation significance at state and national level; and
- Collect adequate data to allow calculation of the Significant Environmental Benefit (SEB) offset requirements as part of the proposal to remove native vegetation along the proposed transmission line route.

1.2 Project Area

The Project Area consists of the 500 m transmission line corridor, which includes the proposed alignment and a 250 m buffer either side (Figure 1).

The Study Area for the desktop component of the ecological baseline assessment (i.e. database searches, review of existing biological surveys, data and mapping) included a 5 km buffer along both sides of the proposed transmission line alignment (i.e. 10 km corridor). Anything broader than this is considered to be the Regional Study Area.

Figure 1. Location and extent of the proposed Carriewerloo Substation to Prominent Hill transmission line, South Australia.

2 COMPLIANCE AND LEGISLATIVE SUMMARY

2.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act and the *Environment Protection and Biodiversity Conservation Regulations 2000* provide a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as 'matters of national environmental significance'. The nine matters of national environmental significance protected under the Act are:

1. World Heritage properties
2. National Heritage places
3. Wetlands of international importance (listed under the RAMSAR Convention)
4. Listed threatened species and ecological communities
5. Migratory species protected under international agreements
6. Commonwealth marine areas
7. The Great Barrier Reef Marine Park
8. Nuclear actions (including uranium mines
9. A water resource, in relation to coal seam gas development and large coal mining development

Matters 4 and 5 are relevant to the Project.

Any action that has, will have, or is likely to have a significant impact on matters of national environmental significance requires referral under the EPBC Act. Substantial penalties apply for undertaking an action that has, will have or is likely to have significant impact on a matter of national environmental significance without approval.

2.2 Native Vegetation Act 1991

Native vegetation within the Project Area is protected under the NV Act and *Native Vegetation Regulations 2017*. Any proposed clearance of native vegetation in South Australia (unless exempt under the *Native Vegetation Regulations 2017*) is to be assessed against the NV Act Principles of Clearance, and requires approval from the Native Vegetation Council (NVC). A net environmental benefit is generally conditional on an approval being granted.

2.3 National Parks and Wildlife Act 1972

Native plants and animals in South Australia are protected under the NPW Act. It is an offence to take a native plant or protected animal without approval. Threatened plant and animal species are listed in Schedules 7 (endangered species), 8 (vulnerable species) and 9 (rare species) of the Act. Persons must not:

- Take a native plant on a reserve, wilderness protection area, wilderness protection zone, land reserved for public purposes, a forest reserve or any other Crown land
- Take a native plant of a prescribed species on private land

- Take a native plant on private land without the consent of the owner (such plants may also be covered by the NV Act)
- Take a protected animal or the eggs of a protected animal without approval
- Keep protected animals unless authorised to do so
- Use poison to kill a protected animal without approval

Conservation rated flora and fauna species listed on Schedules 7, 8, or 9 of the NPW Act are known to or may occur within the Project Area. Persons must comply with the conditions imposed upon permits and approvals.

2.4 Natural Resources Management Act 2004

Under the *Natural Resources Management Act 2004* (NRM Act) landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation.

Key components under the Act include the establishment of regional Natural Resource Management (NRM) Boards and development of regional NRM Plans; the ability to control water use through prescription, allocations and restrictions; requirement to control pest plants and animals and activities that might result in land degradation.

3 BACKGROUND INFORMATION

3.1 Project details

The Project consists of an above-ground 275 kV transmission line running from Carriewerloo Substation at the Solar Reserve proposed Aurora Project to the existing Mount Gunson South substation, and a 132 kV transmission line connecting the Mount Gunson South substation to the existing 132 kV Prominent Hill transmission line to the west of the Olympic Dam Special Mining Lease.

3.1.1 IBRA

The Interim Biogeographical Regionalisation of Australia (IBRA) identifies geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. The bioregions are further refined into subregions and environmental associations (DEW 2011). The Project Area is located within the Gawler IBRA Bioregion and the Arcoona Plateau, Gawler Lakes and Roxby IBRA Subregions. The IBRA Environmental Associations have not been updated for IBRA version 7.0 for the entire Project Area.

Native vegetation remnancy figures for IBRA subregions are useful for setting regional landscape targets. Approximately 99% (1,077,028 ha) of the Arcoona Plateau IBRA Subregion is mapped as remnant vegetation, of which less than 1% (710 ha) is formally conserved. Approximately 62% (1,271,089 ha) of the Gawler Lakes IBRA Subregion is mapped as remnant native vegetation, of which 2% (30,615ha) is formally conserved. Approximately 98% (1,375,681 ha) of the Roxby IBRA Subregion is mapped as remnant native vegetation, of which none is formally conserved. Areas are formally conserved and protected within National Parks and Wildlife reserves, private Heritage Agreements under the NV Act and Indigenous Protected Areas. A full summary is provided below in Table 1.

Table 1. IBRA bioregion, subregion, and environmental association environmental landscape summary.

Gawler IBRA Bioregion	
Semi-arid to arid, flat topped to broadly rounded hills of the Gawler Range Volcanics and Proterozoic sediments, low plateaux on sandstone and quartzite with an undulating surface of Aeolian sand or gibbers and rocky quartzite hills with colluvial footslopes, erosional and depositional plains and salt encrusted lake beds, with Black Oak (belah) and Myall low open woodlands, open Mallee scrub, Bluebush/Saltbush open chenopod shrublands and tall Mulga shrublands on shallow loams, calcareous earths and hard red duplex soils.	
Arcoona Plateau IBRA Subregion	
A series of low plateau on sandstone and quartzite with an undulating surface of aeolian sand or gibbers over red duplex soils, and rocky quartzite hills with colluvial footslopes. There is a cover of low chenopod shrubland, *Acacia victoriae* tall shrubland with a chenopod shrub understorey and fringing *Acacia papyrocarpa* woodland.	
Remnant vegetation	Approximately 99% (1,077,028 ha) of the subregion is mapped as remnant native vegetation, of which 1% (710ha) is formally conserved.
Landform	Dissected sandstone plateau with bold eastern escarpment. Surface undulating to hilly and often gibber-covered, particularly in east.
Geology	Sands, clays, silts; pallid zones & ferruginised breakaway scarps. Silcrete & silcrete skins; stony plains & plateau remnants. Colluvial fans, alluvial sands, silts, clays & gravels. Stony tablelands, gibber plains & stone circles (gilgai effects).

Soil	Crusty red duplex soils, Red calcareous loams.
Vegetation	Chenopod shrublands.
Conservation significance	34 species of threatened fauna, 14 species of threatened flora.
Gawler Lakes IBRA Subregion	
An undulating upland plain underlain by quartzite and sandstone, with shallow loamy soils. Encompasses the Woomera plateau, which is characterised by the absence of trees and tall shrubs, except on floodplains, where Mulga (*Acacia aneura*), Bullock bush (*Alectryon oleifolius ssp. canescens*), occasional Red Gums (*Eucalyptus camaldulensis*) and other species may be found. The gibber-covered areas are either bare or carry a scattered growth of Samphire (*Halosarcia* spp.) and Bindyi (*Sclerolaena* spp.). The depositional plains to the south and south-west of the plateau are covered with deep calcareous earths characteristically carrying an open Myall (*Acacia papyrocarpa*) woodland with a Bluebush (*Maireana sedifolia*) understorey, or red aeolian sand sheets and dunes with open Mulga shrubland or a low woodland of *Casuarina pauper* or *Callitris glaucophylla*.	
Remnant vegetation	Approximately 62% (1,271,089 ha) of the subregion is mapped as remnant native vegetation, of which 2% (30,615 ha) is formally conserved.
Landform	Undulating plains overlain with sand sheets and dunes, with occasional silcrete capped rises.
Geology	Alluvium, colluvium (sand silt clay & gravels). Silcrete cappings & Ti-rich skins. Dune sand & residual sand mantles. Evaporites (gypsum & halite). Bleached Cretaceous shales. Silicified rhizomorphs & nodular silcrete (Tertiary).
Soil	Brown calcareous earths, Crusty loamy soils with red clayey subsoils, Sand soils, brown and red, Shallow dense loams.
Vegetation	Assumed native vegetation cover.
Conservation significance	39 species of threatened fauna, 33 species of threatened flora.
Roxby IBRA Subregion	
An ancient alluvial plain between the Arcoona Tablelands and Stuart Range complex, substantially covered with more recent sands. In the west are well-spaced low dunes of *Acacia aneura* woodland over *Acacia* spp., *Dodonaea* spp. and grasses, and sandsheets of *Acacia aneura* woodland over *Maireana sedifolia* and grasses. *Acacia* shrublands also typify the dunes. Calcareous plains have *Acacia papyrocarpa* woodlands with *Maireana sedifolia* and *Atriplex vesicaria*. *Casuarina pauper* over *Hakea leucoptera*, perennial chenopods and *Ptilotus obovatus* occupy rises above the plain. The linear dunefield in the east has dunes of *Acacia aneura*, *Acacia ramulosa* and *Callitris spp*. over *Dodonaea*, *Eragrostis eriopoda* and *Aristida contorta*. Between the dunes are *Acacia papyrocarpa* and *aireana sedifolia* on calcareous soils, saline swales of *Atriplex* spp., *Gunniopsis quadrifida* and *Frankenia* spp. or claypans of *Eragrostis* spp., *Duma florulenta* or *Melaleuca glomerata* fringes. Broad saline flats in the west of the region, possibly marking older palaeo channels, support variable *Atriplex* spp. / *Maireana* spp. Low Shrublands and possess salt-lake/lunette chain complexes of mixed character.	
Remnant vegetation	Approximately 98% (1,375,681 ha) of the subregion is mapped as remnant native vegetation, of which none is formally conserved.
Landform	Undulating terrain with mesas and buttes, some saline seasonally swampy areas with gypseous lunettes. Dune formations in east.
Geology	Variable stone & gravel mantle. Some low silcrete capped hills. Evaporite deposits (gypsum, halite). Sand, silt, clay deposits in lowlands.
Soil	Brown calcareous earths.
Vegetation	Arid and semi-arid Acacia Low Open Woodlands and Shrublands with tussock grass

Conservation significance	41 species of threatened fauna, 11 species of threatened flora.

3.1.2 Administrative boundaries

The Project Area is located in the South Australian Arid Lands NRM Region (SAALNRM).

3.1.3 Existing Land use

The Project Area interacts with a number of Pastoral Leases. In order from south to north, the transmission line passes through Carriewerloo, Mt. Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Andamooka and Roxby Downs. These stations have primarily grazed sheep for some time being south of the Dog Fence, however pastoral use varies dependent on market demands, availability of stock, climatic conditions and other variables. The limited water resource availability in the region does however necessitate low stocking rates for the predominant period.

The wider Regional Study Area as defined in section 2.1 in general as well as being subject to the operations and infrastructure of sheep and cattle stations, also has been influenced by the construction and operation of Woomera Rocket Range. Woomera was declared a prohibited area in 1947 as part of Britain's defence requirements following World War II. It needed a large, remote area in which to test new weapons systems. Today the area is still in use as an RAAF base (Department of Defence, 2018).

Numerous pastoral dams exist in the Regional Study Area and are required for livestock. The dams are manipulated on regular occasions for the use and benefit of livestock. As a result, they tend to be highly altered and recognized as sites with high siltation and nitrification. Dams can retain water through extended droughts by pumping water from other areas or, conversely, can remain dry during wetter periods when no stock are present. As a result, the aquatic flora and fauna that potentially utilise pastoral dams will vary due to anthropogenic influences. While pastoral dam's existence within the landscape does provide opportunity for species to utilise resources, the nature of dam management renders them ineffective in providing consistent ecological habitat value.

3.2 Arid zone systems

The main driver of biological activity in Australia's arid areas is water and one of the defining characteristics of the arid lands is the 'boom and bust' phenomenon characterised in part by eruptive life history traits of fauna. Variability is a driving factor of the 'boom and bust' responses of arid zone ecosystems, with many of the flora and fauna having adopted life history strategies to enable rapid responses to opportunistic conditions (SAALNRM, 2010). Vegetation grows quickly and fauna reproduce rapidly after rain, with some species often contracting back to very low numbers when resources are reduced. Drought refuges are important habitat features where sufficient resources are available for a species to persist until the next significant rain or flood event.

When the volume or intensity of rainfall over the Gawler bioregion results in water run-off, surface water converges into drainage lines and eventually, if flows are large enough, onto floodplains and finally salt lakes (DEH, 2009). The inland saline lakes in the Gawler bioregion such as the Pernatty Lagoon are highly

dynamic systems that when inundated become very productive and support breeding of terrestrial flora and fauna species (DEH, 2009).

Some vegetation also relies on storages of groundwater to remain healthy (SAALNRM, 2006). The scale of groundwater dependence for different components of the arid lands aquatic ecosystems may range from entirely groundwater dependent through to no dependence (surface water / rainfall only), with transitional categories in between such as 'highly dependent', 'proportional dependence' and 'limited dependence' (SAALNRM, 2006).

Some rivers and creek lines that appear dry on the surface continue to flow underground in what is termed as 'hyporheic' flow, providing refuge for aquatic insects which then provide resources for other components of the ecosystem (SAALNRM, 2006). Arid zone creeklines and river systems, and salt lake ecosystems are influenced by the maintenance of the variability of frequency and duration of lake bed inundation, depth of flooding, source of water, flood timing and dry phases (SAALNRM, 2006).

3.2.1 Salt lakes

The lakes in the South Australian arid lands only contain water episodically and have widely variable salinities. Salt lakes and claypans are prominent drainage features of the Gawler bioregion, and mainly occur at the ends of drainage lines, or as a series of depressions along ancient river channels that have been in-filled by river sands or gravels, and are now covered by more recent sediments (DEH, 2009). The inland saline lakes in the Gawler bioregion such as Lake Torrens are highly dynamic systems that when inundated become very productive and support breeding of numerous species (DEH, 2009). The inland aquatic areas are of high importance to Australia's overall biological diversity (SAALNRM, 2006).

The substantial lakes in the Study Area include Pernatty Lagoon and Lake Windabout located approximately 45 km and 55 km west of Lake Torrens, respectively. Pernatty Lagoon is the larger of these two lakes, being 65 km long and 4 to 12 km wide (Creelman, 2005), while Lake Windabout is 21 km long and 6 km wide. Both of these lakes fill via run off from the Arcoona Hills, located to the east of the lakes. These two lakes are surrounded by substantial red sand dune fields.

A number of smaller lakes (collectively referred to as the Arcoona Lakes) are also located in the northern section of the Study Area. Although these are reduced in geographic extent when compared to Lake Torrens, Pernatty Lagoon or Lake Windabout, these are still potentially able to support a large number of bird species, especially when in flood (Pedler and Kovac, 2013).

4 METHODS

4.1 Desktop study

A desktop study was conducted to assess the potential for any threatened and protected species (both Commonwealth and State listed) to occur within the Project Area. This was achieved by undertaking database searches using a 5 km buffer along either side of the proposed alignment of the transmission line (Study Area) along with review of historic reports relevant to the Regional Study Area.

4.1.1 Protected Matters Search Tool (PMST) – EPBC Act

A Protected Matters Search Tool (PMST) report was generated on 22 March 2018 to identify matters of national environmental significance under the *EPBC Act 1999* relevant to the Study Area (DotEE, 2018). The PMST is maintained by the Department of the Environment and Energy (DotEE) and was used to identify flora and fauna species or ecological communities of national environmental significance that may occur or have suitable habitat within the Study Area.

4.1.2 Biological Database of South Australia (BDBSA) – NPW Act

Threatened species listed under South Australia's *National Parks and Wildlife Act 1972* were assessed using the Biological Databases of South Australia (BDBSA). The dataset was obtained on 22 March 2018 and used to identify threatened species that have been recorded within the Study Area (DEW 2018). Records of threatened species listed under the EPBC Act were also identified.

4.1.3 Assessment of the likelihood of occurrence

The likelihood of each threatened or protected flora and fauna species occurring within the Study Area was assessed. A likelihood of occurrence rating (Highly Likely / Known, Likely, Possible, Unlikely, Impossible) was assigned to each threatened or protected species identified in the desktop PMST and BDBSA search (Table 2).

Table 2. Criteria for the likelihood of occurrence of species within the Project Area.

Likelihood	Criteria
Highly Likely/Known	• Records in the last 10 years, the species does not have highly specific niche requirements, the habitat is largely intact and falls within the known range of the species distribution; • The species was recorded as part of project surveys.
Likely	• Records within the previous 20 years, the area falls within the known distribution of the species and the area provides species habitat which is largely intact.
Possible	• Records within the previous 20 years, the area falls inside the known distribution of the species but the area does not provide species habitat which is largely intact. • Records within 20 -40 years, survey effort is considered adequate, habitat is present and intact and species of similar habitat needs have been recorded in the area.
Unlikely	• Records wthin 20 -40 years, however suitable habitat does not occur and species of similar habitat requirements have not been recorded in the area.

Likelihood	Criteria
	• No records within the previous 40 years despite suitable habitat being known to occur in the area or, • No records despite adequate survey effort.
Impossible	• Species cannot occur in Project Area (e.g. it is impossible for a marine mammal to occur in a terrestrial Project Area).

4.1.4 Desktop study limitations

The content of the desktop study was derived from existing datasets and references from a range of sources. EBS has not attempted to verify the accuracy of any such information.

Flora and fauna records were sourced from the Protected Matters Database via the PMST and the Biological Data Base of South Australia (BDBSA). The BDBSA only includes verified flora and fauna records submitted to DEW or partner organisations. It is recognised that drawing conclusions can be unreliable within areas that have been under represented in terms of biological studies. It is possible therefore, that significant species occur within the Regional Study Area that are not reflected by database records. Although much of the BDBSA data has been through a variety of validation processes, the lists may contain errors and should be used with caution. DEW give no warranty that the data is accurate or fit for any particular purpose of the user or any person to whom the user discloses the information.

The findings and conclusions expressed by EBS are based solely upon information in existence at the time of the assessment. The combination of database records and background research have provided a solid foundation for determining the flora and fauna that are likely or are known to occur within the Project Area.

4.2 Review of previous surveys

A review of previously conducted flora and fauna assessments within the Regional Study Area was undertaken to identify any potential ecological constraints that have been previously identified. The review specifically focused on the detailed information contained in '*Appendix N Terrestrial Ecology*' of the '*Olympic Dam Expansion Draft Environmental Impact Statement*' (EIS) (BHP Billiton, 2009).

4.3 Field survey

4.3.1 Vegetation survey

The vegetation survey was performed in accordance with the Rangelands Assessment Method (RAM) devised by the NVC (NVC 2017). The RAM is suitable for assessing vegetation systems within the South Australian Arid Lands and Alinytjara Wilurara NRM Board regions. The new method aligns the assessment of vegetation (and land) condition with the RAM developed by Natural Resources South Australian Arid Lands for the rapid assessment of pastoral properties in sheep and cattle country, but is adapted for native vegetation assessments in arid rangelands throughout South Australia (NVC 2017). The outcomes from these assessments are reflective of condition and the offset values associated with any clearance. The three components of the biodiversity value of the individual sites are;

- Landscape context;

- Vegetation condition (including a measure of land condition); and
- Conservation value.

These are scored based on the criteria outlined below in Table 3.

Table 3. Factors that influence the value of the three parameters used to calculate the total SEB area and biodiversity value in the Rangelands Assessment Method.

Parameter	Factors
Landscape context	• Number of land form features present • Size of the area being affected • Presence of wetland features • Level of protection of native vegetation in the geographic area
Vegetation condition	• Utilisation of perennial species (Intact, Modified, Over-utilised) • Biotic and physical disturbance (e.g. presence of litter mats (+), bare scalds (-)) • Vegetation strata present and notably absent (i.e. removed) • Introduce plant species cover
Conservation value	• Presence of Commonwealth or State listed threatened ecological communities, and their conservation rating • Number of threatened plant species recorded (directly and historically), and their conservation rating • Number of threatened fauna species recorded (directly and historically), and their conservation rating, and potential habitat within the site

Each area to be assessed (i.e. each application area) within the methodology framework are assigned specific naming protocols. Individual areas are termed ‘Blocks’, which are further divided into stratified ‘Sites’. Each Site relates to a vegetation association found within the Block.

The three component scores are combined to provide ‘Unit Biodiversity Score’ (per hectare) and then multiplied by the size (hectares) of the Site to provide a ‘Total Biodiversity Score’ for each Site, and then the overall Block.

The conservation significance scores were calculated from direct and historical observations of flora and fauna species of conservation significance. Historical observations were obtained from the PMST and BDBSA using a defined 50 km point buffer. For the PMST, only species or species habitat known to occur within the 50 km buffer were included (as per the RAM manual sections 5.3.2 and 5.3.3) (NVC 2017).

The number of sites assessed is generally determined by dividing blocks into predetermined areas usually based on one or all of;

- Rainfall Gradient
- Grazing Gradient
- Pastoral Paddocks

The assessment design and sampling protocol used for this assessment was modified to deal with the long linear but narrow transmission line corridor. The number of ‘Sites’ were pre-determined in this instance to reflect the range of vegetation communities from a number of landforms without the need for exceedingly high and restrictive sample size requirements. The assessment sites were mapped and agreed as satisfactorily fulfilling the necessary requirements by the Native Vegetation Biodiversity Management Unit via email on 16/3/2018.

Targeted surveys for specific species (in this case *Frankenia plicata*) were undertaken in areas where it was deemed that there was a higher likelihood that this species may occur. Particular locations targeted included the southern and northern fringes of Lake Windabout, some gilgai habitats amd creeklines on the Arcoona Plateau and some shrubland areas at the south end of Pernatty Lagoon.

4.3.2 Fauna assessment

As the Study Area was traversed by vehicle during the vegetation survey, all fauna species, signs of fauna (e.g. scats, burrows, skeletons etc.) and potential habitat for fauna were recorded. Birds are an excellent indicator of general environmental health including habitat condition and ecosystem function, and most can be easily observed without the need for trapping. Therefore, bird species were targeted during the fauna assessment. The value of habitat for threatened fauna listed under the EPBC Act and NPW Act was also determined when searching the Study Area.

While the Pernatty Knob-tailed Gecko is known from the Project Area, a targeted search was undertaken for this species at night in the dunes on Pernatty Station approximately 5 km south of Lake Windabout. Weather conditions were not particularly suitable for sighting the species and none were located during the survey.

4.3.3 Field survey limitations

The timing of the vegetation survey was not optimal for detection of annual and herbaceous species. Some indigenous flora species identification was limited to genus level due to a lack of distinguishing identification features such as flowers or fruits. It should be noted, however; that the perennial species inventory was complete and data collected is considered more than adequate to complete rangeland vegetation assessment.

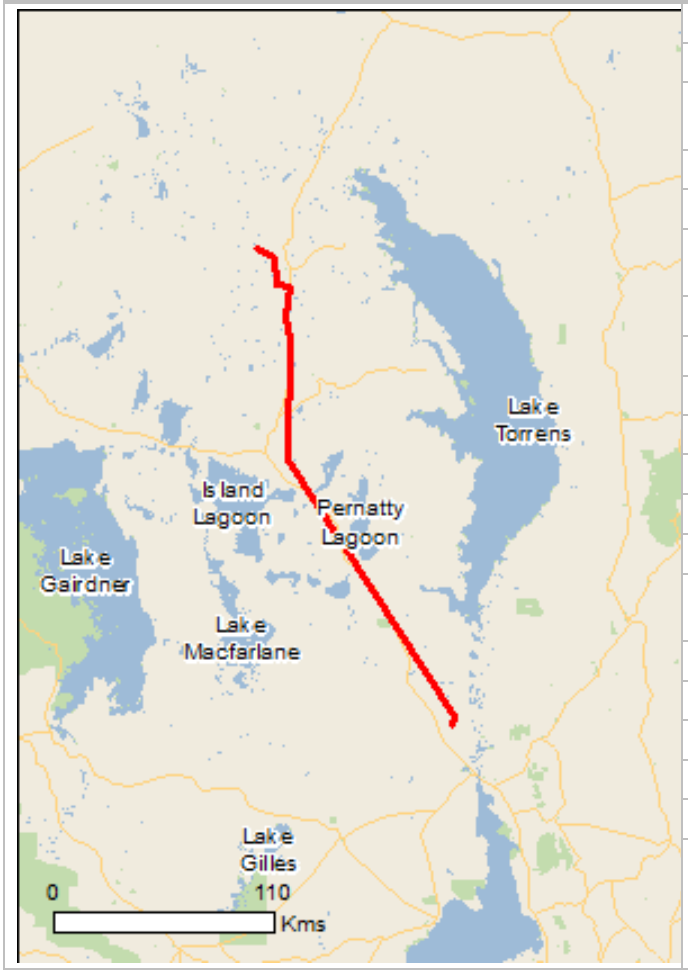
The compiled list of fauna observations does not represent all species expected to occur in the Project Area. Being an opportunistic only survey, the likelihood of detection of many species is largely reduced with many species active for small periods of the day or nocturnal, limiting the ability to assess their occurence.

5 RESULTS

5.1 Protected Matters Search Tool Results

The results of the PMST report are summarised in Table 4 (DotEE 2018). The relevant matters of national environmental significance, other matters protected under the *EPBC Act 1999*, and threatened species listed under the *NPW Act 1972* are discussed in detail below. Observations from the field survey regarding species and habitat presence have been integrated into the discussion.

Table 4. Summary EPBC Act Protected Matters Search Tool results (DotEE 2018).

Study Area (5 km buffer each side)	Matters of national environmental significance under the EPBC Act	Identified within the search area
	World heritage properties	None
	National heritage properties	None
	Wetlands of international importance	None
	Great Barrier Reef marine park	None
	Commonwealth marine area	None
	Threatened ecological communities	None
	Threatened species	9
	Migratory species	12
	Commonwealth land	3
	Commonwealth heritage places	None
	Listed marine species	16
	Whales and other cetaceans	None
	Critical habitats	None
	Commonwealth reserves terrestrial	None
	Commonwealth reserves marine	None
	State and Territory reserves	None
	Regional forest agreements	None
	Invasive species	23
	Nationally important Wetlands	None
	Key ecological features (marine)	None

5.1.1 Nationally threatened flora

One flora species listed as endangered under the EPBC Act, *Frankenia plicata*, was identified in the PMST as potentially occurring or having suitable habitat within 5 km of the Project Area known collectively as the Study Area. This species was considered as possibly occurring within the Project Area despite no observations being recorded during the field assessment of the Study Area. A summary of this species is provided in Table 5.

Table 5. Threatened flora species potentially occurring within the Study Area identified in the PMST (DotEE 2018)

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Comment
		Aus	SA		
Flora					
Frankenia plicata	Frankenia	EN		Possible	The species is a low, mat-forming perennial shrub on lower slopes of hills and in small run-off channels. There were targeted searches made for this species at the fringes of salt lake margins at Pernatty Lagoon, Lake Windabout and Lake Mary in sandy well drained soils of high salinity. This species is known from well drained soils and a wide variety of landforms, however has also been recorded in the Regional Study Area from within stream channels and on heavy loams on low slopes. Despite the low numbers of records from within the Regional Study Area and there being no recorded observations during the baseline assessment following some targeted searches, it is still possible that this species is present within the Project Area. *Frankenia* are notoriously difficult to identify in the field however the leaf structure of this species leaves them as being reasonably distinct in having the underside leaf margins completely concealed. No *Frankenia* observed during the field survey showed these characteristics.

Conservation status: **Aus**.: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA**: South Australia (*National Parks and Wildlife Act 1972*).
Conservation codes: **CE**: Critically Endangered. **EN/E**: Endangered. **VU/V:** Vulnerable. **R**: Rare.

5.1.2 Nationally threatened fauna

Eight fauna species protected under the *EPBC Act 1999* were identified by the PMST as potentially occurring or having suitable habitat within the Study Area. This includes seven bird and one mammal species. A summary of these species and comment regarding their likelihood of occurrence within the Project Area is provided in Table 6.

5.1.3 Migratory fauna

Twelve migratory bird species were identified in the PMST as potentially occurring or having suitable habitat within the Study Area. A summary of these species and comment regarding their likelihood of occurrence within the Project Area is provided in Table 6. Due to the presence of salt lakes and ephemeral ponds present within the Project Area, some of these migratory species are likely to utilise these habitats as stopover areas, or when seasonal conditions are suitable, as permanent southern hemisphere summer layover.

5.1.4 Marine fauna

Sixteen marine bird species were identified in the PMST as potentially occurring or having suitable habitat within the Study Area. A summary of these species and comment regarding their likelihood of occurrence within the Project Area is provided in Table 6.

The Rainbow Bee-eater (*Merops ornatus*) is known to occur within the Project Area. This species is distributed across much of mainland Australia, inhabiting open woodlands and shrublands, including Mallee, and in open forests that are usually dominated by *Eucalyptus*. It also occurs in grasslands (Gibson 1986) and, especially in arid or semi-arid areas, in riparian, floodplain or wetland vegetation assemblages (Badman 1989). It was observed as a call during the field assessment having a distinct pitch that is instantly recognisable in the arid region.

5.1.5 Nationally threatened ecosystems

No threatened ecological communities listed under the EPBC Act were identified by the PMST as occurring in the Study Area. Previous assessments of the broader study area (BHP Billiton 2009) and the field survey undertaken for this assessment also did not identify any threatened ecological communities.

Table 6. Threatened, migratory and marine fauna species potentially occurring within the Study Area identified in the PMST (DotEE 2018)

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Comment
		Aus	SA		
Aves					
Actitis hypoleucos	Common Sandpiper	Mi. (W), Ma	R	Likely	Coastal shorebird, presence would be as stopover only as migratory species Found in coastal or inland wetlands, both saline and fresh. It is found mainly on muddy edges or rocky shores. During the breeding season in the northern hemisphere, it prefers freshwater lakes and shallow rivers
Amytornis modestus	Thick-billed Grasswren	VU		Possible	Known from area recorded in previous baseline surveys such as the Olympic Dam EIS. Favours chenopod shrublands, especially those supporting *Maireana* spp. and *Atriplex* spp. Prefers areas along drainage lines where shrubs are taller and thicker.
Amytornis textilis myall	Western Grasswren	VU		Unlikely	The western Grasswren (Gawler Ranges) has been recognised as one of five subspecies of A. textilis, it occurs only in the eastern Gawler Ranges / north-eastern Eyre Peninsula of South Australia.
Apus pacificus	Fork-tailed swift	Mi. (M), Ma		Possible	Asian origin - species is aerial during its stay in Australia
Ardea alba	Great Egret	Ma		Possible	Floodwaters, rivers, wetlands, mudflats
Ardea ibis	Cattle Egret	Ma	R	Possible	Grasslands, woodlands and wetlands with a preference for moist areas with tall grass, or shallow open wetlands, and wetland margins
Calidris acuminata	Sharp-tailed Sandpiper	Mi. (W), Ma		Possible	Prefers the grassy edges of shallow inland freshwater wetlands. It is also found around swage farms, flooded fields, mudflats, mangroves, rocky shores and beaches. Its breeding habitat in Siberia is the peat-hummock and lichen tundra of the high Arctic
Calidris ferruginea	Curlew Sandpiper	CE, Mi. (W), Ma		Possible	Curlew Sandpipers in Australia are present within coastal and subcoastal habitats. The habitats within which they are present from fresh to hypersaline, and include: intertidal mudflats, saltworks, sewage farms, Wetlands, lakes, swamps and lagoons (Pizzey and Knight 2007).
Calidris melanotos	Pectoral Sandpiper	Mi. (W), Ma		Possible	Stopover, 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
Charadrius veredus	Oriental Plover	Mi. (W), Ma		Possible	In non-breeding grounds, they prefer coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands. Flyover only coastal shorebird may use plains away from water

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Comment
		Aus	SA		
Gallinago hardwickii	Latham's Snipe	Mi. (W), Ma	R	Likely	Flyover only Coastal shorebird, prefer vegetated wetlands however may utilise water points and dam areas within Project Area as stopover point. Most recent record from within Study Area, 2000
Leipoa ocellata	Malleefowl	VU	V	Unlikely	The Murray Mallee is the stronghold for the Malleefowl, but it has severely declined throughout its range. It is now found in scattered locations through semi-arid rangelands and dry-land cropping zones in the south east of South Australia and the Eyre Peninsula. Principally found in mallee eucalypt woodland and scrub as well as dry forest dominated by other eucalypts, Mulga, and other Acacia sp. They feed on seeds and herbage, and build nest mounds in sandy substrates with leaf litter. If suitable connectivity exists and intact Mallee possible occurrences may occur. Unlikely in degraded habitat.
Merops ornatus	Rainbow Bee-eater	Ma		Known	The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also occurs in grasslands and, especially in arid or semi-arid areas, in riparian, floodplain or wetland vegetation assemblages. Often observed in Mulga communities. Observed during baseline survey.
Motacilla cinerea	Grey Wagtail	Mi. (T), Ma		Unlikely	Vagrant A migratory species found within Europe, Asia and North America, has been recorded in Australia infrequently. Most of these records are from northern Australia.
Motacilla flava	Yellow Wagtail	Mi. (T), Ma		Unlikely	Vagrant Breeds in Europe and Alaska before migrating south into Asia and Africa. Regular summer visitor to northern Australia, however has been recorded in all states. Prefers grasslands and swamps as well as Saltmarshes or prepared lands (sports fields, airfields etc.).
Numenius madagascariensis	Eastern Curlew	CE, Mi. (W), Ma	V	Unlikely	Feeds in saltmarsh communities, very unlikely inland
Pandion haliaetus	Osprey	Mi (W), Ma	E	Possible	This species has an extremely large range, however In Australia, Ospreys are generally found in the northern coastal areas. A southern population inhabits from Kangaroo Island in South Australia, westward to the Great Australian Bight. Fish make up some 99% of the Osprey's diet.

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Comment
		Aus	SA		
Pezoporus occidentalis	Night Parrot	EN	E	Unlikely	Long thought extinct, this species historically occupied much of semi-arid and arid Australia. Habit appears to be mainly open grasslands consisting principally of *Triodia* in stony or sandy environments. Present distribution of the species is unknown, with the confirmed locations being in South-western Queensland, the Pilbara, Western Australia, southern Northern Territory and North of Lake Eyre, South Australia. The species is believed to be highly nomadic, moving into areas with preferred habitat when resources are good. There is a lack of intact habitat within the Project Area.
Rostratula australis	Australian Painted Snipe	EN, Ma	V	Unlikely	Pelagic marine species
Tringa nebularia	Common Greenshank	Mi. (W), Ma		Possible	Coastal shorebird, stopover possible on migratory flyway
Mammalia					
Pseudomys australis	Plains Rat	VU	V	Likely	Primarily found in gibber (stone-covered) plains and mid slopes with boulders, small stones and Gilgai's. Primary habitat is considered to be the drainage channels and depressions with deep friable cracking clays. These habitats are considered to be best able to collect water from even minor falls of rain. Secondary habitats are associated with Gilgai's and minor drainage areas with low perennial chenopod shrublands and heavier cracking clays. In years of very good rainfall, this species occurs on adjoining sandy plains. During poor conditions, core refuge areas may occur on low-lying Gilgai's and watercourses of gibber plains. Known from the region, widespread refuge habitat available for species and widespread on Arcoona Plateau. This species shows incredible resilience being able to persist for long periods underground lying in wait for the next boom period to breed. The irruptive life history strategy of this species means they can be present in high numbers for short periods before becoming largely inconsopicuous again for long periods until suitable seasonal conditions re-occur.

Conservation status: Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA:** South Australia (*National Parks and Wildlife Act 1972*).
Conservation codes: CE: Critically Endangered. **EN/E:** Endangered. **VU/V:** Vulnerable. **R:** Rare. **Mi**: Migratory, **Ma**: Marine, **T**: Terrestrial, **W**: Wetland species.

5.2 Biological Database of South Australia Results

5.2.1 Flora

Four hundred and sixty-nine flora species were highlighted as having records within the BDBSA. Of these, eight species of state threatened flora were identified in the BDBSA as being recorded within the Study Area. No nationally threatened species were recorded from within the study area. A summary of these species and comment regarding their likelihood of occurrence within the Project Area is provided in Table 5.

The location of threatened flora species recorded within the Study Area is shown in Figure 2. All flora species recorded in the BDBSA within the Study Area are presented in Appendix 1.

Only one of these species was observed during the field survey, *Santalum spicatum* (Sandalwood). Three other species were deemed as likely occurring within the Project Area based on the available habitat observed and the type of lifeform. Species such as *Citrus glauca* for example were deemed unlikely because while they are present in the Regional Study Area (personal observations by EBS), if they were present within the Project Area it is extremely likely they would be known due to the conspicuous habit and importance as a culturally significant species.

Table 7. Threatened flora species records from within the Study Area identified by the BDBSA search.

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Most recent record	Comment
		Aus	SA			
Flora						
Brachyscome eriogona	Brachycome		R	Unlikely	1966	Occurs around Gilgai's and low areas which get wet after good rainfall. Most recent record in low dune areas within Project Area. Unlikely to be recorded during the baseline study due to the conditions at the time of the survey.
Calandrinia sphaerophylla	Bead Purslane		R	Unlikely		*Calandrinias* put on good shows of bright pink flowers in spring. This species has a record at the southern end of the northern asset alignment however was not located during the survey.
Citrus glauca	Desert Lime		V	Unlikely	1993	Occasionally occurs within low dunes and sandy swales. It would be very unlikely that there were any populations of this species present within the Project Area which are not already well known of given their importance to Cultural heritage.
Gratwickia monochaeta	Gratwickia		R	Likely	1991	This species is inconspicuous, only being a short lived annual species which can be widespread when conditions allow. Would be likely to be present however the impact of a project like this would be minimal given the mass flowering that occurs when this species flourishes.
Ophioglossum polyphyllum	Large Adder's-tongue		R	Likely	1991	The species is known to inhabit moist places on sand hills and sand plains and can often form large colonies on open clay loams. It is frequently encountered in ranges where it occurs in shallow soil pockets subject to flooding or amongst rocks or along stream banks. This species was recorded alongside the powerline track south of Lake Windabout in a sandy loam swale. It is likely to be present during or after periods of significant rainfall.
Orobanche cernua var. *australiana*	Australian Broomrape		R	Likely	1990	Listed as rare but relatively common in the region and often encountered, primarily in sandy creeks lined with species such as *Acacia ligulata* and *Senecio magnificus*. Due to the linear nature of populations it is expected that this project would have a very low impact if any.

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Most recent record	Comment
		Aus	SA			
Santalum spicatum	Sandalwood		V	Known	2007	Sandalwood grows in loam soils and amongst rocks in woodland and scrubland areas (ASGAS, 2003) and is primarily found in the southern half of Western Australian and South Australia. This species often occurs sporadically as individuals in a variety of habitats throughout the semi-arid rangelands of SA. Recorded from within the Project Area. Individuals are sparsely scattered. There was a general lack of regeneration observed within the Project Area. Hard to assess risk given very sporadic presence in the landscape.
Swainsona microcalyx	Wild Violet		R	Possible	1987	Often grows in areas adjacent to saline lagoons and creeks, this species is also reliant on good rainfall so its presence can be rarely ascertained. Most likely to be recorded around southern edge of Pernatty Lagoon and Lake Windabout. Most records west of Project Area.

Conservation status: **Aus**.: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA**: South Australia (*National Parks and Wildlife Act 1972*).
Conservation codes: **CE**: Critically Endangered. EN/E: Endangered. **VU/V**: Vulnerable. **R**: Rare.

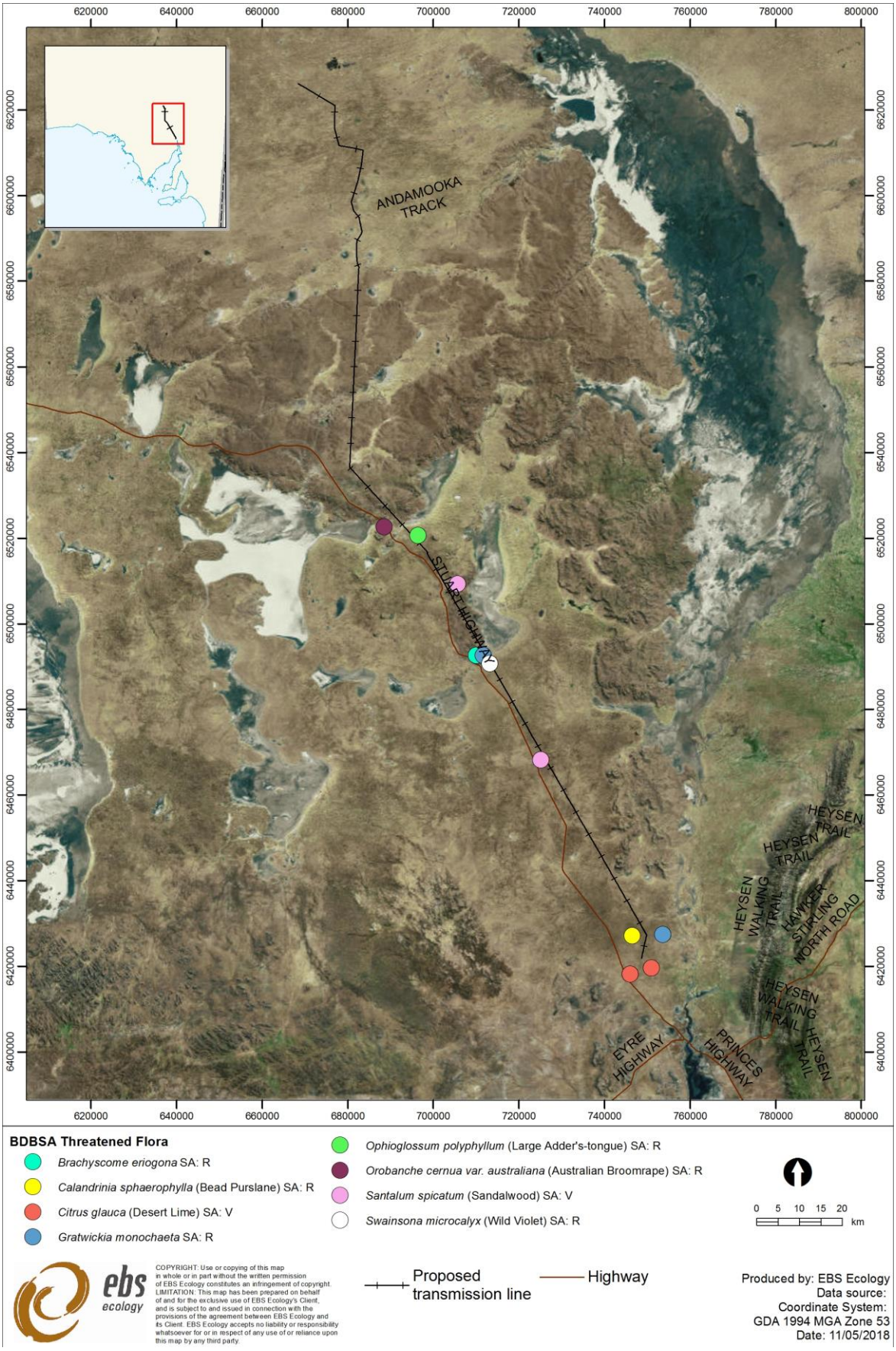


Figure 2. Threatened flora species recorded within the Study Area identified in BDBSA database search (DEW 2018).

5.2.2 Fauna

A total of 282 fauna records within the Study Area were shown in the results of the BDBSA search. This included two amphibians, 177 avian species (including six exotic species), 26 mammals (including eight exotic species) and 77 reptiles. Of these, 24 birds, one mammal and two reptile conservation significant species were identified in the BDBSA as being recorded within the Study Area. Plains Mouse (*Pseudomys australis*), Common Sandpiper (*Actitis hypoleucos*) and Lathams Snipe (*Gallinago hardwickii*) were recorded from within the Study Area and these were previously discussed in the PMST results (Table 6). A summary of the additional species recorded from the BDBSA and comment regarding their likelihood of occurrence within the Project Area is summarised below in Table 8. Six of these species were deemed likely to be occurring within the Project Area. A further 14 species were thought to be possibly utilising the Project Area for part of their habitat requirements.

The location of threatened fauna species recorded within the Study Area are shown in Figure 3 and all fauna species recorded in the BDBSA within the Study Area are presented in Appendix 2.

Table 8. Threatened fauna species records from within the Study Area identified by the BDBSA search.

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Most recent record	Comment
		Aus	SA			
Actitis hypoleucos	Common Sandpiper		R	Likely	2001	See table 6
Anas rhynchotis rhynchotis	Australasian Shoveler		R	Possible	1999	The Australasian Shoveler (*Anas rhynchotis rhynchotis*) is a species of waterfowl that regularly occurs inland. Within the Project Area, the species is likely to occur at pastoral dams and may temporally inhabit inland waterbodies during flood.
Anhinga novaehollandiae	Australasian Darter		R	Unlikely	2000	The Australasian Darter is a moderate to large sized diving waterbird. The species is considered unlikely to occur due to the absence of river channels within the Project Area, which it inhabits.
Ardea ibis	Cattle Egret		R	Possible	1986	See table 6
Ardeotis australis	Australian Bustard		V	Likely	2006	The Australian Bustard (*Ardeotis australis*) is a large ground-dwelling species that inhabits plains over much of the Australian continent. Suitable habitat in tableland and chenopod shrubland is widespread over the Study area, and as such, the species is considered likely to occur.
Arenaria interpres	Ruddy Turnstone	Mi	R	Unlikely	1993	The Ruddy Turnstone (*Arenaria interpres*) is a species of shorebird that is most frequently encountered within coastal environments. This species rarely occurs inland, and as such, is considered unlikely to occur. As an EPBC listed migratory species, any observations are likely to be short term stopovers.
Biziura lobata	Musk Duck		R	Possible	2007	The Musk Duck (*Biziura lobata*) is a species of waterfowl that inhabits inland waterbodies. This species is less likely to occur at pastoral dams unless they are expansive, as they prefer large waterbodies.
Cladorhynchus leucocephalus	Banded Stilt		V	Possible	2000	The Banded Stilt (*Cladorhynchus leucocephalus*) is a species of shorebird that regularly ventures inland to breed upon Salt Lakes. Flooded inland waterbodies are also expected to provide foraging habitat for this species.
Climacteris affinis	White-browed Treecreeper		R	Unlikely	1900	The White-browed Treecreeper (*Climacteris affinis*) is a species of passerine that occurs in well vegetated inland scrubs, where stands of rough-barked trees occur. This habitat type is largely absent for the Study area and given the species has not been sighted since 1900, it has been assessed as unlikely to occur.

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Most recent record	Comment
		Aus	SA			
Egretta garzetta	Little Egret		R	Unlikely	1993	The Little Egret (*Egretta garzetta*) is a wading waterbird species that typically occurs within coastal and subcoastal areas. The species may inhabit inland wetlands; however, these predominantly occur within the Murray Darling Basin. As such, the species is considered unlikely to occur within the Project Area.
Falco peregrinus	Peregrine Falcon		R	Possible	1998	The Peregrine Falcon (*Falco Peregrinus*) is a species of raptor that is distributed over the entire Australian continent. The species can inhabit a wide range of habitats from plains to woodlands, and therefore may occur within the Study area. Peregrine Falcons typically nest on cliffs; however, human created structures or the disused nests of other raptors may also support breeding opportunities for this species within the Study area.
Gallinago hardwickii	Lathams Snipe		R	Likely	2000	See table 6.
Limosa limosa	Black-tailed Godwit	Mi	R	Unlikely	1998	The Black-tailed Godwit (*Limosa limosa*) is a species of migratory shorebird that is predominantly occurs within coastal habitats. The species irregularly uses inland waterbodies, of which, most are restricted to the Murray Darling Basin. As an EPBC listed migratory species, any observations are likely to be short term stopovers on migratory flight paths
Lophochroa leadbeateri mollis	Major Mitchell's Cockatoo		R	Possible	1999	The Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) is a species of cockatoo restricted to semi-arid and arid Australia. Suitable habitat for this species is relatively widespread in the Study area, as it may inhabit chenopod shrublands, timbered watercourses, Mulga and *Casuarina pauper* woodland.
Neophema chrysostoma	Blue-winged Parrot		V	Possible	1999	The Blue-winged Parrot (*Neophema chrysostoma*) is a migratory species of parrot that primarily breeds in the south-east of Australia. Following the breeding season, the species expands its distribution in to semi-arid regions. Suitable habitat for Blue-winged Parrots in the Project Area is widespread; and includes chenopod shrublands, Mulga and Myall woodlands.
Neophema splendida	Scarlet-chested Parrot		R	Possible	1996	The Scarlet-chested Parrot (*Neophema splendida*) is a highly nomadic and irruptive parrot that inhabits arid Australia. The species would be most likely to occur within areas of vegetated dunes and Mulga.
Oxyura australis	Blue-billed Duck		R	Possible	2000	The Blue-billed Duck (*Oxyura australis*) is a species of waterfowl that inhabits inland waterbodies. This species is less likely to occur at pastoral dams unless they are expansive, as they prefer large waterbodies.

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Most recent record	Comment
		Aus	SA			
Phaps histrionica	Flock Bronzewing		R	Possible	2013	The Flock Bronzewing (*Phaps histrionica*) is a highly nomadic species of pigeon that forms flocks numbering thousands of individuals. This species is irregularly recorded at Roxby Downs, and would be expected to be most likely to occur in the northern sectors of the Study area.
Plegadis falcinellus	Glossy Ibis		R	Possible	1999	The Glossy Ibis is a nomadic and irruptive species of waterbird. The species regularly occurs at ephemeral waterbodies, and therefore, could occur within the Project Area on exceptionally wet years.
Podiceps cristatus	Great Crested Grebe		R	Possible	1999	The Great Crested Grebe (*Podiceps cristatus*) is a species of waterfowl that inhabits inland waterbodies. This species is less likely to occur at pastoral dams unless they are expansive, as they prefer large waterbodies.
Porzana tabuensis	Spotless Crake		R	Possible	2000	The Spotless Crake (*Porzana tabuensis*) is a small shorebird species that is reliant upon well vegetated wetlands. As such, dams with emergent and fringing vegetation may support this species.
Stictonetta naevosa	Freckled Duck		V	Likely	2004	The Freckled Duck (*Stictonetta naevosa*) is a species of waterfowl that regularly occurs inland. Within the Project Area, the species is likely to occur at pastoral dams and may temporally inhabit inland waterbodies during flood.
Tringa glareola	Wood Sandpiper	Mi	R	Possible	2001	The Wood Sandpiper (*Tringa glareola*) is a species of migratory shorebird. Although more common in coastal and sub-coastal environments, the species does occur inland. Pastoral dams and inland waterbodies may provide temporal habitat for this species during migratory flight path stops or resting sites being an EPBC listed migratory species.
Aspidites ramsayi	Woma Python		R	Unlikely	1990	The Woma is a large python with an average length of 1.5 m and a maximum length of approximately 2.7 m. Widespread throughout arid and semi-arid Australia from coastal Western Australia to western Queensland. The Woma is a ground dweller that seeks shelter in hollow logs, animal burrows or thick herbage during the day. It can also use its head like a shovel to dig and enlarge its burrow. With the most recent record nearly 30 years ago, it is still remotely possible that this species occurs within the Study area.

Scientific name	Common name	Conservation status		Likelihood of occurrence within Project Area	Most recent record	Comment
		Aus	SA			
Nephrurus deleani	Pernatty Knob-tailed Gecko		R	Likely	2000	The Pernatty Knob-tailed Gecko is endemic to South Australia, only occurring within an area of approximately 500 km2 north of Port Augusta, to the east of Island Lagoon and Lake Macfarlane and around Pernatty Lagoon (Ehmann and Watson, undated). It occupies sand dune habitat where it digs burrows, backfilling them from within, to refuge during the day. This species is very likely to be present within the Project Area. A short night time survey was conducted for this species during the assessment in a *Callitris glaucophylla* Woodland on sand under without any observations
Pseudomys australis	Plains Mouse	VU	V	Likely	2010	See table 6.

Conservation status: **Aus**.: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA**: South Australia (*National Parks and Wildlife Act 1972*).
Conservation codes: **CE**: Critically Endangered. EN/E: Endangered. **VU/V**: Vulnerable. **R**: Rare.

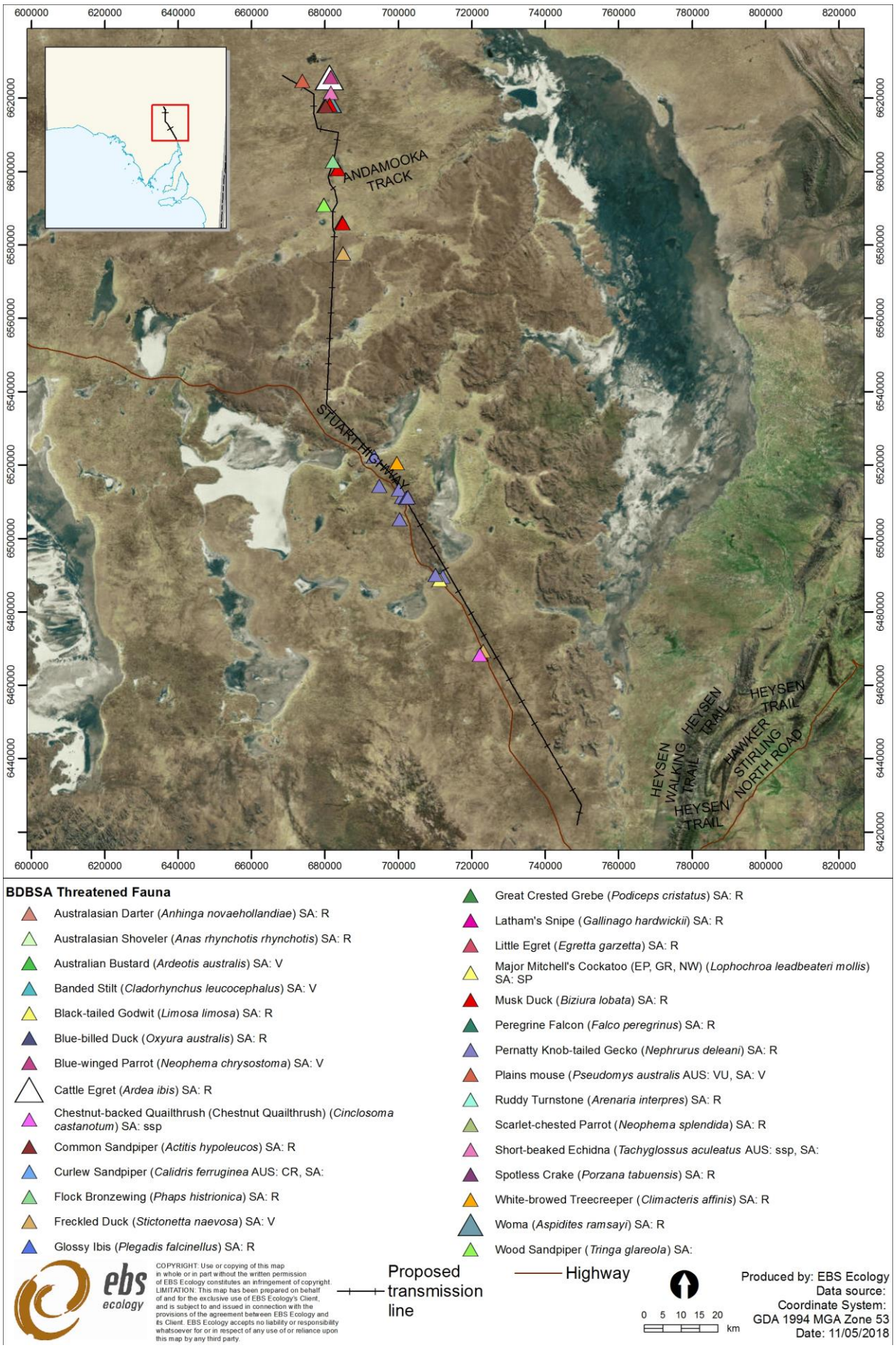


Figure 3. Threatened fauna species recorded within the Study Area identified in BDBSA database search (DEW 2018).

5.2.3 State threatened ecosystems

No vegetation communities were listed as threatened for the relevant sub region on the Provisional List of State Threatened Ecosystems (DEH, in progress). Two communities were listed as 'of concern' for the Arcoona Sub Region (GAW 04);

- *Eucalyptus coolabah* (Coolibah) Woodland on levees and channel banks of regularly inundated floodplains
- *Atriplex nummularia* (Golden Goosefoot) Open Shrubland with occasional emergent *Eucalyptus camaldulensis* (River Red Gum) or *E. coolabah* (Coolibah) on low sandy rises of floodplains

Neither of these vegetation communities were observed during the field survey or were recognised as pre-existing vegetation associations in past vegetation association mapping.

5.2.4 Invasive species

Twenty-five exotic species were identified by the PMST as potentially occurring or having suitable habitat within the Study Area. This includes eight bird, seven mammal and 10 flora species. A summary of these species, their status and comment regarding their likelihood of occurrence within the Project Area is provided in Table 9.

Sixty-eight exotic species were identified in the BDBSA as being recorded within the Study Area. This includes six bird, eight mammal and 54 flora species. One mammal species recoded was *Ovis aries* (Sheep) which is generally a non-invasive species so is excludued from the list. All BDBSA records are listed in Appendix 1 and Appendix 2 and include exotic species.

Table 9. Exotic flora and fauna species potentially occurring within the Study Area identified in the PMST database searches (DotEE 2018).

Scientific name	Common name	Status	Likelihood of occurrence within Project Area	Observed within Study Area
AVES	**Birds**			
Alauda arvensis	Skylark		Likely	Yes
Anas platyrhynchos	Mallard		Unlikely	No
Columba livia	Domestic Pigeon		Possible	No
Passer domesticus	House Sparrow		Likely	Yes
Streptopelia chinensis	Spotted Turtle-dove		Unlikely	No
Struthio camelus	Ostrich		Unlikely	No
Sturnus vulgaris	Common Starling		Likely	No
Turdus merula	Common Blackbird		Unlikely	No
MAMMALIA	**Mammals**			
Camelus dromedarius	Camel		Unlikely	No
Capra hircus	Goat		Known	Yes
Felis catus	Cat		Known	No
Mus musculus	House Mouse		Known	No
Oryctolagus cuniculus	European Rabbit		Known	Yes
Rattus rattus	Black Rat		Possible	No
Vulpes vulpes	European Red Fox		Likely	No

Scientific name	Common name	Status	Likelihood of occurrence within Project Area	Observed within Study Area
PLANTAE	**Plants**			
Asparagus asparagoides	Bridal Creeper	WoNS, D	Unlikely	No
Austrocylindropuntia spp.	Prickly Pears	WoNS,	Possible	No
Carrichtera annua	Ward's Weed	WoNS, E	Likely	Yes
Cylindropuntia spp.	Prickly Pears	WoNS,	Possible	No
Lycium ferocissimum	African Boxthorn	WoNS, D	Likely	Yes
Opuntia spp.	Prickly Pears	WoNS, D	Likely	Yes
Parkinsonia aculeate	Jerusalem Thorn	WoNS, D	Unlikely	No
Prosopis spp.	Mesquite	WoNS,	Unlikely	No
Solanum elaeagnifolium	Silver Nightshade	WoNS,	Possible	No
Tamarix aphylla	Athel Pine	WoNS, D	Likely	No

Status: **WoNS**: Weed of National Significance (*Environment Protection and Biodiversity Conservation Act 1999*). **D**: Declared (*Natural Resources Management Act 2004*). **E**: Environmental weed (DPTI).

Rangeland weed species have been historically introduced through a number of vectors, some deliberately and others unintentionally. Species such as *Acetosa vesicaria* (Ruby Dock) and *Cenchrus ciliaris* (Buffel Grass) have anecdotally been introduced though the Afghan cameleers. Saddle padding was constructed from the seed heads of these species which then spread through the inland areas. Areas such as road and rail corridors are prime areas where weeds spread uncontained or are frequently introduced. Creeks and the nature of episodic rain events common to arid regions spreads seed resources through flood events. Stock movement from station to station, often from long distances has also aided the spread of weeds through hooves, seed stuck in fur and wool, trucks, and animal droppings. Road works and seed transfer through machinery being contaminated from other work sites are the chief man made vectors.

Buffel Grass is considered a valuable pasture species where warm season rainfall is the predominant climatic driver, foremost throughout much of central Queensland. However, areas in the north eastern pastoral district and far north-west of the state provide highly suitable conditions in certain years. The high summer rainfall events in 2011 and 2012 saw a substantial spread of this species southward into the Agricultural areas with records as far south as Crystal Brook.

No observations of *Cenchrus ciliaris* (Buffel Grass) were made during the field survey.

5.3 Olympic Dam Expansion EIS review

BHP Billiton (2009) describe the ecological features within the 10 km southern infrastructure corridor (SIC), including vertebrates present, landforms and vegetation condition, structure and diversity. The SIC extends from Roxby Downs Municipality to Point Lowly. Therefore, only sections a-d are relevant to the Project Area (BHP Billiton 2009). The proposed alignment of the Project Area falls within the SIC from Carriewerloo Substation until it diverts west at Roxby Down Municipality.

Flora and fauna surveys for the EIS were conducted in March and April 2006. The majority of historical flora and fauna surveys were conducted in winter and spring of 1991, with supplementary flora surveys conducted in December 1991 and March 1992. Minor changes to the original route were surveyed in 1997.

Fauna surveys for the EIS included determination of habitat type and opportunistic observations. Historic mammal and reptile surveys included two pitfall trap line in each land system, as well as opportunistic observations and active searches. Bird surveys comprised observations along traverses and waterbird censuses on the Arcoona Lakes.

5.3.1 Vegetation associations

BHP Billiton (2009) identified 65 vegetation associations in the SIC across seven land systems that are relevant to the Project Area. These are summarised in Table 10. It is important to reiterate that the Project Area, for the purposes of the current assessment, constitutes a 500 m transmission line corridor. Therefore, the current field survey was not expected to identify this number of vegetation associations.

Table 10. Relevant land systems, vegetation associations and land forms identified in sections a-d of the 10 km SIC in the Olympic Dam Expansion Draft EIS (BHP Billiton 2009).

Land System	Vegetation Association	Land forms
Roxby	*Acacia victoriae*, *A. ligulata* and *Myoporum* sp. Tall Shrubland	Watercourses
	Acacia ligulata / *Maireana pyramidata* Shrubland	Low dunes around lagoons
	Halosarcia sp. Low Open Shrubland	Lagoon fringes
Lookout	*Melaleuca pauperiflora* ssp. *mutica* Tall Shrubland to Low Woodland	Lagoon fringes (Purple Swamp)
	Sclerolaena tatei Low Shrubland	Calcareous rises
	Acacia tetragonophylla Tall Shrubland	Drainage lines on stony rises
	Maireana pyramidata Shrubland	Sandy-clay soils on plains
	Acacia ligulata Shrubland	Low dunes and sandsheets
	Eremophila duttonii / *Scaevola spinescens* / *Maireana sedifolia* Shrubland	Stony rises
	Maireana sedifolia Open Shrubland	Stony rises
	Chenopodium nitrariaceum Shrubland	Swamps (Purple Swamp)
Arcoona	*Atriplex vesicaria* / *Astrebla pectinata* Low Shrubland	Tablelands
	Atriplex vesicaria / *Maireana astrotricha* Low Shrubland	Tablelands
	Atriplex vesicaria / *Sclerostegia medullosa* / *Maireana eriantha* Low Shrubland	Steep to gentle tableland slopes
	Atriplex vesicaria / *Sclerostegia medullosa* Low Shrubland	Tablelands
	Atriplex vesicaria Low Shrubland	Tablelands

Land System	Vegetation Association	Land forms
	Casuarina pauper Low Open Woodland	Steep slopes of drainage lines and upper escarpment slopes and plateau (Uro Bluff)
	Eremophila duttonii Open to Very Open Shrubland	Steep slopes of drainage lines
	Sclerostegia sp. and *Sclerolaena* sp. Low Shrubland	Gentle tableland slopes
	Atriplex vesicaria / *Halosarcia* sp. Low Shrubland	Foot slopes near lagoons
	Atriplex vesicaria Low Shrubland	Upper catchments of large rocky drainage lines and small rocky drainage lines
	Casuarina pauper +/- Acacia aneura Low Open Woodland	Rocky drainage lines
	Eragrostis australasica Grassland	Gilgai and swamps
	Maireana aphylla +/- Chenopodium nitrariaceum Shrubland	Gilgai
	Myoporum montanum / *Halosarcia* sp. Shrubland	Lower reaches of rocky drainage lines or sandy drainage lines
Torrens	*Halosarcia sp.* Low Open Shrubland	Lagoon fringes
	Atriplex vesicaria / *Halosarcia* sp. Low Open Shrubland	Alluvial plain
	Myoporum acuminatum / *Melaleuca pauperiflora* ssp. *mutica* Tall Shrubland	Alluvial plain
Hesso	*Acacia aneura* Low Open Woodland	Sand plains and dunefields
	Acacia papyrocarpa Low Open Woodland	Sand plains on calcareous sandy loams and swales in dunefields
	Acacia aneura / *Acacia papyrocarpa* Low Open Woodland	Sand plains
	Acacia aneura / *Alectryon oleifolius ssp. canescens* Low Open Woodland	Dune crests and slopes in dunefields
	Acacia burkittii Low Open Woodland	Dunefields
	Casuarina pauper Low Open Woodland	Dunefields
	Callitris glaucophylla Low Open Woodland	Dunefields
	Acacia ramulosa / *A. aneura* / *A. burkittii* Tall Open Woodland	Dune crests and upper dune slopes
	Dodonaea viscosa ssp. *angustissimus* / *Acacia ligulata* Shrubland	Dune crests
	Senna sp. / *Dodonaea microzyga* / *Maireana sedifolia* Shrubland	Stony rises
	Maireana astrotricha +/- Atriplex vesicaria Low Open Shrubland	Stony rises
	Maireana sedifolia Low Open Shrubland	Shallow sandy clay loams over limestone
	Atriplex vesicaria / *Maireana sedifolia* Low Open Shrubland	Sandplains on shallow sands over limestone
	Maireana pyramidata Low Open Shrubland	Sandy clay soils in drainage areas
Bowen	*Acacia aneura* Low Open Woodland	On dunes surrounding lagoon
	Maireana pyramidata Low Open Shrubland	Run-on areas at base of stony rises and sandy-clay soils near lagoons
	Atriplex vesicaria / *Sclerostegia* sp. Low Open Shrubland	Slopes of stony rises
	Maireana sedifolia +/- Atriplex vesicaria Low Open Shrubland	Stony rises
	Halosarcia sp. / *Gunniopsis quadrifida* Low Open Shrubland	Margins of clay pans
	Maireana aphylla / *Muehlenbeckia florulenta* Shrubland	Drainage areas
	Dodonaea viscosa spp. *angustissimus* / *Acacia ligulata* Shrubland	Low dunes
Tent Hill	*Olearia axillaris* / *Scaevola calendulacea* Open Shrubland	White calcareous coastal dunes

Land System	Vegetation Association	Land forms
	Beyeria lechenaultii / *Westringia rigida* Low Open Shrubland	Sandy-clay soils on coastal cliff tops
	Acacia papyrocarpa Low Open Woodland	Foot slopes
	Casuarina pauper Low Woodland to Open Woodland	Foot slopes, steep escarpments and steep quartzite slopes
	Eucalyptus socialis Low Woodland	Tablelands
	Geijera linearifolia Shrubland	Steep quartzite slopes
	Dodonaea viscosa ssp. *angustissimus* Shrubland	Low dunes
	Maireana pyramidata Low Open Shrubland	Run-on areas on foot slopes and in drainage lines
	Acacia victoriae Tall Open Shrubland	Large open drainage lines
	Maireana sedifolia Low Open Shrubland	Tablelands and escarpment slopes and low rises
	Atriplex vesicaria / *Maireana astrotricha* Low Open Shrubland	Upper plateau slopes north of Port Augusta
	Maireana sedifolia / *Atriplex vesicaria* Low Open Shrubland	Plateau and foot slopes
	Myoporum platycarpum Open Woodland	Drainage lines on plateau
	Maireana pyramidata / *M. sedifolia* Low Open Shrubland	Foot slopes
	Triodia irritans Hummock Grassland	Steep escarpment slopes and plateau
	Eucalyptus intertexta Open to Very Open Woodland	Rocky drainage lines on lower foot slopes of tablelands

5.3.2 Flora

WMC (1997) recorded 318 indigenous vascular plant species during surveys of SIC. BHP Billiton (2009) recorded a further 81 species; however, the majority of these were recorded in the pipeline corridor in the Point Lowly area, which is irrelevant to the current project. The Olympic Dam Expansion Draft EIS determined that no flora species of national conservation significance were recorded in the SIC. Two state-listed species were recorded, Sandalwood (*Santalum spicatum*) (V) and Large Adder's-tongue (*Ophioglossum polyphyllum*) (R). The likelihood of occurrence of Sandalwood (known) and Large Adder's-tongue (likely) in the Study Area are discussed in Table 7.

5.3.3 Fauna

Five native and one introduced small mammal species were recorded during previous pitfall trapping surveys (WMC 1997). Three species of kangaroo were also recorded along with sheep, rabbits and goats. There are records for a further nine native species of mammal and five introduced mammals inside the SIC. Thirty reptile species were trapped in pitfall traps within the SIC (WMC 1997). BHP Billiton (2009) identified that an additional 53 reptile species had been recorded within the SIC. Sixty-three bird species were recorded during winter and spring bird counts in the SIC (WMC 1997). A further 143 species had been recorded inside the SIC.

EPBC Act listed species

BHP Billiton (2009) found that four fauna species listed as threatened under the EPBC Act had been recorded within the SIC. The authors also determined that a further four Commonwealth listed fauna

species could potentially occur in the area based on their ranges and the presence of preferred habitat (Table 11).

The likelihood of occurrence of the Thick-billed Grasswren (*Amytornis modestus*) (likely), Plains Rat (*Pseudomys australis*) (likely) and Night Parrot (*Pezoporus occidentalis*) (unlikely) in the Study Area are discussed in Table 6.

The Slender-billed Thornbill (*Acanthiza iredalei*) occurs in arid and semi-arid regions of south-western South Australia. Its known distribution extends across the Nullarbor Plain to Whyalla, Port Augusta and Port Davis in South Australia. The species is considered to possibly occur in the Study Area.

The Western Grasswren (*Amytornis textilis myall*) is restricted to South Australia. It is scattered and widespread on the northeastern Eyre Peninsula, from around Whyalla and Mt Middleback, northwest through the Gawler Ranges (particularly the eastern Gawler Ranges), north to around Lake MacFarlane and eastern Lake Gairdner. The species is considered to possibly occur in the Study Area.

The Great Knot (*Calidris tenuirostris*) has been recorded around the entirety of the Australian coast, with a few scattered records inland. The species is considered unlikely to occur in the Study Area.

The Plains Wanderer (*Pedionomus torquatus*) inhabits sparse native grasslands and is often absent from areas where grass becomes too dense or too sparse. The species nests amongst native grasses and herbs, or sometimes amongst crops, feeding on a mixture of seeds, invertebrates and leaves. The species is considered unlikely to occur in the Project Area.

The authors recognised then as EBS does now, that the distribution of the Pernatty Knob-tailed Gecko most closely coincides with the SIC and current Project Area. Suitable habitat for this species occurs in *Acacia* shrubland between Lake Windabout and Pernatty Lagoon (BHP Billiton 2009).

Since the publication of the EIS, four federal-listed species identified by BHP Billiton (2009) have had their listing under the EPBC Act updated. The Great Knot (*Calidris tenuirostris*) and Plains-wander (*Pedionomus torquatus*) are now critically endangered, and the Greater Long-eared Bat (*Nyctophilus timoriensis*) and Pernatty Knob-tailed Gecko (*Nephrurus deleani*) are no longer listed.

NPW Act listed species

BHP Billiton (2009) identified a further two state-listed reptile species, eighteen state-listed wetland migratory waterbird species, and 11 state-listed bushland bird species that had been recorded within the SIC. These are summarised in Table 11.

No state-listed species identified by BHP Billiton (2009) have had their listing under the NPW Act updated since the publication of the EIS.

Table 11. EPCA Act and NPW Act listed species identified in the Olympic Dam Expansion Draft EIS (BHP Billiton 2009). Up-to-date conservation statuses are shown in parentheses.

Scientific name	Common name	Conservation status		Recorded / potentially occurring
		Aus	SA	
AVES	**Birds**			
Acanthiza iredalei	Slender-billed Thornbill	VU	R	Recorded
Actitis hypoleucos	Common Sandpiper		R	Recorded
Amytornis modestus	Thick-billed Grasswren	VU		Recorded
Amytornis textilis myall	Western Grasswren	VU		Recorded
Anas rhynchotis	Australasian Shoveler		R	Recorded
Anhinga melanogaster	Darter		R	Recorded
Ardeotis australis	Australian Bustard		V	Recorded
Arenaria interpres	Ruddy Turnstone		R	Recorded
Biziura lobata	Musk Duck		R	Recorded
Burhinus grallarius	Bush Stone-curlew		R	Recorded
Cacatua leadbeateri	Major Mitchell's Cockatoo		R	Recorded
Calamanthus cautus	Shy Heathwren		R	Recorded
Calidris tenuirostris	Great Knot	(CE)	R	Recorded
Cinclosoma castanotus	Chestnut Quail-thrush		R	Recorded
Cladorhynchus leucocephalus	Banded Stilt		V	Recorded
Climacteris affinis	White-browed Treecreeper		R	Recorded
Coturnix ypsilophora	Brown Quail		V	Recorded
Egretta garzetta	Little Egret		R	Recorded
Gallinago hardwickii	Latham's Snipe		R	Recorded
Haematopus fuliginosus	Sooty Oystercatcher		R	Recorded
Haematopus longirostris	Pied Oystercatcher		R	Recorded
Limosa limosa	Black-tailed Godwit		R	Recorded
Myiagra inquieta	Restless Flycatcher		R	Recorded
Neophema chrysostoma	Blue-winged Parrot		V	Recorded
Neophema elegans	Elegant Parrot		R	Recorded
Neophema splendida	Scarlet-chested Parrot		R	Recorded
Numenius madagascariensis	Eastern Curlew		V	Recorded
Oxyura australis	Blue-billed Duck		R	Recorded
Pedionomus torquatus	Plains-wanderer	VU (CE)	E	Potentially
Pezoporus occidentalis	Night Parrot	EN	E	Potentially
Plegadis falcinellus	Glossy Ibis		R	Recorded
Podiceps cristatus	Great Crested Grebe		R	Recorded
Sterna nereis	Fairy Tern		E	Recorded
Stictonetta naevosa	Freckled Duck		V	Recorded
MAMMALIA	**Mammals**			
Nyctophilus timoriensis	Greater Long-eared Bat	VU (removed)	V	Potentially
Pseudomys australis	Plains Rat	VU	V	Potentially
REPTILIA	**Reptiles**			
Morelia spilota	Carpet Python		R	Recorded
Nephrurus deleani	Pernatty Knob-tailed Gecko	VU (removed)	R	Recorded
Vermicella annulata	Common Bandy-Bandy		R	Recorded

Conservation status: **Aus**.: Australia (Environment Protection and Biodiversity Conservation Act 1999). **SA**: South Australia (National Parks and Wildlife Act 1972).
Conservation codes: **CE**: Critically Endangered. **EN/E**: Endangered. **VU/V**: Vulnerable. **R**: Rare.

5.4 Key habitats

The key habitat types based on the on-ground assessment of the Study Area undertaken from the 19th – 23rd March 2018 are summarised below. Each habitat discussed is a broad description based on the dominant overstorey composition of each community.

5.4.1 Sandplain / low plain

This habitat is largely present at the southern end of the alignment where sand clay loams are over limestone. The species which are evolved to tolerate these soil types are dominated by *Maireana* shrubs, primarily *Maireana astrotricha* (Low Bluebush), *Maireana sedifolia* (Pearl Bluebush), *Maireana pyramidata* (Black Bluebush) and *Maireana georgei* (Satiny Bluebush) Other dominant shrub species include *Atriplex vesicaria* (Bladder Saltbush), *Rhagodia spinescens* (Thorny/spiny Saltbush) and *Senna* spp. (Senna). Areas where the loam depth exceeds 0.5 metre, *Acacia papyrocarpa* (Western Myall) will generally become the overstorey dominant species grading to *Acacia aneura* (Mulga) in sandier zones or those with less limestone calcrete underlying.

5.4.2 Dunes and swales

Remnant sand dunes and swales were typically dominated by an *Acacia aneura* (Mulga) dominant community with a range of understorey shrubs dependent largely on soil type and structure. Co- dominant species such as *Myoporum platycarpum* (False Sandalwood), *Casuarina pauper* (Black Oak) and *Callitris glaucophylla* (Northern Cypress Pine) occur spasmodically within these areas. A wider range of understorey shrubs inhabits the dunes and swales in comparison to low plain areas largely in the form of Acacias such as *Acacia ramulosa* (Horse Mulga), *Acacia burkittii* (Pin Bush), *Acacia ligulata* (Sandhill Wattle) and *Acacia tetragonophylla* (Dead Finish). In many areas short lived perennial and perennial grass species will provide significant cover if rainfall in the preceding 6 months is adequate for growth.

5.4.3 Stony tablelands / Arcoona plateau

The Arcoona Plateau was present within the alignment and provides a specialised habitat being comprised of heavy clay soils and a self-mulching cover of stones. The shrub cover is the dominant overstorey, primarily *Atriplex vesicaria* (Bladder Saltbush) as well as other halophytic tolerant species such as *Frankenia serpyllifolia* (Sea Heath), *Abutilon halophilum* (Plains Lantern), *Tecticornia medullosa* (Samphire), *Maireana eriantha* (Silver Bluebush) and *Maireana appressa* (Maireana). This vegetation community is exceptionally well represented at a regional level, however in terms of the rangelands as a whole, this community is relatively unique in its structure. This habitat provides significant refuge habitat for the Nationally Vulnerable Plains Mouse (*Pseudomys australis*).

5.4.4 Salt lakes and ephemeral claypans

Salt lakes and ephemeral claypans provide intermediate interruptions to the general landscape. The pan areas generally have no vegetation present however the margins are often home to a diverse and poorly represented vegetation structure that are highly tolerant of gypseous conditions. Species such as *Gunniopsis quadrifida* as well as other *Gunniopsis* spp. (Sturt's Pigface), *Tecticornia* spp. (Samphire),

Sarcozona praecox (Sarcozona), *Disphyma crassifolium* (Round-leaf Pigface) and *Melaleuca pauperifolia* ssp. *mutica* (Boree).

Salt and inland lakes within the arid interior of Australia fill on an irregular basis, however when this does occur, they become important wetlands for many bird species (Roshier et al. 2002). When inundated with water, these usually dry lakes provide key breeding and feeding grounds for many species, as well as providing resting points for migratory or nomadic species. Due to the large spatial scale of inland Australia and the distribution of inland lakes being widely spread, Australian waterbirds are highly mobile and dispersive, and are able to exploit temporary wetlands across much of the arid interior (Roshier et al., 2002). As such, the volume of species and abundance of birds arriving at these inlands wetlands when in prime condition can be very high. This was highlighted after the exceptional rainfall event in 1989. During a five-year period (1989–1994) that the Arcoona tablelands lakes held water, more than 150,000 birds from 56 species were observed inhabiting the Arcoona tableland lake system, which comprises of approximately 11 separate lakes (Pedler and Kovac, 2013). Therefore, it is considered that this habitat is of high conservation value.

A suite of endemic invertebrate fauna such as scorpions, spiders, ants, beetles and crickets, are known to occur on dry salt lake beds in South Australia, including Lake Torrens and its surrounding water bodies e.g. Pernatty Lagoon and Lake Windabout (Hudson, 1997).

The region is also home to aquatic invertebrates which will lay dormant as eggs until rainfall events stimulate their life cycle. Brine Shrimp (*Artemia sp* and *Parartemia sp*) species lay eggs that survive long periods of drought or dry conditions, before practically exploding back into existence with sustainable rainfall. Some of these species are also important within food chains, providing the large supplies of food resources in areas generally lacking. An example of this is the Banded Stilt which usually breeds on dry lake beds after the rainfall stimulate invertebrates such as Brine Shrimp to multiply.

5.4.5 Ephemeral creeklines

Ephemeral creeklines were largely present in the stony tableland communities where runoff falls away to inland salt lakes. These were commonly dominated by *Casuarina pauper* with an understorey of low shrubs and perennial grass species. Ephemeral creeks did not have any species of conservation significance highlighted as part of the desktop searches are observed during the baseline assessment present.

5.5 Flora

5.5.1 Vegetation associations

Vegetation associations were based on the previous Olympic Dam expansion EIS. Many of these associations overlapped somewhat with many changes based purely on co-dominant species presence/absence, which made transitional areas highly variable and difficult to map accurately. The rangeland assessment limits the number of perennial communities and landforms to 49 across the entire state, which is very broad; however most of the communities encountered during the assessment can be generally categorised into one of the 20 specific communities summarised below (Table 12). As noted in Section 5.1.7, no vegetation associations listed as threatened at a regional, state or national level were observed. Vegetation association locations within the Project Area are shown below in Figures 4 to 12.

Table 12. Description of the vegetation associations present in the Project Area.

Association	Description
1	*Acacia papyrocarpa* (Western Myall) Open Woodland
2	*Acacia aneura* (Mulga) Mixed Woodland
3	*Casuarina pauper* (Black Oak) / *Acacia aneura* (Mulga) Open Woodland
4	*Casuarina pauper* (Black Oak) Woodland
5	*Callitris glaucophylla* (Northern Cypress Pine) Woodland
6	*Acacia aneura* (Mulga) / *Acacia papyrocarpa* (Western Myall) Mixed Woodland
7	*Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrubland
8	*Acacia aneura* (Mulga) +/- *Alectryon oleifolius* (Bullock Bush) Shrubland
9	*Maireana sedifolia* (Pearl Bluebush) Low Open Shrubland
10	*Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)
11	*Atriplex vesicaria* (Bladder Saltbush)+/- *Maireana astrotricha* (Low Bluebush) Mixed Low Open Shrubland
12	*Acacia aneura* (Mulga), *Acacia ramulosa* (Horse Mulga) Woodland over *Acacia ligulata* (Sandhill Wattle)
13	*Acacia ligulata* (Sandhill Wattle) / *Dodonaea viscosa* (Sticky Hop-bush) Shrubland
14	*Tecticornia* spp. (Samphire) +/- *Atriplex vesicaria* (Bladder Saltbush) Low shrubland
15	*Casuarina pauper* (Black Oak) Creekline
16	*Atriplex vesicaria* (Bladder Saltbush) +/- *Eragrostis australasica* (Swamp Canegrass) Low Open Shrubland
17	*Maireana aphylla* (Cotton Bush) Low Shrubland
18	*Melaleuca pauperiflora* ssp. *mutica* (Boree) Shrubland +/- *Acacia ligulata* (Sandhill Wattle)
19	*Maireana astrotricha* (Low Bluebush) Low Open Shrubland
20	*Chenopodium nitrariaceum* (Nitre Goosefoot) Open Shrubland

At least one rangeland assessment was conducted for each association with many having up to five, dependent on the landform type, vegetation condition and variables such as grazing intensity. In total 56 rangeland assessments were conducted for the length of the transmission line.

Scores for the rangelands assessment contribute to the vegetation clearance requirements for the Project. At the current point in time the exact clearance requirement is uncertain, therefore the block size and clearance parameters may vary slightly from the current Unit Biodiversity Score (UBS) as shown in Appendix 3. All calculations for the Native Vegetation Clearance will be addressed in a subsequent report once the Project layout and refinements have been finalised.

Figure 4. Vegetation Associations location map 1 of 9.

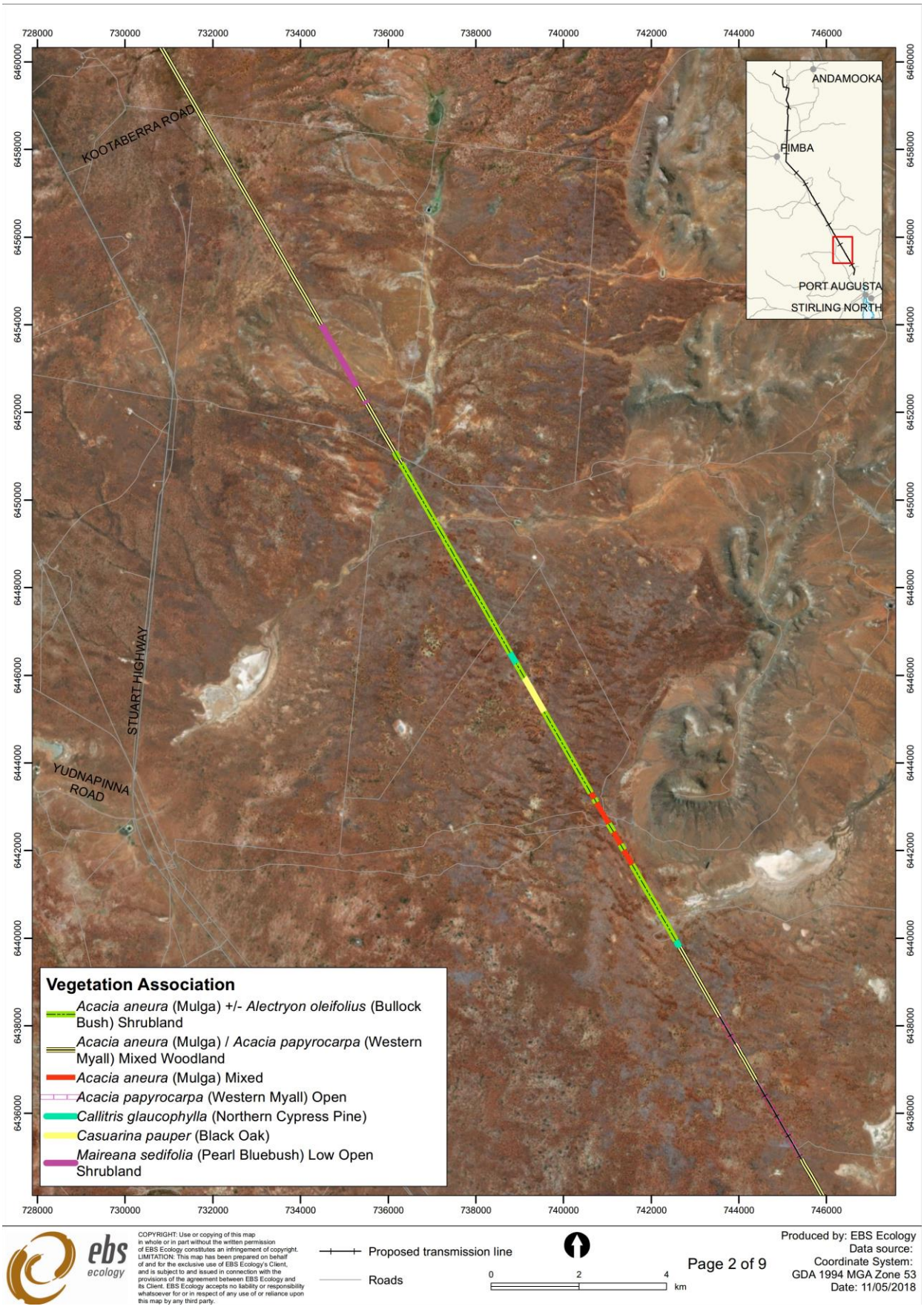


Figure 5. Vegetation Associations location map 2 of 9.

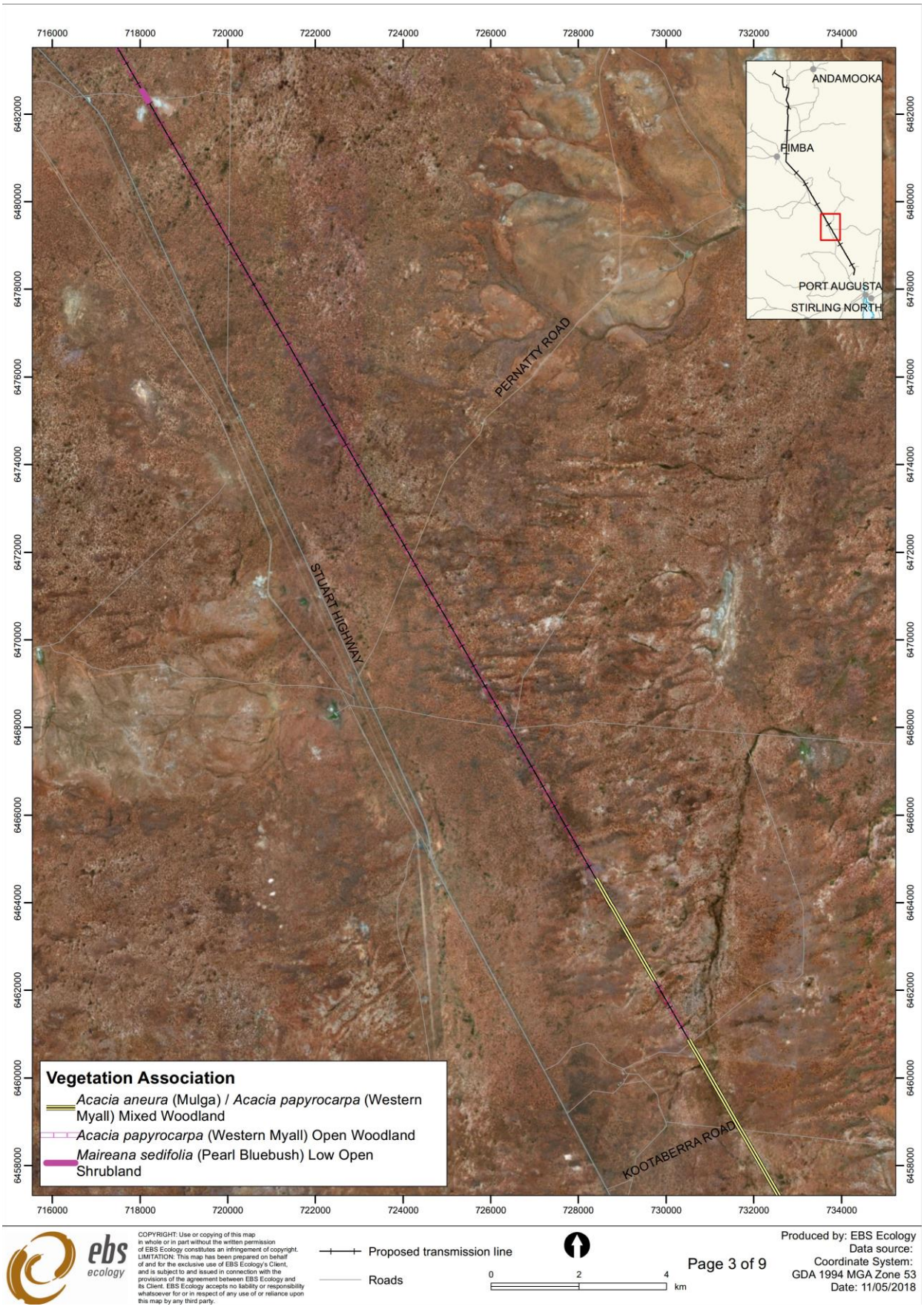


Figure 6. Vegetation Associations location map 3 of 9.

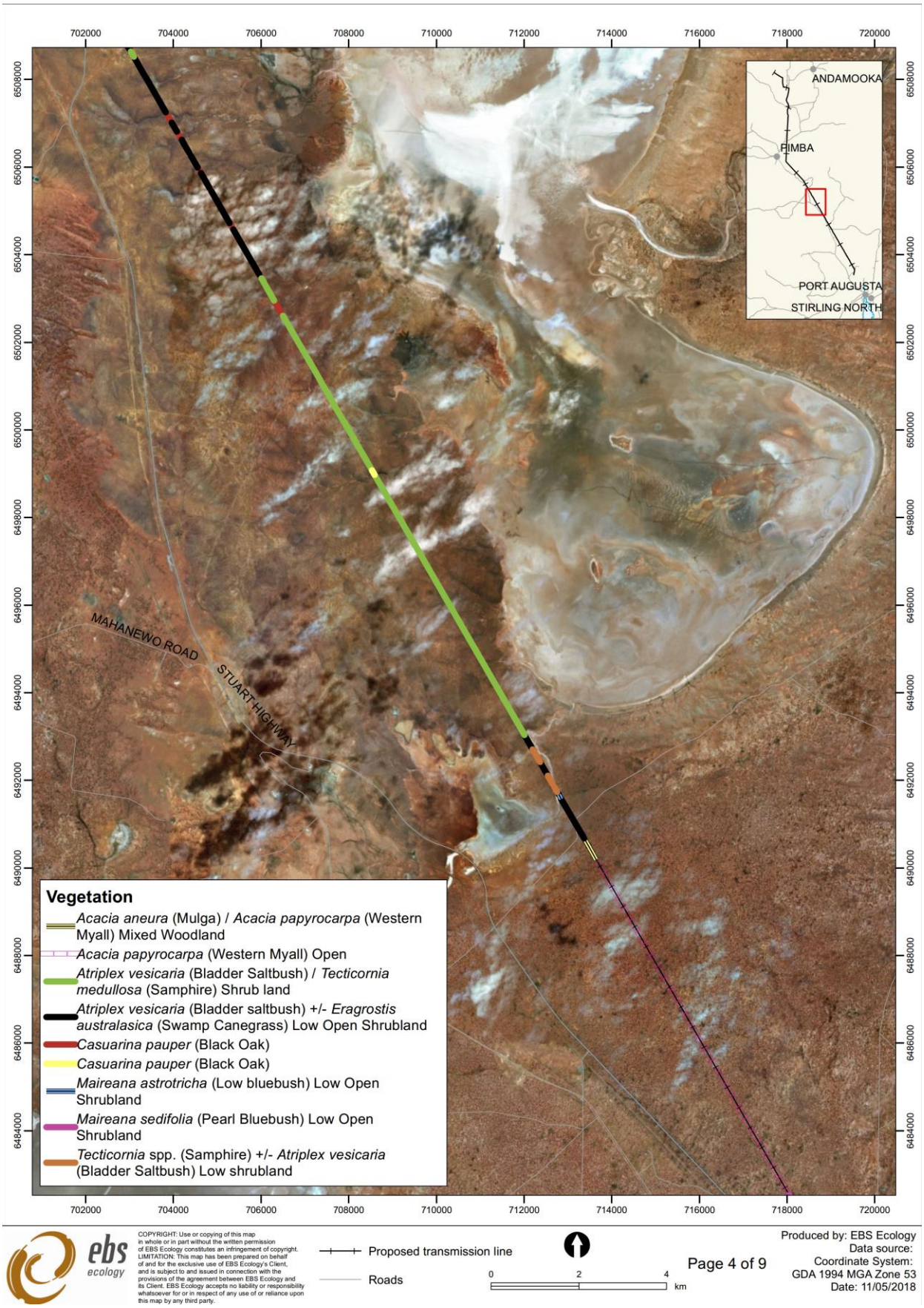


Figure 7. Vegetation Associations location map 4 of 9.

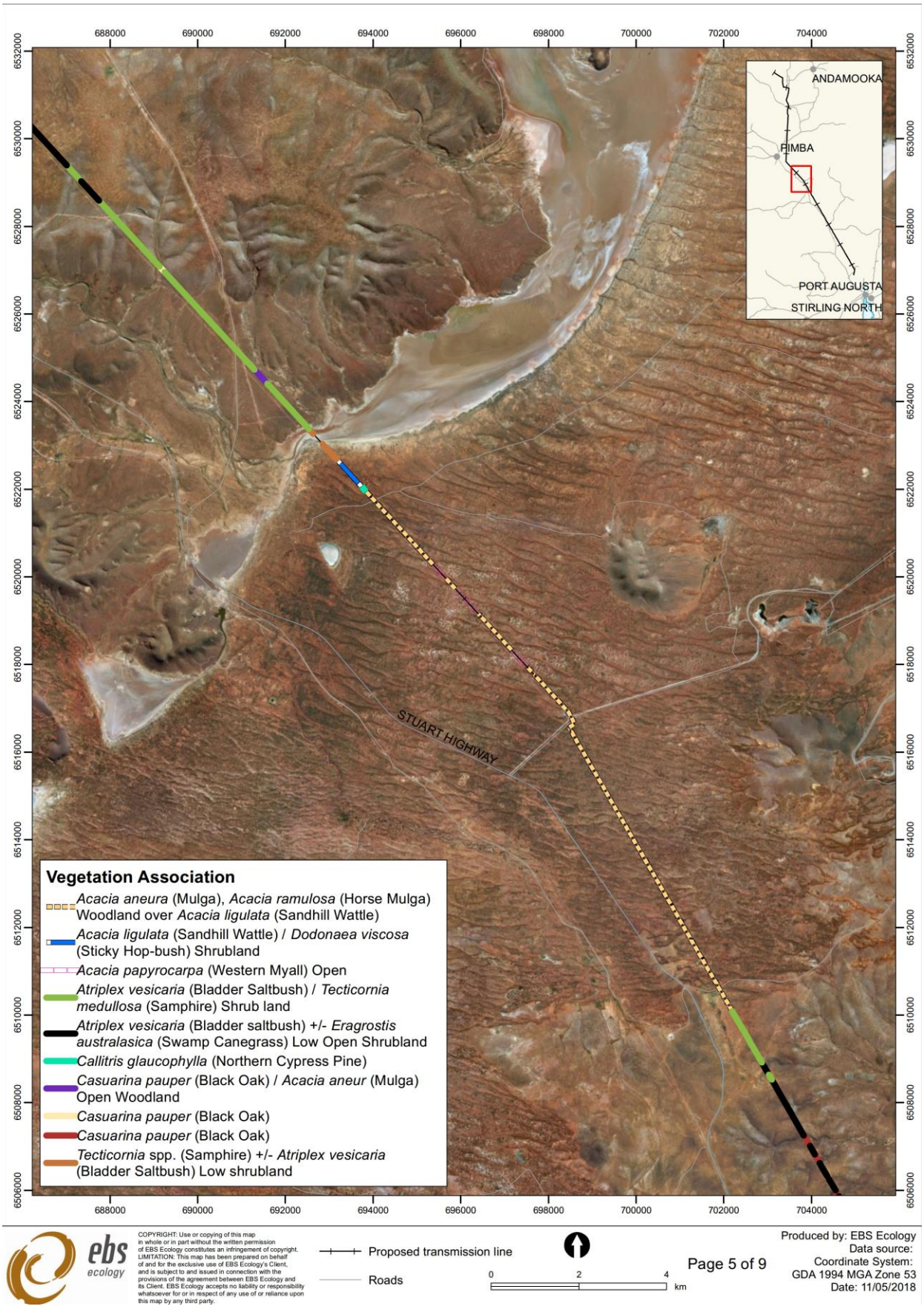


Figure 8. Vegetations Associations location map 5 of 9.

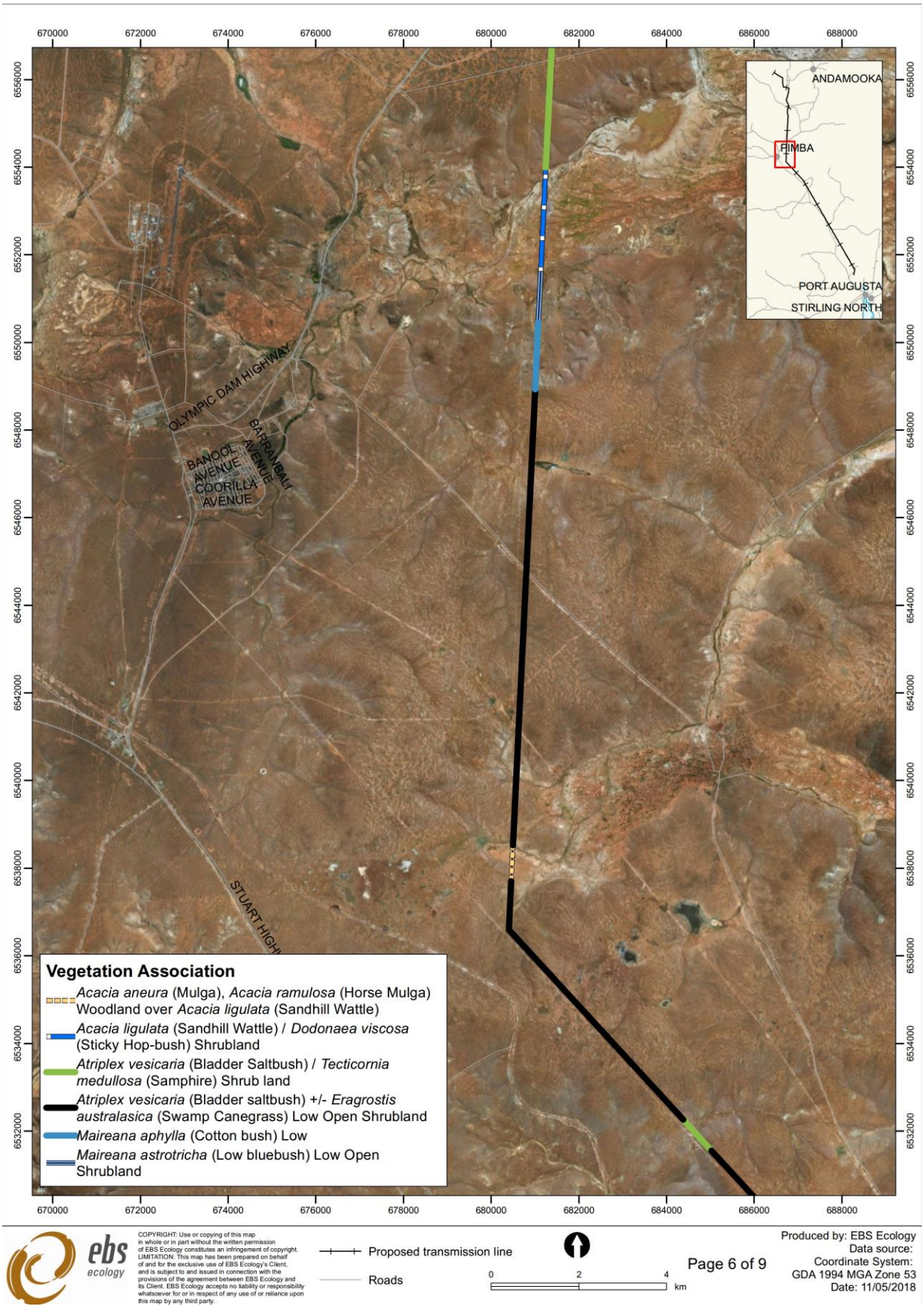


Figure 9. Vegetation Associations location map 6 of 9.

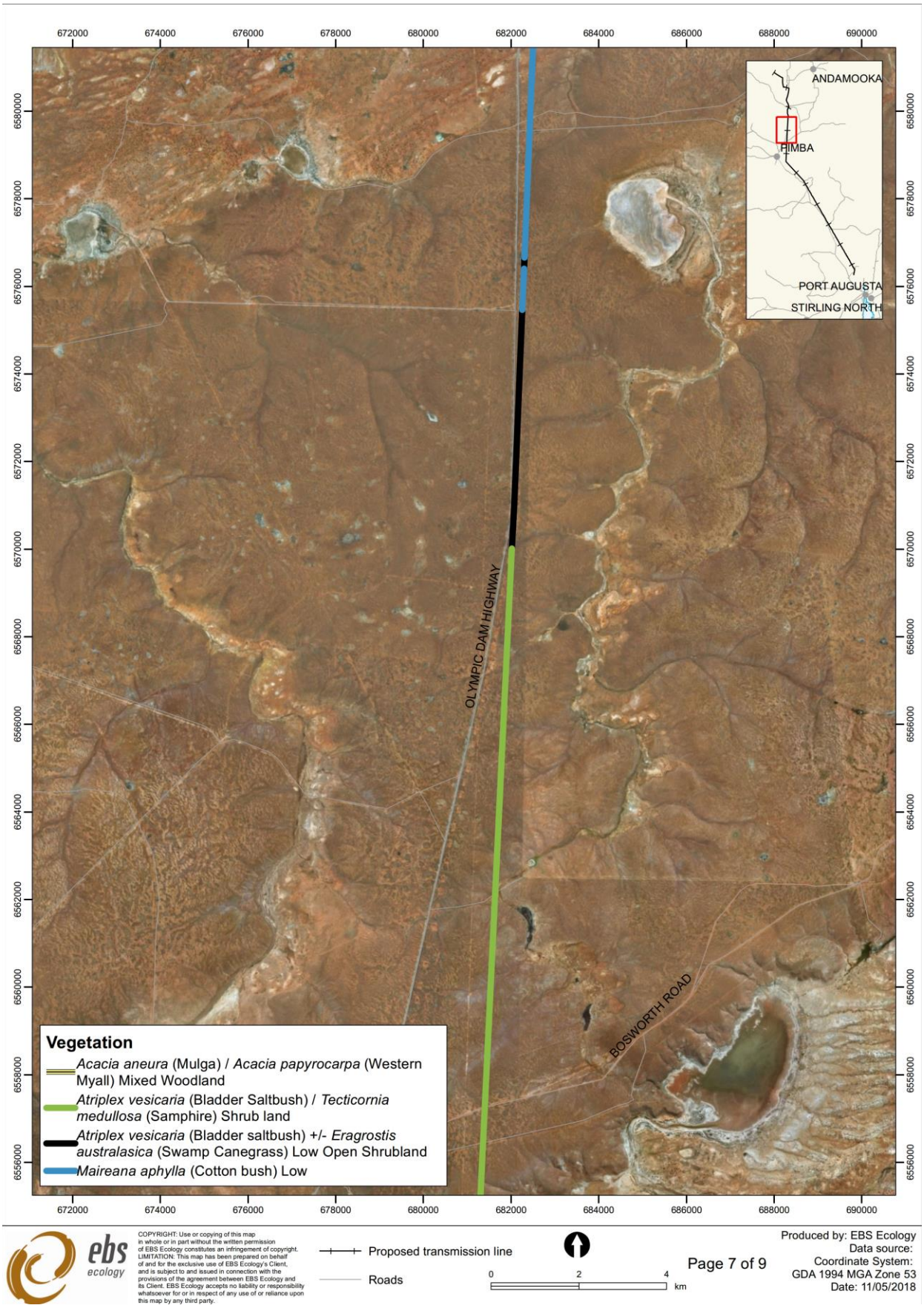


Figure 10. Vegetation Associations location map 7 of 9.

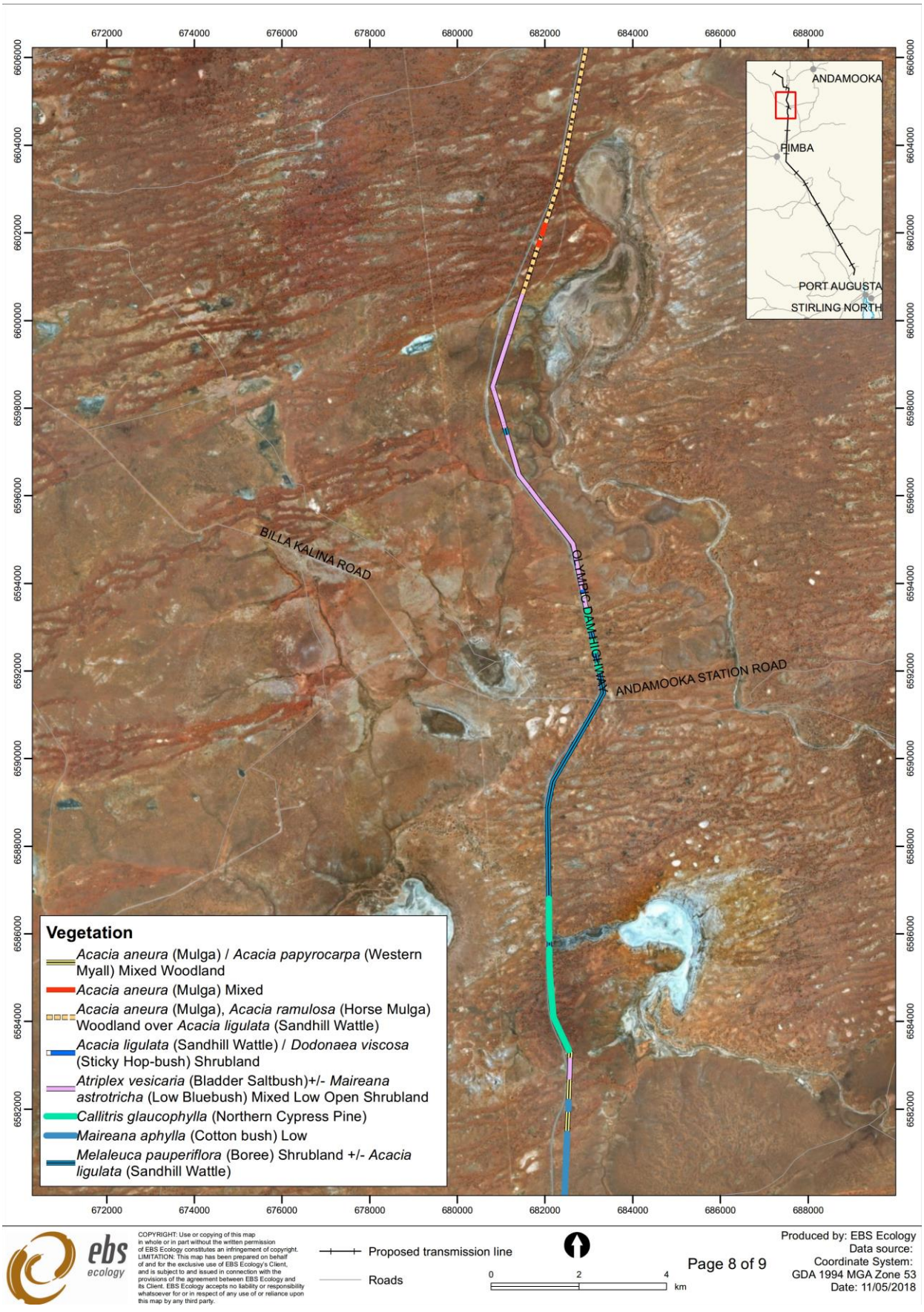


Figure 11. Vegetation Associations location map 8 of 9.

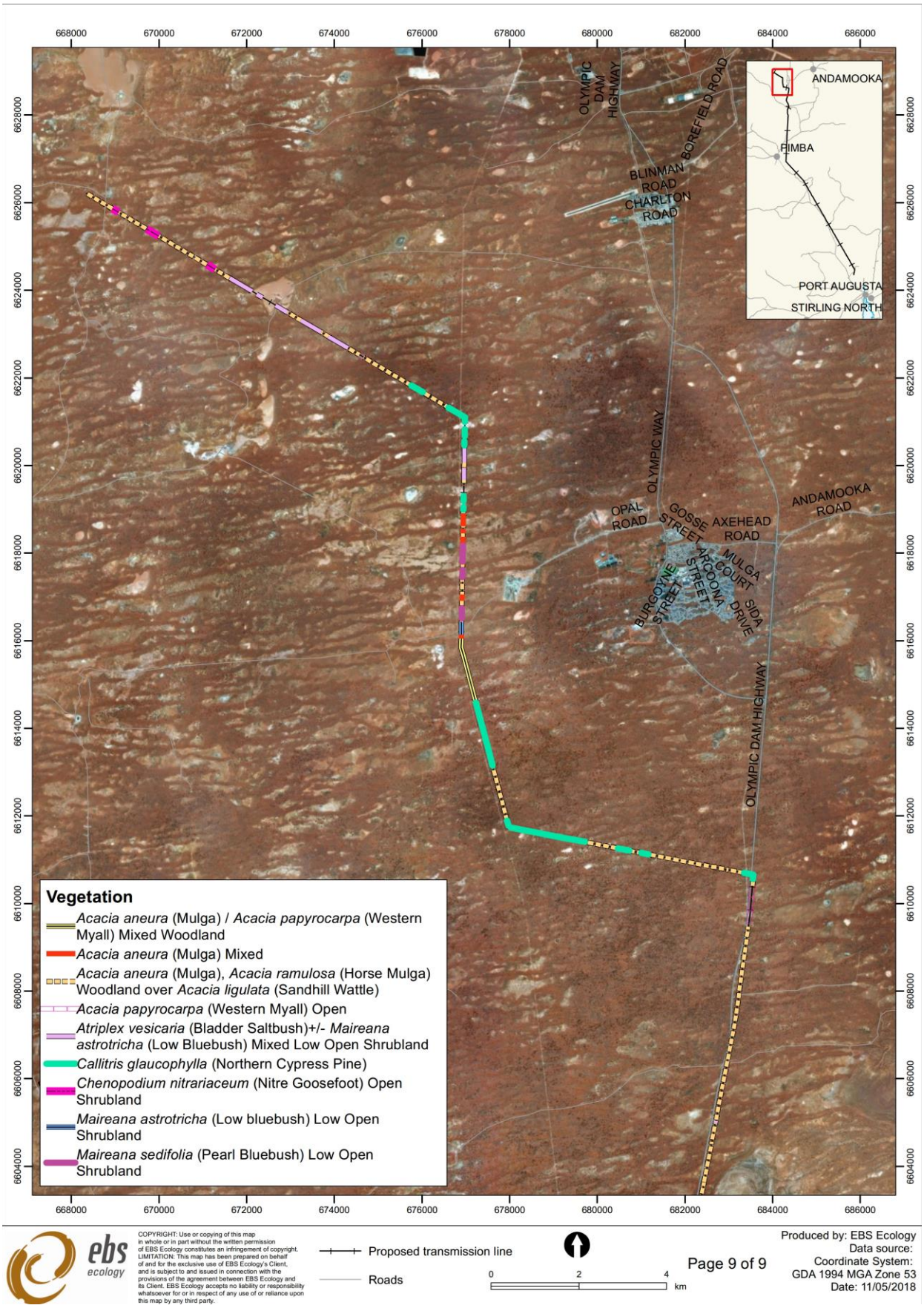


Figure 12. Vegetation Associations location map 9 of 9.

Vegetation association 1: *Acacia papyrocarpa* (Western Myall) Open Woodland

This association dominates the southern section of the alignment and was present where shallow loams over limestone exists. This association is largely present within the wider region as a belt approximately extending from the eastern edge of the Nullarbor Plain through to the Flinders Ranges and from Port Augusta through to the Arcoona plateau area (Miller et al. 2002). Understorey within these areas is generally specialised for this community with the drip line and shaded area most reliably consistent with perennial shrubs including *Rhagodia spinescens* (Spiny Saltbush), *Enchylaena tomentosa* (Ruby saltbush), *Maireana trichoptera* (Hairy Fruit Bluebush), *Maireana erioclada* (Rosy Bluebush) and *Chenopodium curvispicatum* (Cottony Goosefoot). A dense litter mat is also present in areas of better condition and this makes these sites very important in terms of fauna refuge and roosting sites, nutrient cycling locations and providing stability to the general landscape. Inter-tree areas were typically filled with low shrubs such as *Maireana sedifolia* (highly alkaline regions), *Maireana astrotricha*, and sparsely scattered trees such as *Myoporum platycarpum* (False Sandalwood), *Alectryon oleifolius* Bullock Bush) and *Santalum acuminatum* (Quandong).

Table 13 shows the species commonly recorded within this community during the assessment while Figure 13 shows a representative photo of the community within the Project Area.

Table 13. *Acacia papyrocarpa* Open Woodland community summary.

Overstorey species	*Acacia papyrocarpa* (Western Myall)
Midstorey species	*Santalum acuminatum* (Quandong) *Acacia ramulosa* (Horse Mulga) *Acacia oswaldii* (Umbrella Wattle)
Understorey species	*Maireana sedifolia* (Pearl Bluebush) *Maireana astrotricha* (Low Bluebush) *Maireana pyramidata* (Black Bluebush) *Senna* spp. (Senna)
Threatened species	*Santalum spicatum* (SA: Rare)
Declared or significant weeds	Often occurs with *Carrichtera annua* (Wards Weed). Other species typically occurring in the area include *Carthamus lanatus* (Star Thistle) and *Sisymbrium sp.* (Mustard)
Vegetation condition	Typically found in good condition
Unit biodiversity scores	Average 58.86

Figure 13. Vegetation Association 1 *Acacia papyrocarpa* Open Woodland.

Vegetation association 2: *Acacia aneura* (Mulga) Mixed Woodland

Acacia aneura (Mulga) Mixed woodland forms a zone of deeper sand profiles, which supports species that can establish a larger root zone. Mixed trees shrubs and often perennial grasses will persist in these areas and this community forms a very large part of the overall arid region flora. Whilst Mulga dominates the large part of the cover, other species such as *Alectryon oleifolius* (Bullock Bush) many other *Acacia spp.* (Wattles) *Casuarina pauper* (Black Oak) and numerous other small to medium shrubs occur. This community is often interspersed with ephemeral creeks that support a large diversity of species in periods of good rainfall.

Because Mulga is such a common and significant component of the Australian arid zone, it is important to the ecology and environmental management of arid ecosystems (Miller et al. 2002). Mulga has the capacity to channel water down its phyllodes and stems so that rainfall is concentrated at the base of the trunk (Slayter 1965). This significantly increases the amount of water available for Mulga roots and species growing beneath the canopy, making small showers more effective (Kerle 1995). This highlights the importance of this species to the diversity of the arid flora.

Table 14 shows the species commonly recorded within this community during the assessment while Figure 14 shows a representative photo of the community within the Project Area.

Table 14. *Acacia aneura* Mixed Woodland community summary.

Overstorey species	*Acacia aneura* (Mulga) *Alectryon oleifolius* (Bullock Bush)
Midstorey species	*Senna spp. (Sennas)* *Acacia ramulosa (Horse Mulga)*
Understorey species	*Maireana spp. (Bluebushes)* *Atriplex vesicaria (Bladder Saltbush)* *Chenopodium curvispicatum (Cottony Goosefoot)* *Rhagodia spinescens (Spiny Saltbush)* *Sclerolaena spp.* (Bindyis)
Threatened species	None Observed
Declared or significant weeds	*Carrichtera annua* (Wards Weed)
Unit biodiversity scores	Average 59.9

Figure 14. Vegetation Association 2 *Acacia aneura* Mixed Woodland.

Vegetation association 3: *Casuarina pauper* (Black Oak) / *Acacia aneura* (Mulga) Open Woodland

Casuarina pauper (Black Oak) is often observed as patches or clumps of trees amongst other areas of Mulga and or other communities. These groves are also commonly prominent occupying areas of outcropping stone or rises where other species are unable to compete and have low overstorey diversity.This community is not recognised as providing critical habitat for any fauna species of note; however, it is likely that this community still plays an important role in the wider ecological makeup of the arid region. This community is widespread and well represented both within the Project Area and in the region generally.

Table 15 shows the species commonly recorded within this community during the assessment while Figure 15 shows a representative photo of the community within the Project Area.

Table 15. *Casuarina pauper* / *Acacia aneura* Open Woodland community summary.

Overstorey species	*Acacia aneura* (Mulga) *Casuarina pauper* (Black Oak)
Midstorey species	*Dodonaea viscosa ssp. angustissimus* (Sticky Hop-bush) *Senna spp.* (Sennas) *Myoporum montanum* (Western Boobialla)
Understorey species	*Maireana spp.* (Bluebushes) *Enchylaena tomentosa* (Ruby Saltbush) *Ptilotus obovatus* (Silver Mulla Mulla) *Sida spp.* (Sidas) *Sclerolaena obliquicuspis* (Oblique spined Bindyi)
Threatened species	None observed
Declared or significant weeds	None observed
Unit biodiversity scores	Average 52.27

Figure 15. Vegetation Association 3 *Casuarina pauper* / *Acacia aneura* Open Woodland.

Vegetation association 4: *Casuarina pauper* (Black Oak) Woodland

Casuarina pauper (Black Oak) occurs across much of South Australia, typically growing in groves in red-brown soils with light-textured topsoil and calcareous subsoil. Understories are often dominated by chenopod shrubs and forbs including species of *Maireana* spp. (Bluebushes), *Chenopodium* spp. (Goosefoots), *Enchylaena tomentosa* (Ruby Saltbush), *Rhagodia spinescens* (Spiny Saltbush) and *Sclerolaena* spp. (Bindyis). This association often occurs on exposed outcrops and has low diversity; however, assessments undertaken during this survey show reasonable condition (Table 16). The community assessed also had good cover values and dense foliage indicating good health (Figure 16).

Grazing from domestic stock and invasive pests including goats and rabbits has limited Black Oak recruitment and seedlings have also been shown to die through desiccation (Auld 1995). Therefore, a reduction in total grazing pressure is critical during dry periods on semi-arid and arid grazing land to promote recruitment.

Table 16 shows the species commonly recorded within this community during the assessment while Figure 16 shows a representative photo of the community within the Project Area.

Table 16. *Casuarina pauper* Woodland community summary.

Overstorey species	*Casuarina pauper* (Black Oak)
Midstorey species	*Dodonaea viscosa* ssp. *angustissimus* (Sticky Hop-bush) *Senna artemisioides* ssp. *petiolaris* (Senna) *Maireana brevifolia* (Lobe Fruited Bluebush) *Maireana turbinata (Top Bluebush)* *Maireana pyramidata* (Black Bluebush) *Maiereana pentatropis* (Winged-fruit Bluebush)
Understorey species	*Ptilotus obovatus* (Silver Mulla Mulla) *Sclerolaena* spp. (Bindyis) *Enchylaena tomentosa* (Ruby Saltbush)
Threatened species	None observed
Declared or significant weeds	None observed
Unit biodiversity scores	Average 61.52

Figure 16. Vegetation Association 4 *Casuarina pauper* Woodland.

Vegetation association 5: *Callitris glaucophylla* (Northern Cypress Pine) Woodland

This community is present within the Project Area as small communities that are often homogenous in nature, occupying high dune ridges within Mulga communities. Some examples of very old trees are present within the Project Area.

Domestic stock and rabbit grazing have been implicated as major factors limiting its regeneration according to Read, (1995) while other factors such as altered fire regimes and weed invasion is stated in Thompson and Eldridge, (2005). A lack of regeneration indicates that species distribution is currently contracting with the fragmentary distribution of the species being strongly controlled by wildfire.

Table 17 shows the species commonly recorded within this community during the assessment while Figure 17 shows a representative photo of the community within the Project Area.

Table 17. *Callitris glaucophylla* Woodland community summary.

Overstorey species	*Callitris glaucophylla* (Northern Cypress Pine) *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) *Pittosporum angustifolium* (Native Apricot)
Midstorey species	*Acacia ramulosa (Horse Mulga)* *Dodonaea viscosa* ssp. *angustissimus* (Sticky hop-bush)
Understorey species	*Enchylaena tomentosa (Ruby saltbush)* *Maireana pentatropis* (Tall Bluebush) *Maireana triptera* (Winged-fruit Bluebush) *Abutilon leucopetalum* (Desert Lantern) *Ptilotus obovatus* (Silver Mulla Mulla) *Enneapogon avenaceus* (Common Bottlewashers)
Threatened species	None observed
Declared or significant weeds	*Carrichtera annua* (Wards Weed), *Sonchus oleraceus* (Sow Thistle)
Unit biodiversity scores	Average 52.2

Figure 17. Vegetation Association 5 *Callitris glaucophylla* Woodland.

Vegetation association 6: *Acacia aneura* (Mulga) / *Acacia papyrocarpa* (Western Myall) Mixed Woodland

This community is transitional between Mulga and Myall and was observed as a community where neither overstorey species dominated clearly within areas. The understorey and mixed tree and shrub species was consistent with both of the directly dominant overstorey species.

Table 18 shows the species commonly recorded within this community during the assessment while Figure 18 shows a representative photo of the community within the Project Area.

Table 18. *Acacia aneura* / *Acacia papyrocarpa* Mixed Woodland community summary.

Overstorey species	*Acacia aneura* (Mulga) *Acacia papyrocarpa* (Western Myall) *Myoporum platycarpum* (False Sandalwood) *Acacia ramulosa* (Horse Mulga)
Midstorey species	*Maireana sedifolia* (Pearl Bluebush) *Atriplex vesicaria* (Bladder Saltbush) *Maireana georgei* (Satiny Bluebush) *Rhagodia spinescens* (Spiny Saltbush) *Chenopodium curvispicatum* (Cottony Goosefoot) *Maireana pyramidata* (Black Bluebush)
Understorey species	*Podolepis capillaris* (Invisible Plant)
Threatened species	None observed
Declared or significant weeds	*Opuntia* spp. (Wheel Cactus)
Unit biodiversity scores	Average 55.1

Figure 18. Vegetation Association 6 *Acacia aneura* / *Acacia papyrocarpa* Open Woodland.

Vegetation association 7: *Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrubland

Atriplex vesicaria is a relatively long-lived perennial that is dominant or co-dominant over large areas of arid and semi-arid southern Australia (Williams 1979). This association occurs on clay or clay-loam soils, and Aeolian accession (Wilson, Tupper and Tong way 1982).

A.vesicaria is particularly susceptible to heavy defoliation. Leigh and Mulham (1971) found that the more heavily *A.vesicaria* shrubs were grazed the less likely they were to regenerate. Completely defoliated individuals did not regrow, irrespective of soil moisture status or season Leigh and Mulham 1971). Heavy defoliation can occur close to watering points (Osborn, Wood and Paltridge 1932) and during periods of low rainfall, when the availability of more favourable ephemeral and perennial species reduces (Eldridge, Westoby and Stanley 1990). The loss or degradation of the perennial *A. vesicaria*, and subsequent succession to shorter-live chenopods and grasses (Stanley 1983), is detrimental to the rangeland environment since it leads to a reduction in the forage availability during drought for both native species and stock, and increases the risk of soil erosion (Eldridge, Westoby and Stanley 1990).

Table 19 shows the species commonly recorded within this community during the assessment while Figure 19 shows a representative photo of the community within the Project Area.

Table 19. *Atriplex vesicaria* / *Tecticornia medullosa* Shrubland community summary.

Overstorey species	*Atriplex vesicaria* (Bladder Saltbush) *Tecticornia medullosa* (Samphire)
Midstorey species	*Frankenia serpyllifolia* (Sea Heath) *Maireana eriantha* (Silver Bluebush)
Understorey species	*Abutilon halophilum* (Plains Lantern *Sclerolaena ventricosa* (Salt Bindyi) *Sclerolaena intricata* (Intricate Poverty Bush) *Sclerolaena brachyptera* (Short Wing Bindyi)
Threatened species	None
Declared or significant weeds	*Carthamus lanatus* (Star Thistle)
Vegetation condition	Moderate
Unit biodiversity scores	Average 50.2

Figure 19. Vegetation Association 7 *Atriplex vesicaria* / *Tecticornia medullosa* Shrubland.

Vegetation association 8: *Acacia aneura* (Mulga) +/- *Alectryon oleifolius* (Bullock Bush) Shrubland

The *Acacia aneura* (Mulga) and *Alectryon oleifolius* (Bullock Bush) communities occupy small patches where the dominance is shared between these species. Bullock bush communities are usually associated with floodplains and areas of temporary wetting; however, this species will be observed regularly as a mixed component of many other communities. It is unknown what influences the density of Bullock bush within the area; however, it is often regarded as a sign of good condition given its high palatability for cattle and lack of recruitment due to species such as rabbits consuming new emergent juveniles.

Table 20 shows the species commonly recorded within this community during the assessment while Figure 20 shows a representative photo of the community within the Project Area.

Table 20. *Acacia aneura* +/- *Alectryon oleifolius* Shrubland community summary.

Overstorey species	*Acacia aneura* (Mulga) *Acacia ramulosa* (Horse Mulga)
Midstorey species	*Maireana pentatropis* (Tall Bluebush) *Abutilon leucopetalum* (Desert Lantern) *Solanum quadriloculatum* (Plains Nightshade) *Maireana georgei* (Satiny Bluebush) *Enchylaena tomentosa* (Ruby Saltbush) *Ptilotus obovatus* (Silver Mulla Mulla)
Understorey species	*Sida fibulifera* (Pin Sida) *Podolepis capillaris* (Invisible Plant
Threatened species	None observed
Declared or significant weeds	None observed
Unit biodiversity scores	Average 56.14

Figure 20. Vegetation Association 8 *Acacia aneura* +/- *Alectryon oleifolius* Shrubland.

Vegetation association 9: *Maireana sedifolia* (Pearl Bluebush) Low Open Shrubland

Maireana sedifolia is characteristic of limestone/calcrete and alkaline soil conditions. The calcareous earths commonly have surface textures ranging from clay loams to loams. Overgrazing in this landscape has resulted in the replacement of palatable perennial pastures by poor quality grasses such as *Austrostipa* spp. and *Aristida* spp. as well as thorny sub-shrubs from the genera *Dissocarpus* and *Sclerolaena*. Apart from the vascular plant community, the calcareous earths support a rich suite of soil surface organisms which together make up a biological or microphytic crust (Eldridge 1996). These crusts are complex associations of mosses, lichens, liverworts, cyanobacteria, fungi and bacteria, which are bound onto soils. During unfavourable times such as droughts, microphytic crusts may provide the only biological protective cover on the soil surface.

Table 21 shows the species commonly recorded within this community during the assessment while Figure 21 shows a representative photo of the community within the Project Area.

Table 21. *Maireana sedifolia* Low Open Shrubland community summary.

Overstorey species	*Maireana sedifolia* (Pearl Bluebush) *Senna artemisioides* ssp. *artemisioides* (Silver leaf Senna) *Senna cardiosperma* ssp. *gawlerensis* (Gawler Ranges Senna) *Atriplex vesicaria (*Bladder Saltbush*)* *Maireana pyramidata* (Black Bluebush) *Maireana georgei* (Satiny Bluebush)
Midstorey species	*Ptilotus obovatus* (Silver Mulla Mulla)
Understorey species	*Sclerolaena cuneata* (Yellow-stemmed Bindyi) *Maireana trichoptera* (Hairy Fruit Bluebush) *Sclerolaena uniflora* (Bassia)
Threatened species	None observed
Declared or significant weeds	None observed
Unit biodiversity scores	56.11

Figure 21. Vegetation Association 9 *Maireana sedifolia* Low Open Shrubland.

Vegetation association 10: *Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)

Western Myalls have paramount importance for the ecosystem and community dynamics of arid lands. The concentration of organic matter, total nitrogen, total sulphur and total and available phosphorus beneath Western Myalls has been shown to increase with tree age until maturity (Facelli and Brock, 2000). As such, several species are almost completely restricted to the canopy environment and Facelli and Brock (2000) found that under-canopy species were shown to decline rapidly following the death of Myalls, and the vacant patches were colonised by exotic annual species.

Key values of this association include maintenance of landscape function and soil productivity. Table 22 shows the species commonly recorded within this community during the assessment while Figure 22 shows a representative photo of the community within the Project Area.

Table 22. *Acacia papyrocarpa* Woodland over *Atriplex vesicaria* community summary.

Overstorey species	*Acacia papyrocarpa* (Western Myall)
Midstorey species	*Dodonaea viscosa* ssp. *angustissimus* (Sticky Hop-bush) *Atriplex vesicaria* (Bladder Saltbush) *Maireana pyramidata* (Black Bluebush) *Enchylaena tomentosa* (Ruby Saltbush) *Rhagodia spinescens* (Spiny Saltbush) *Exocarpos aphyllus* (Ballart) *Maireana georgei* (Satiny Bluebush)
Understorey species	*Enneapogon polyphyllus* (Bottlewashers) *Aristida contorta* (Kerosene Grass) *Dissocarpus paradoxus* (Cannonball) *Sclerolaena cuneata* (Yelow-stemmed Bindyi)
Threatened species	None observed
Declared or significant weeds	None observed
Unit biodiversity scores	59.93

Figure 22. Vegetation Association 10 *Acacia papyrocarpa* Woodland over *Atriplex vesicaria*.

Vegetation association 11: *Atriplex vesicaria* (Bladder Saltbush) Low Open Shrubland

This vegetation association dominates the areas where the soil profile is reduced to shallow loam over bedrock which provides a limited ability for larger species to persist.

Table 23 shows the species commonly recorded within this community during the assessment while Figure 23 shows a representative photo of the community within the Study Area.

Table 23. *Atriplex vesicaria* Low Open Shrubland community summary.

Overstorey species	*Atriplex vesicaria* (Bladder Saltbush) *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) *Dodonaea viscosa* ssp. *angustissimus* (Sticky hop-bush) *Maireana astrotricha* (Low Bluebush) *Maireana aphylla* (Cotton Bush) *Gunniopsis quadrifida* (Sturts Pigface)
Midstorey species	*Sida ammophila* (Sand Sida) *Sclerolaena obliquicuspis* (Oblique-spined Bindyi) *Sclerolaena intricata* (Intricate Poverty Bush) *Frankenia sp.* (Sea Heath)
Understorey species	*Enneapogon sp.* (Bottlewashers) *Sporobolus actinocladus (*Ray Grass*)* *Aristida contorta* (Kerosene Grass) *Dissocarpus paradoxus* (Cannonball)
Threatened species	None observed
Declared or significant weeds	None observed
Unit biodiversity scores	59.7

Figure 23. Vegetation Association 11 *Atriplex vesicaria* Low Open Shrubland.

Vegetation Association 12: *Acacia aneura* (Mulga) / *Acacia ramulosa* (Horse Mulga) Low Woodland over *A. ligulata* (Sandhill Wattle)

This community occupies the low dune rises between the sand plains and deeper dune profiles. *Acacia ligulata* (Sandhill Wattle) indicates deeper sand areas and *Acacia ramulosa* (Horse Mulga) the shallower areas with the transition from the typical *Acacia aneura* (Mulga) sand plain structure. The transitional nature of this community means that there are often blurred lines between other communities and therefore a wide range of habitat niches and species richness as a result (Table 24). The areas often are well grassed with perennial grass species tussocks and have moderate cover (Figure 24). Rabbits tend to occupy these areas in good numbers at times.

Table 24 shows the species commonly recorded within this community during the assessment while Figure 24 shows a representative photo of the community within the Project Area.

Table 24. *Acacia aneura* / *A. ramulosa* Low Woodland over *A. ligulata* community summary.

Overstorey species	*Acacia aneura* (Mulga) *Acacia ramulosa* (Horse Mulga) *Acacia ligulata* (Sandhill Wattle) *Pimelea microcephala* ssp. *microcephala* (Desert Riceflower)
Midstorey species	*Aristida holathera* var. *holathera* (Three-awn) *Maireana pentatropis* (Tall Bluebush) *Chenopodium curvispicatum* (Cottony Goosefoot) *Leiocarpa leptolepis* (Plains Plover-daisy)
Understorey species	*Dissocarpus paradoxus* (Cannonball) *Maireana coronata (*Fissure Bluebush*)* *Sclerolaena obliquicuspis* (Oblique-spined Bindyi) *Solanum quadriloculatum* (Plains Nightshade) *Enneapogon avenaceus* (Common Bottlewashers) *Aristida contorta* (Kerosene Grass) *Sida ammophila* (Hill Sida) *Digitaria brownii* (Cotton Panic Grass)
Threatened species	None observed
Declared or significant weeds	*Brassica tournefortii* (Wild Mustard)
Unit biodiversity scores	Average 63.08

Figure 24. Vegetation Association 12 *Acacia aneura* / *A. ramulosa* Low Woodland over *A. ligulata*.

Vegetation association 13: *Acacia ligulata* (Sandhill Wattle) / *Dodonaea viscosa* (Sticky Hop-bush) Shrubland

This vegetation association was recorded on undulating dune areas where there was a relatively mobile sand structure. These communities are highly reliant on perennial low shrubs and grasses to provide stability. Exotic species coverage was high in these zones with winter growing annuals prevalent throughout all areas surveyed for this project.

This community is known habitat for the Pernatty Knob-tailed Gecko (*Nephrurus deleani*) (SA: Rare). This species is endemic to South Australia and is only found within an area of 500 km^2. Within this range their distribution is patchy. Soil compaction from increased traffic in the Project Area during works will considerably threaten this species through burrow habitat loss. Further research is required to assess the population stability.

Table 25 shows the species commonly recorded within this community during the assessment while Figure 25 shows a representative photo of the community within the Project Area.

Table 25. *Acacia ligulata* / *Dodonaea viscosa* Shrubland community summary.

Overstorey species	*Dodonaea viscosa* ssp. *angustissimus* (Sticky Hop-bush) *Acacia ligulata* (Sandhill Wattle) *Acacia ramulosa* (Horse Mulga)
Midstorey species	*Enchylaena tomentosa* (Ruby saltbush) *Rhagodia spinescens* (Spiny Saltbush)
Understorey species	*Aristida contorta* (Kerosene Grass) *Salsola australis* (Salsola) *Sida ammophila* (Hill Sida)
Threatened species	*Nephrurus deleani* (Pernatty Knob-tailed Gecko)
Declared or significant weeds	*Brassica tournefortii* (Wild Mustard)
Unit biodiversity scores	47.73

Figure 25. Vegetation Association 13 *Acacia ligulata* / *Dodonaea viscosa* Shrubland.

Vegetation association 14: *Tecticornia spp.* (Samphire) Low Shrubland

This association was recorded in areas surrounding claypans and inland salt lakes. Samphire's such as *Tecticornia spp.* are among the most salt tolerant terrestrial plant species and are considered a 'key-stone' group since they usually comprise the dominant vegetation in inland salt lake/marsh habitats. These habitats are highly variable, both spatially and temporally in terms of their salt concentration, which in turn has a pronounced influence over the type and amount of vegetation present in any one location. Inland salt lakes together comprise only a very small proportion of arid Australia.

Table 26 shows the species commonly recorded within this community during the assessment while Figure 26 shows a representative photo of the community within the Project Area.

Table 26. *Tecticornia sp*. Low Shrubland community summary.

Overstorey species	*Melaleuca pauperiflora* ssp. *mutica* (Boree) *Myoporum montanum* (Western Boobialla)
Midstorey species	*Atriplex vesicaria* (Bladder Saltbush) *Tecticornia indica* ssp. *leiostachya* (Samphire) *Maireana oppositifolia* (Heathy Bluebush) *Tecticornia arbuscula* (Shrubby Samphire) *Gunniopsis quadrifida* (Sturts Pigface) *Maireana appressa* (Bluebush) *Tecticornia pergranulata* (Black seed Samphire) *Atriplex acutibractea* (Sandhill Saltbush)
Understorey species	*Osteocarpum sp.*(Bonefruit) *Sclerolaena decurrens* (Green bindyi) *Disphyma crassifolium* ssp. *clavellatum* (Round-leaf Pigface)
Threatened species	None observed
Declared or significant weeds	None observed
Unit biodiversity scores	59.91

Figure 26. Vegetation Association 14 *Tecticornia sp*. Low Shrubland.

Vegetation association 15: *Casuarina pauper* (Black Oak) Creekline

This vegetation association occurred in an ephemeral creekline. When functioning properly, ephemeral creeks provide valuable ecological and hydrological functions in arid systems. These include: hydrological landscape connections; surface and subsurface water storage and exchange; ground-water recharge and discharge; sediment transport, storage, and deposition; nutrient storage and cycling; wildlife habitat and migration corridors; support for vegetation communities to help stabilize stream banks; and water supply and water-quality filtering. Moisture content is relatively greater, both spatially and temporally, in arid and semi-arid region creeks than in surrounding areas. This results in higher flora and fauna abundance and species richness in and proximal to ephemeral creeks (Levick et al. 2008).

Table 27 shows the species commonly recorded within this community during the assessment while Figure 27 shows a representative photo of the community within the Project Area.

Table 27. *Casuarina pauper* Creekline community summary.

Overstorey species	*Casuarina pauper* (Black Oak) *Myoporum montanum* (Western Boobialla) *Acacia aneura* (Mulga)
Midstorey species	*Dodonaea lobulata* (Lobe-leaf Hop-bush) *Scaevola spinescens (*Spiny Fanflower*)* *Senna artemisioides ssp. artemisioides (*Silver-leaf Senna*)* *Atriplex vesicaria* (Bladder Saltbush) *Enchylaena tomentosa* (Ruby Saltbush) *Eremophila serrulata* (Emu-bush)
Understorey species	*Abutilon halophilum (*Plains Lantern Bush*)* *Pterocaulon sphacelatum* (Fruit Salad Plant) *Solanum quadriloculatum* (Plains Nightshade) *Ptilotus obovatus* (Silver Mulla Mulla)
Threatened species	None observed
Declared or significant weeds	Malv*astrum americanum var. americanum* (Malvastrum)
Unit biodiversity scores	59.21

Figure 27. Vegetation Association 15 *Casuarina pauper* Creekline.

Vegetation association 16: *Atriplex vesicaria* (Bladder Saltbush) +/- *Eragrostis australasica* (Swamp Canegrass) Low Shrubland

The community within this area is typical of the Arcoona Plateau area and is highlighted by silcrete duricrusts formed on top of soils characterised by heavy clays and interspersed by gilgai depressions. The soils are highly sodic which means that a narrow niche is available and is occupied by halophytic flora species meaning species tolerant to saline conditions and low moisture availability. The duricrust is essential to the stability of this landscape without which, the highly dispersive soil would wash away.

Table 28 shows the species commonly recorded within this community during the assessment while Figure 28 shows a representative photo of the community within the Project Area.

Table 28. *Atriplex vesicaria* +/- *Eragrostis australasica* Low Shrubland community summary.

Overstorey species	*Atriplex vesicaria* (Bladder Saltbush) *Eragrostis australasica* (Swamp Canegrass)
Midstorey species	*Dissocarpus paradoxus* (Cannonball) *Sclerolaena intricata* (Intricate Poverty Bush) *Teucrium racemosum* (Grey Germander)
Understorey species	*Atriplex holocarpa* (Pop Saltbush) *Eragrostis setifolia* (Neverfail) *Euphorbia tannensis ssp. eremophila* (Desert Spurge) *Frankenia serpyllifolia* (Sea Heath)
Threatened species	None observed
Declared or significant weeds	*Solanum nigrum* (Black Nightshade)
Unit biodiversity scores	Average 55.87

Figure 28. Vegetation Association 16 *Atriplex vesicaria* +/- *Eragrostis australasica* Low Shrubland.

Vegetation association 17: *Maireana aphy*lla (Cottonbush) Low Shrubland

This community is observed in areas where the soil is temporarily inundated for short periods. This community is known for supporting some nationally threatened species such as Thick-billed Grasswren (*Amytornis modestus*), which utilise the shrubs for shelter, and the soil structure is often suitable as refuge habitat for the Plains Mouse (*Pseudomys australis*).

Table 29 shows the species commonly recorded within this community during the assessment while Figure 29 shows a representative photo of the community within the Project Area.

Table 29. *Maireana aphylla* Low Shrubland community summary.

Overstorey species	*Atriplex vesicaria* (Bladder Saltbush) *Maireana aphylla* (Cotton Bush) *Santalum lanceolatum* (Native Plum) *Rhagodia spinescens* (Spiny Saltbush)
Midstorey species	*Frankenia serpyllifolia* (Sea Heath) *Maireana georgei* (Satiny Bluebush)
Understorey species	*Eriochiton sclerolaenoides* (Woolly-fruit Copperburr)
Threatened species	None observed
Declared or significant weeds	*Citrullus lanatus* (Bitter Melon) *Medicago* sp. (Medic)
Unit biodiversity scores	35.88

Figure 29. Vegetation Association 17 *Maireana aphylla* Low Shrubland.

Vegetation association 18: *Melaleuca pauperiflora* (Boree) Shrubland +/- *Acacia ligulata* (Sandhill Wattle)

Melaleuca pauperifolia is typically observed within areas of ephemeral salt pans and saline springs. Within the Project Area it was noted primarily at the Lake Mary fringes adjacent to the main road. Very widely scattered individuals were also present on the banks of Lake Windabout. These were commonly associated with *Tecticornia* species and gypseous tolerant halophytes or as a very narrow transition from sand loving species such as *Acacia ligulata*.

Table 30 shows the species commonly recorded within this community during the assessment while Figure 30 shows a representative photo of the community within the Project Area.

Table 30. *Melaleuca pauperiflora* Shrubland +/- *Acacia ligulata* community summary.

Overstorey species	*Melaleuca pauperiflora ssp. mutica* (Boree)
Midstorey species	*Acacia ligulata* (Sandhill Wattle)
Understorey species	*Tecticornia* spp. (Samphires) *Atriplex vesicaria* (Bladder Saltbush) *Enchylaena tomentosa* (Ruby Saltbush) *Gunniopsis quadrifida* (Sturts Pigface)
Threatened species	None observed
Declared or significant weeds	*Brassica tournefortii* (Wild Mustard)
Unit biodiversity scores	45.7

Figure 30. Vegetation Association 18 *Melaleuca pauperiflora* Shrubland +/- *Acacia ligulata*.

Vegetation association 19: *Maireana astrotricha* (Low Bluebush) Low Open Shrubland

The *Maireana astrotricha* shrublands encountered during the survey period were in poor to moderate condition at the time of the survey assessment. This community often occurs on areas of stone outcropping with shallow loams. A species of conservation significance likely to be recorded from this community was the flock Bronzewing Pigeon (*Phaps histrionica*), which is rated rare in South Australia. This community is well represented however and was given a moderate conservation value within the Project Area.

Table 31 shows the species commonly recorded within this community during the assessment while Figure 31 shows a representative photo of the community within the Project Area.

Table 31. *Maireana astrotricha* Low Open Shrubland community summary.

Overstorey species	*Maireana astrotricha* (Low Bluebush) *Atriplex vesicaria* (Bladder Saltbush) *Maireana pyramidata* (Black Bluebush) *Myoporum montanum* (Western Boobialla) *Acacia victoriae* (Elegant Wattle)
Midstorey species	*Eragrostis setifolia* (Neverfail) *Pterocaulon sphacelatum* (Fruit Salad Plant)
Understorey species	*Enneapogon avenaceus* (Common Bottlewashers) *Maireana coronata* (Fissure Bluebush) *Sclerolaena obliquicuspis* (Oblique-spined Bindyi) *Enneapogon polyphyllus* (Bottlewashers) *Euphorbia drummondii* (Caustic Weed)
Threatened species	None observed
Declared or significant weeds	*Citrullus* sp. (Bitter Melon)
Unit biodiversity scores	52.03

Figure 31. Vegetation Association 19 *Maireana astrotricha* Low Open Shrubland.

Vegetation association 20: *Chenopodium nitrariaceum* (Nitre Goosefoot) Open Shrubland

This community occupies ephemeral swamps on very heavy cracking clay soils. This makes these patches of high conservation significance being refuge habitats for the nationally threatened species Plains Rat (*Pseudomys australis*).

Table 32 shows the species commonly recorded within this community during the assessment while Figure 32 shows a representative photo of the community within the Project Area.

Table 32. *Chenopodium nitrariaceum* Open Shrubland community summary.

Overstorey species	*Chenopodium curvispicatum* (Cottony Goosefoot) *Duma florulenta* (Lignum)
Midstorey species	*Maireana integra* (Bluebush) *Atriplex holocarpa* (Pop Saltbush) *Eragrostis dielsii* (Mulka)
Understorey species	*Sclerolaena decurrens* (Green Bindyi) *Dissocarpus paradoxus* (Cannonball) *Eriochiton sclerolaenoides* (Woolly-fruit Copperburr)
Threatened species	None observed
Declared or significant weeds	May get infested with species such as *Nicotiana glauca* (Tree Tobacco)
Unit biodiversity scores	43.29

Figure 32. Vegetation Association 20 *Chenopodium nitrariaceum* Open Shrubland.

6 DISCUSSION

The Project Area alignment going from a south to north direction passes through a number of different landforms from flat calcrete plains, to low sand plains, low dunes, salt pans, stony plateau and back into low dunes / swales at the northern connection site. None of the vegetation communities identified across the length of the alignment were considered conservation significant under national and state legislation.

The background desktop studies confirmed one nationally listed flora species, eight nationally listed fauna species and 12 migratory species as potentially having habitat within the Study Area. Of these, one fauna species and two migratory or marine species were considered likely or known to be present within the Project Area.

Specific targeted searches for the nationally endangered species *Frankenia plicata* was undertaken however due to the wide range of habitats that this species as been historically recorded within, made targeting single areas difficult. Overall very few *Frankenia* of any species were encountered within the Study Area during the assessment and *Frankenia plicata* was not detected.

The BDBSA search highlighted four flora state threatened species potentially occupying the Project Area. Only one of these species was observed during the field survey, *Santalum spicatum* (Sandalwood). With the individual trees within the study area very sparsely present. An additional 27 state threatened fauna species were highlighted of which three were considered likely as being present within the Project Area. No species of national conservation significance were highlighted as part of the BDBSA search.

A large number of the species observed as part of the PMST and BDBSA searches were highly transient species and were most probably records from periods when the salt lakes were under the influence of semi-permanent water. Under the existing conditions (or conditions where water is present for very short periods such as directly after rainfall) these species are very unlikely to be present within the Project Area.

Specific vegetation communities were highlighted as conservation significant based on the potential habitat these provide for a number of threatened flora and fauna species. Areas of deep sand dunes in the Oakden Hills and Pernatty pastoral leases area specifically, provide important habitat for the Pernatty Knob-tailed Gecko (*Nephrurus deleani*, Rare, SA). The fringes and sections of salt lakes are of ecological significance due to providing potential habitat for salt lake margin specific species such as *Frankenia plicata* (not observed) and possibly a variety of migratory waders at times during wet periods.

Areas of stony tablelands provide refuge habitat for the nationally threatened Plains Mouse (*Pseudomys australis*). These sites have a tapestry of cracking clay gilgai and areas of *Eragrostis australasica* (Swamp Canegrass) which are known to be sites of refuge habitat for this species. This refuge habitat is widespread on the Arcoona Plateau and in the broader region and the Project Area represents a very small proportion of the potential habitat available in the region.

Small areas of *Maireana aphylla* (Cottonbush) are known habitat for the nationally threatened species Thick Billed Grasswren (*Amytornis modestus*). These habitats are often linear, with Cottonbush preferring sites with drain off channels or areas temporarily inundated or have periods of extended wetting. Habitat for this species is widespread across the broader region to the north. Suitable habitat is not extensive

within the Project Area, but is present in at least one patch near Woomera. There are no BDBSA records within the Study Area for this species.

Other nationally threatened fauna such as the Common Sandpiper are not restricted to specific narrow or limited areas of habitat and the Project Area represents a very small proportion of the habitat used by these species.

The individual vegetation associations were assessed under the most recent *Native Vegetation Regulations 2017* using the Rangelands Assessment Method. Unit Biodiversity scores are defined as the primary score outcome from these which showed a range of values dependent on a number of variables. Overall scores varied from 34 to just over 73. These values were relatively consistent across the transmission alignment with the lower score a degraded sand dune under the influence of Four Wheel Drive Vehicles near Woomera and the higher values an *Acacia papyrocarpa* Woodland at Mt Arden. The median value for all scores was 52.4.

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8 APPENDICES

Appendix 1. Flora species recorded in the BDBSA within the Study Area (DEW 2018).

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Abutilon cryptopetalum ssp. cryptopetalum	Hill Lantern-bush				25/09/1991
Abutilon fraseri ssp. diplotrichum	Dwarf Lantern-bush				25/09/1991
Abutilon fraseri ssp. fraseri	Dwarf Lantern-bush				26/03/2007
Abutilon halophilum	Plains Lantern-bush				9/06/2013
Abutilon otocarpum	Desert Lantern-bush				13/07/1954
Acacia aneura complex	Mulga				1/04/2007
Acacia aneura var.	Mulga				10/09/2006
Acacia aneura var. aneura	Mulga				27/03/2007
Acacia aneura var. aneura (NC)	Mulga				19/11/1998
Acacia aneura var. intermedia	Broad-leaf Mulga				26/03/2007
Acacia brachystachya	Turpentine Mulga				26/03/2007
Acacia burkittii	Pin-bush Wattle				26/03/2007
Acacia cibaria (NC)	Turpentine Mulga				19/11/1998
Acacia kempeana	Witchetty Bush				3/11/1929
Acacia ligulata	Umbrella Bush				10/09/2006
Acacia oswaldii	Umbrella Wattle				10/09/2006
Acacia papyrocarpa	Western Myall				1/04/2007
Acacia ramulosa var.	Horse Mulga				10/09/2006
Acacia ramulosa var. linophylla	Horse Mulga				30/11/2003
Acacia ramulosa var. ramulosa	Horse Mulga				12/02/1987
Acacia stenophylla	River Cooba				20/01/1989
Acacia tetragonophylla	Dead Finish				1/01/1981
Acacia victoriae ssp. victoriae	Elegant Wattle				15/10/1990
Actinobole uliginosum	Flannel Cudweed				1/08/1989
Alectryon oleifolius ssp. canescens	Bullock Bush				27/03/2007
Alternanthera denticulata	Lesser Joyweed				24/07/1992
Amaranthus grandiflorus	Large-flower Amaranth				10/04/1989
Amaranthus mitchellii	Boggabri Weed				1/04/2003
Amaranthus mitchellii (NC)	Boggabri Weed				12/11/1996
Amyema maidenii ssp. maidenii	Pale-leaf Mistletoe				25/07/1991
Amyema preissii	Wire-leaf Mistletoe				12/11/1996
Amyema quandang var. quandang	Grey Mistletoe				30/07/1991
Anacampseros australiana	Australian Anacampseros				16/01/1998
Angianthus glabratus	Smooth Angianthus				22/10/1966
Arabidella filifolia	Thread-leaf Cress				31/07/1991
Arabidella glaucescens					5/04/1989
Arabidella trisecta	Shrubby Cress				2/04/1989
Aristida contorta	Curly Wire-grass				18/11/1989
Aristida holathera var. holathera	Tall Kerosene Grass				27/03/2007
Aristida nitidula	Brush Three-awn				20/03/1992
Arthropodium fimbriatum	Nodding Vanilla-lily				1/08/1991

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Astrebla pectinata	Barley Mitchell-grass				20/03/1992
Atriplex holocarpa	Pop Saltbush				27/03/2007
Atriplex limbata	Spreading Saltbush				19/08/1971
Atriplex lindleyi ssp. lindleyi	Baldoo				26/07/1991
Atriplex spongiosa	Pop Saltbush				21/09/1963
Atriplex stipitata	Bitter Saltbush				27/03/2007
Atriplex suberecta	Lagoon Saltbush				16/07/1992
Atriplex velutinella	Sandhill Saltbush				2/09/2001
Atriplex vesicaria	Bladder Saltbush				1/04/2007
Austrobryonia micrantha	Desert Cucumber				20/01/1989
Austrostipa acrociliata	Graceful Spear-grass				21/08/1955
Austrostipa nitida	Balcarra Spear-grass				27/03/2007
Austrostipa platychaeta	Flat-awn Spear-grass				1/01/1989
Austrostipa scabra group	Falcate-awn Spear-grass				12/11/1996
Austrostipa scabra ssp. falcata	Slender Spear-grass				12/11/1996
Austrostipa sp.	Spear-grass				1/04/2007
Austrostipa trichophylla					24/09/1991
Bergia trimera	Three-part Water-fire				27/03/2007
Blennodia pterosperma	Wild Stock				1/01/1916
Boerhavia coccinea	Tar-vine				29/03/1989
Boerhavia dominii	Tar-vine				20/03/1992
Boerhavia dominii (NC)	Tar-vine				27/03/2007
Bothriochloa ewartiana	Desert Blue-grass				14/04/1997
Brachyscome ciliaris var. lanuginosa	Woolly Variable Daisy				9/06/2013
Brachyscome dichromosomatica var. dichromosomatica	Large Hard-head Daisy				29/07/1991
Brachyscome eriogona			R		23/10/1966
Brachyscome exilis	Slender Daisy				11/10/1955
Brachyscome gilesii	Giles Daisy				10/09/1968
Brachyscome lineariloba	Hard-head Daisy				13/11/1996
Brassica tournefortii	Wild Turnip			#	10/09/2006
Bromus arenarius	Sand Brome				13/11/1996
Bulbine alata	Winged Bulbine-lily				1/10/1985
Bulbine semibarbata	Small Leek-lily				13/11/1996
Calandrinia disperma	Two-seed Purslane				1/10/1939
Calandrinia eremaea	Dryland Purslane				25/09/1991
Calandrinia pumila	Tiny Purslane				18/05/1989
Calandrinia remota	Round-leaf Parakeelya				12/11/1996
Calandrinia sphaerophylla	Bead Purslane		R		18/08/1990
Calendula arvensis	Field Marigold			#	7/10/1939
Callitris glaucophylla	White Cypress-pine				12/11/1996
Calotis cymbacantha	Showy Burr-daisy				10/09/2006
Calotis erinacea	Tangled Burr-daisy				26/03/2007
Calotis hispidula	Hairy Burr-daisy				13/11/1996
Calotis latiuscula	Leafy Burr-daisy				31/07/1991

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Calotis multicaulis	Woolly-headed Burr-daisy				6/08/2004
Calotis plumulifera	Woolly-headed Burr-daisy				10/09/1968
Calotis porphyroglossa	Channel Burr-daisy				31/07/1991
Carrichtera annua	Ward's Weed			#	27/03/2007
Casuarina pauper	Black Oak				31/07/1991
Cenchrus ciliaris	Buffel Grass			#	12/03/2015
Centaurea melitensis	Malta Thistle			#	1/01/1981
Centipeda crateriformis ssp. crateriformis	Common Sneezeweed				10/09/1968
Centipeda cunninghamii	Common Sneezeweed				26/03/2007
Centipeda thespidioides	Desert Sneezeweed				6/10/2001
Centrolepis eremica	Dryland Centrolepis				3/08/1989
Cheilanthes lasiophylla	Woolly Cloak-fern				22/04/1989
Cheilanthes sieberi ssp. sieberi	Narrow Rock-fern				31/07/1991
Chenopodium curvispicatum	Cottony Goosefoot				27/03/2007
Chenopodium desertorum ssp. desertorum	Frosted Goosefoot				27/03/2007
Chenopodium gaudichaudianum	Scrambling Goosefoot				2/08/1991
Chenopodium murale	Nettle-leaf Goosefoot			#	26/09/1991
Chenopodium nitrariaceum	Nitre Goosefoot				6/10/2001
Chenopodium sp.	Goosefoot				27/03/2007
Chloris virgata	Feather-top Rhodes Grass			#	15/07/1992
Citrullus amarus	Bitter Melon			#	27/03/2007
Citrullus colocynthis	Colocynth			#	26/03/2007
Citrus glauca	Desert Lime		V		14/02/1993
Convolvulus clementii					26/10/1992
Convolvulus remotus	Grassy Bindweed				27/03/2007
Conyza bonariensis	Flax-leaf Fleabane			#	12/01/1993
Crassula colorata var. acuminata	Dense Crassula				23/09/1975
Crassula colorata var. colorata	Dense Crassula				1/08/1989
Crassula tetramera	Australian Stonecrop				10/09/1968
Cressa australis	Rosinweed				24/07/1992
Crinum flaccidum	Murray Lily				9/03/2000
Crotalaria eremaea ssp. eremaea	Downy Loose-flowered Rattle-pod				2/09/2001
Crotalaria eremaea ssp. strehlowii	Smooth Loose-flowered Rattle-pod				22/02/1983
Crotalaria sp.	Rattle-pod/Bird-flower				9/06/2013
Cucumis myriocarpus ssp. myriocarpus	Paddy Melon			#	26/03/2007
Cullen cinereum	Annual Scurf-pea				12/01/2009
Cullen graveolens	Native Lucerne				13/11/1996
Cullen pallidum	White Scurf-pea				1/05/1938
Cymbopogon ambiguus	Lemon-grass				5/06/1990
Cynodon dactylon var. dactylon	Couch			#	12/01/1993
Cyperus alterniflorus	Umbrella Flat-sedge				20/01/1989
Cyperus alterniflorus f. Oodnadatta (K.L.Wilson 4612)	Umbrella Flat-sedge				1/04/2003

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Cyperus bulbosus	Bulbous Flat-sedge				26/05/1998
Cyperus gymnocaulos	Spiny Flat-sedge				2/09/2001
Cyperus laevigatus	Bore-drain Sedge				11/04/1997
Cyperus rigidellus	Dwarf Flat-sedge				11/04/1997
Cyperus victoriensis	Yelka				28/05/1998
Dactyloctenium radulans	Button-grass				29/03/1989
Datura leichhardtii	Leichhardt's Thorn-apple			#	14/01/1991
Daucus glochidiatus	Native Carrot				13/11/1996
Dichanthium sericeum ssp. humilius	Annual Silky Blue-grass				28/08/1951
Dichanthium sericeum ssp. sericeum	Silky Blue-grass				28/05/1998
Digitaria brownii	Cotton Panic-grass				27/03/2007
Digitaria ciliaris	Summer Grass			#	20/01/1989
Dimorphocoma minutula					22/10/1966
Disphyma crassifolium ssp. clavellatum	Round-leaf Pigface				16/07/1992
Dissocarpus paradoxus	Ball Bindyi				27/03/2007
Dodonaea lobulata	Lobed-leaf Hop-bush				30/07/1991
Dodonaea microzyga var. microzyga	Brilliant Hop-bush				29/03/1989
Dodonaea viscosa ssp.	Sticky Hop-bush				10/09/2006
Dodonaea viscosa ssp. angustissima	Narrow-leaf Hop-bush				27/03/2007
Duboisia hopwoodii	Pituri				13/10/1992
Duma florulenta	Lignum				27/03/2007
Dysphania cristata	Crested Crumbweed				26/03/2007
Dysphania plantaginella	Plantain Crumbweed				13/05/1992
Einadia nutans ssp. eremaea	Dryland Climbing Saltbush				27/03/2007
Einadia nutans ssp. nutans	Climbing Saltbush				1/05/1938
Eleocharis acuta	Common Spike-rush				20/01/1989
Eleocharis pallens	Pale Spike-rush				20/01/1989
Enchylaena tomentosa var.	Ruby Saltbush				10/09/2006
Enchylaena tomentosa var. tomentosa	Ruby Saltbush				27/03/2007
Enneapogon avenaceus	Common Bottle-washers				27/03/2007
Enneapogon caerulescens	Blue Bottle-washers				24/05/1992
Enneapogon cylindricus	Jointed Bottle-washers				27/03/2007
Enneapogon polyphyllus	Leafy Bottle-washers				27/03/2007
Enteropogon acicularis	Umbrella Grass				20/01/1989
Eragrostis australasica	Cane-grass				13/11/1996
Eragrostis basedowii	Neat Love-grass				30/05/1989
Eragrostis dielsii	Mulka				27/03/2007
Eragrostis falcata	Sickle Love-grass				5/04/1989
Eragrostis laniflora	Hairy-flower Woollybutt				5/03/1981
Eragrostis parviflora	Weeping Love-grass				28/05/1998
Eragrostis setifolia	Bristly Love-grass				10/04/1989
Eragrostis trichophora	Hairyflower Lovegrass			#	18/03/2015
Eragrostis xerophila	Knotty-butt Neverfail				3/03/1981
Eremophila alternifolia	Narrow-leaf Emubush				1/01/1981

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Eremophila deserti	Turkey-bush				1/08/1991
Eremophila duttonii	Harlequin Emubush				24/09/1991
Eremophila glabra ssp. glabra	Tar Bush				27/03/2007
Eremophila latrobei ssp. glabra	Crimson Emubush				7/04/1989
Eremophila longifolia	Weeping Emubush				26/03/2007
Eremophila oppositifolia ssp. oppositifolia	Opposite-leaved Emubush				11/10/1971
Eremophila paisleyi ssp. paisleyi					2/10/1991
Eremophila scoparia	Broom Emubush				21/06/1987
Eriachne helmsii	Woollybutt Wanderrie				7/04/1989
Eriochiton sclerolaenoides	Woolly-fruit Bluebush				10/09/2006
Eriochlamys behrii	Woolly Mantle				1/10/1985
Eriochloa australiensis	Australian Cupgrass				24/07/1997
Eriochloa pseudoacrotricha	Perennial Cupgrass				28/05/1998
Erodium angustilobum (NC)					13/11/1996
Erodium aureum				#	19/09/1989
Erodium carolinianum	Clammy Heron's-bill				10/09/2006
Erodium cicutarium	Cut-leaf Heron's-bill			#	1/08/1939
Erodium crinitum	Blue Heron's-bill				3/08/1989
Erodium cygnorum	Blue Heron's-bill				24/09/1991
Erodium sp.	Heron's-bill/Crowfoot				26/03/2007
Eucalyptus intertexta	Gum-barked Coolibah				1/08/1950
Euphorbia drummondii (NC)					27/03/2007
Euphorbia multifaria					2/05/1989
Euphorbia porcata					3/03/1981
Euphorbia stevenii	Bottletree Spurge				5/10/1966
Euphorbia tannensis ssp. eremophila	Desert Spurge				27/03/2007
Euphorbia terracina	False Caper			#	27/03/2007
Euphorbia thelephora var. australis					14/04/1997
Euphorbia wheeleri	Wheeler's Spurge				17/05/1989
Euphorbiaceae sp.	Spurge Family				26/03/2007
Exocarpos aphyllus	Leafless Cherry				7/04/1989
Fimbristylis dichotoma	Common Fringe-rush				14/04/1997
Frankenia foliosa	Leafy Sea-heath				27/10/1976
Frankenia serpyllifolia	Thyme Sea-heath				11/09/2003
Galenia pubescens var. pubescens	Coastal Galenia			#	26/03/2007
Glinus lotoides	Hairy Carpet-weed				21/05/2008
Glossostigma cleistanthum	Spoon Mud-mat				12/01/2009
Glossostigma diandrum	Two-anther Mud-mat				12/01/2009
Glycine canescens	Silky Glycine				2/09/2001
Gnephosis arachnoidea	Spidery Button-flower				22/10/1992
Gnephosis tenuissima	Dwarf Golden-tip				10/09/1968
Goodenia berardiana	Split-end Goodenia				18/09/1974
Goodenia cycloptera	Serrated Goodenia				2/09/2001
Goodenia fascicularis	Silky Goodenia				1/05/1935

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Goodenia lunata	Stiff Goodenia				27/03/2007
Goodenia pinnatifida	Cut-leaf Goodenia				22/10/1992
Gratwickia monochaeta			R		25/09/1991
Gunniopsis calva					22/10/1966
Gunniopsis papillata	Twin-leaf Pigface				25/09/1991
Gunniopsis quadrifida	Sturt's Pigface				3/03/1981
Gunniopsis septifraga	Green Pigface				21/09/1963
Hakea leucoptera ssp. leucoptera	Silver Needlewood				10/09/2006
Helianthus annuus	Sunflower			#	16/07/1992
Heliotropium europaeum	Common Heliotrope			?	26/03/2007
Heliotropium supinum	Creeping Heliotrope			#	22/10/1990
Hibiscus krichauffianus	Velvet-leaf Hibiscus				21/02/1990
Holcus lanatus	Yorkshire Fog			#	1/10/1989
Hordeum glaucum	Blue Barley-grass			#	13/11/1996
Hyalosperma glutinosum ssp. glutinosum	Golden Sunray				24/09/1991
Hypertelis cerviana	Wire-stem Chickweed				27/03/2007
Hypochaeris glabra	Smooth Cat's Ear			#	24/09/1991
Indigofera psammophila	Sand Indigo				29/03/1989
Isoetopsis graminifolia	Grass Cushion				1/08/1989
Isolepis australiensis	Southern Club-rush				3/08/1989
Jasminum didymum ssp. lineare	Native Jasmine				6/03/1997
Juncus aridicola	Inland Rush				2/04/1991
Juncus bufonius	Toad Rush				22/10/1990
Lachnagrostis filiformis	Common Blown-grass				20/01/1989
Lactuca serriola f. serriola	Prickly Lettuce			#	15/07/1992
Lawrencia glomerata	Clustered Lawrencia				9/06/2013
Leiocarpa leptolepis	Pale Plover-daisy				13/11/1996
Leiocarpa tomentosa	Woolly Plover-daisy				13/07/1954
Leiocarpa websteri	Narrow Plover-daisy				13/11/1996
Lemooria burkittii	Wires-and-wool				3/08/1989
Lepidium muelleri-ferdinandi	Mueller's Peppercress				1/08/1989
Lepidium oxytrichum	Green Peppercress				2/05/1989
Lepidium papillosum	Warty Peppercress				13/11/1996
Lepidium phlebopetalum	Veined Peppercress				27/03/2007
Lepidium sagittulatum	Fine-leaf Peppercress				1/05/1938
Leptorhynchos baileyi	Bailey's Buttons				24/09/1991
Leucochrysum molle	Hoary Sunray				30/07/1991
Lotus cruentus	Red-flower Lotus				13/11/1996
Lycium australe	Australian Boxthorn				30/08/2014
Lycium ferocissimum	African Boxthorn			#	25/06/1991
Lysiana exocarpi ssp. exocarpi	Harlequin Mistletoe				7/04/1989
Lysiana murrayi	Mulga Mistletoe				27/03/2007
Maireana aphylla	Cotton-bush				9/06/2013
Maireana appressa	Pale-fruit Bluebush				21/09/1963

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Maireana astrotricha	Low Bluebush				10/09/2006
Maireana brevifolia	Short-leaf Bluebush				1/05/1964
Maireana cannonii	Cannon's Bluebush				29/07/1991
Maireana ciliata	Hairy Fissure-plant				22/10/1992
Maireana eriantha	Woolly Bluebush				25/09/1991
Maireana erioclada	Rosy Bluebush				10/09/2006
Maireana georgei	Satiny Bluebush				26/10/1992
Maireana integra	Entire-wing Bluebush				23/10/1966
Maireana lobiflora	Lobed Bluebush				27/03/2007
Maireana pentatropis	Erect Mallee Bluebush				27/03/2007
Maireana pyramidata	Black Bluebush				1/04/2007
Maireana sedifolia	Bluebush				1/04/2007
Maireana spongiocarpa	Spongy-fruit Bluebush				31/07/1991
Maireana trichoptera	Hairy-fruit Bluebush				1/08/1991
Maireana triptera	Three-wing Bluebush				30/05/1989
Maireana turbinata	Top-fruit Bluebush				26/10/1992
Malva parviflora	Small-flower Marshmallow			#	1/08/1989
Malva preissiana	Australian Hollyhock				7/10/1939
Malvastrum americanum var. americanum	Malvastrum			?	26/03/2007
Marsilea drummondii	Common Nardoo				24/07/1997
Marsilea drummondii (NC)	Common Nardoo				27/03/2007
Marsilea exarata	Swayback Nardoo				25/09/1991
Marsilea hirsuta	Short-fruit Nardoo				1/08/1989
Marsilea sp.	Nardoo				27/03/2007
Medicago minima var. minima	Little Medic			#	26/09/1991
Medicago polymorpha var. polymorpha	Burr-medic			#	13/11/1996
Medicago sativa	Lucerne			#	16/07/1992
Melaleuca xerophila	Boree				3/03/1981
Menkea australis	Fairy Spectacles				1/08/2001
Menkea crassa	Fat Spectacles				13/07/1954
Microseris lanceolata	Yam Daisy				7/08/1991
Minuria cunninghamii	Bush Minuria				27/03/2007
Minuria denticulata	Woolly Minuria				21/01/1989
Minuria leptophylla	Minnie Daisy				16/10/1992
Monachather paradoxus	Bandicoot Grass				10/07/1987
Myoporum montanum	Native Myrtle				15/07/1992
Myoporum platycarpum ssp. platycarpum	False Sandalwood				27/03/2007
Myriophyllum verrucosum	Red Milfoil				24/07/1992
Neurachne munroi	Window Mulga-grass				4/03/1981
Nicotiana glauca	Tree Tobacco			#	5/06/1990
Nicotiana simulans	Native Tobacco				2/05/1989
Nicotiana velutina	Velvet Tobacco				26/03/2007
Olearia calcarea	Crinkle-leaf Daisy-bush				19/07/1954

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Oligocarpus calendulaceus				#	21/08/1992
Omphalolappula concava	Burr Stickseed				2/05/1989
Ophioglossum polyphyllum	Large Adder's-tongue		R		30/07/1991
Opuntia ficus-indica	Indian Fig			#	1/01/1984
Orobanche cernua var. australiana	Australian Broomrape		R		4/09/1990
Osteocarpum acropterum var. acropterum	Tuberculate Bonefruit				10/09/1968
Osteocarpum dipterocarpum	Two-wing Bonefruit				2/09/2001
Owenia acidula	Sour Plum				6/08/1991
Oxalis perennans	Native Sorrel				5/08/1991
Pachymitus cardaminoides	Sand Cress				7/08/1991
Panicum laevinode					24/03/1992
Paractaenum novae-hollandiae ssp. reversum	Barbed-wire Grass				3/03/1981
Paractaenum refractum	Bristle-brush Grass				14/04/1997
Parkinsonia aculeata	Jerusalem Thorn			#	20/01/1989
Peganum harmala	African Rue			#	16/10/2009
Phlegmatospermum cochlearinum	Downy Cress				7/08/1991
Phyllanthus fuernrohrii	Sand Spurge				12/11/1996
Phyllanthus lacunarius	Lagoon Spurge				26/03/2007
Pimelea microcephala ssp. microcephala	Shrubby Riceflower				27/03/2007
Pimelea trichostachya	Spiked Riceflower				16/07/1992
Pittosporum angustifolium	Native Apricot				5/04/1989
Plagiobothrys plurisepaleus	White Rochelia				3/08/1989
Plantago drummondii	Dark Plantain				22/10/1992
Podolepis aristata ssp. auriculata	Grey Copper-wire Daisy				22/10/1992
Podolepis capillaris	Wiry Podolepis				26/03/2007
Podolepis davisiana	Button Podolepis				13/11/1996
Polycalymma stuartii	Poached-egg Daisy				1/01/1981
Polygonum aviculare	Wireweed			#	15/07/1992
Polygonum plebeium	Small Knotweed				24/07/1992
Polypogon monspeliensis	Annual Beard-grass			#	31/12/1991
Polypogon viridis	Water Bent			#	24/07/1997
Portulaca oleracea	Common Purslane				27/03/2007
Prostanthera striatiflora	Striated Mintbush				1/07/1989
Pseudognaphalium luteoalbum	Jersey Cudweed			?	24/07/1992
Pterocaulon sphacelatum	Apple-bush				9/06/2013
Ptilotus obovatus	Silver Mulla Mulla				2/05/1989
Ptilotus obovatus (NC)	Silver Mulla Mulla				1/04/2007
Ptilotus parvifolius	Small-leaf Mulla Mulla				1/08/1991
Ptilotus polystachyus	Long-tails				26/03/2007
Pycnosorus pleiocephalus	Soft Billy-buttons				16/07/1992
Ranunculus pentandrus var. platycarpus	Smooth Buttercup				24/09/1991
Rhagodia spinescens	Spiny Saltbush				12/11/1996
Rhagodia ulicina	Intricate Saltbush				13/07/1954

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Rhodanthe floribunda	White Everlasting				10/09/2006
Rhodanthe microglossa	Clustered Everlasting				10/09/1968
Rhodanthe moschata	Musk Daisy				1/08/1989
Rhodanthe polygalifolia	Milkwort Everlasting				26/10/1992
Rhodanthe pygmaea	Pigmy Daisy				2/05/1989
Rhodanthe stricta	Slender Everlasting				26/10/1989
Rhodanthe stuartiana	Clay Everlasting				5/09/1966
Rhodanthe uniflora	Woolly Daisy				1/08/1989
Roepera aurantiaca ssp. cuneata	Shrubby Twinleaf				27/03/2007
Roepera eremaea					10/09/1968
Roepera ovata	Dwarf Twinleaf				26/03/2007
Rostraria pumila	Tiny Bristle-grass			#	1/08/1989
Rumex crispus	Curled Dock			#	20/01/1989
Rumex crystallinus	Glistening Dock				6/10/2001
Rumex vesicarius	Rosy Dock			#	26/03/2007
Salsola australis	Buckbush				27/03/2007
Santalum acuminatum	Quandong				4/01/1956
Santalum lanceolatum	Plumbush				12/11/1996
Santalum spicatum	Sandalwood		V		27/03/2007
Sarcozona praecox	Sarcozona				10/09/2006
Scaevola spinescens	Spiny Fanflower				1/05/1938
Scambopus curvipes					9/09/2009
Schenkia australis	Spike Centaury				23/04/1993
Schismus barbatus	Arabian Grass			#	13/11/1996
Schoenia ramosissima	Dainty Everlasting				10/09/1968
Schoenus nanus	Little Bog-rush				1/10/1998
Sclerolaena brachyptera	Short-wing Bindyi				22/10/1992
Sclerolaena cuneata	Tangled Bindyi				24/07/1989
Sclerolaena decurrens	Green Bindyi				2/05/1989
Sclerolaena diacantha	Grey Bindyi				3/08/1989
Sclerolaena divaricata	Tangled Bindyi				27/03/2007
Sclerolaena holtiana	Holt's Bindyi				27/03/2007
Sclerolaena intricata	Tangled Bindyi				5/10/1966
Sclerolaena lanicuspis	Spinach Bindyi				2/04/1989
Sclerolaena obliquicuspis	Oblique-spined Bindyi				27/03/2007
Sclerolaena parallelicuspis	Western Bindyi				22/10/1966
Sclerolaena patenticuspis	Spear-fruit Bindyi				27/03/2007
Sclerolaena tatei	Tate's Bindyi				1/01/1938
Sclerolaena uniflora	Small-spine Bindyi				1/08/1989
Sclerolaena ventricosa	Salt Bindyi				8/03/1997
Senecio glossanthus	Annual Groundsel				1/08/1991
Senecio gregorii	Fleshy Groundsel				10/09/1968
Senecio lacustrinus					30/01/1997
Senecio lanibracteus	Inland Shrubby Groundsel				27/05/1989

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Senecio runcinifolius	Thistle-leaf Groundsel				1/04/2003
Senna artemisioides ssp. filifolia	Fine-leaf Desert Senna				31/07/1991
Senna artemisioides ssp. petiolaris					16/06/2013
Senna artemisioides ssp. X coriacea	Broad-leaf Desert Senna				27/03/2007
Senna cardiosperma ssp. gawlerensis	Gawler Ranges Senna				10/09/1968
Senna phyllodinea					13/11/1996
Senna pleurocarpa var. pleurocarpa	Stripe-pod Senna				13/07/1954
Setaria basiclada					6/04/1992
Setaria constricta	Knotty-butt Paspalidium				27/03/2007
Setaria dielsii	Diel's Pigeon-grass				22/04/1989
Setaria reflexa					15/07/1992
Sida ammophila	Sand Sida				10/09/2006
Sida calyxhymenia	Tall Sida				12/11/1996
Sida fibulifera	Pin Sida				27/03/2007
Sida intricata	Twiggy Sida				27/03/2007
Sida petrophila	Rock Sida				26/03/2007
Sida trichopoda	High Sida				13/11/1996
Sisymbrium erysimoides	Smooth Mustard			#	27/03/2007
Solanum chenopodinum	Goosefoot Potato-bush				13/07/1954
Solanum ellipticum	Velvet Potato-bush				9/06/2013
Solanum esuriale	Quena				27/03/2007
Solanum nigrum	Black Nightshade			#	24/07/1992
Solanum petrophilum	Rock Nightshade				12/01/2009
Solanum petrophilum (NC)	Rock Nightshade				26/03/2007
Solanum quadriloculatum	Plains Nightshade				26/03/2007
Sonchus oleraceus	Common Sow-thistle			#	27/03/2007
Sorghum halepense	Johnson Grass			#	16/07/1992
Spergularia diandra	Lesser Sand-spurrey			#	1/08/1989
Sphaeromorphaea littoralis	Spreading Nut-heads				10/03/1990
Sporobolus actinocladus	Ray Grass				5/04/1989
Sporobolus caroli	Yakka Grass				24/03/1992
Stemodia florulenta	Bluerod				26/05/1998
Stenopetalum lineare	Narrow Thread-petal				10/09/1968
Suaeda baccifera	Seablite			#	1/04/2000
Swainsona adenophylla	Violet Swainson-pea				30/08/2010
Swainsona affinis	Small-leaf Swainson-pea				8/03/1997
Swainsona formosa	Sturt Pea				19/09/1989
Swainsona microcalyx	Wild Violet		R		12/02/1987
Swainsona microphylla	Small-leaf Swainson-pea				1/11/2010
Swainsona oliveri					2/05/1989
Swainsona phacoides	Dwarf Swainson-pea				30/08/2010
Swainsona stipularis	Orange Swainson-pea				24/06/1989
Tecticornia disarticulata					24/10/1976
Tecticornia indica ssp. leiostachya	Brown-head Samphire				26/03/2007

SPECIES	COMMON	AUS	SA	Exotic	Last sighting Date
Tecticornia medullosa					13/11/1996
Tecticornia pergranulata ssp. divaricata	Black-seed Samphire				29/07/1991
Tecticornia tenuis	Slender Samphire				6/08/1991
Templetonia egena	Broombush Templetonia				30/07/1991
Tetragonia eremaea	Desert Spinach				26/03/2007
Tetragonia sp.	False Spinach				10/09/2006
Teucrium racemosum	Grey Germander				13/11/1996
Thysanotus baueri	Mallee Fringe-lily				9/11/1925
Trachymene glaucifolia	Blue Parsnip				1/01/1981
Tragus australianus	Small Burr-grass				27/03/2007
Tribulus eichlerianus	Eichler's Caltrop				27/03/2007
Tribulus minutus					27/03/2007
Tribulus sp.	Caltrop				26/03/2007
Tribulus terrestris	Caltrop			#	6/03/1997
Trichanthodium skirrophorum	Woolly Yellow-heads				22/10/1966
Trichodesma zeylanicum var. zeylanicum	Camel Bush				10/04/1989
Trigonella suavissima	Sweet Fenugreek				24/07/1992
Triodia irritans	Spinifex				7/10/1939
Triraphis mollis	Purple Plume Grass				26/03/2007
Triticum aestivum	Wheat			#	16/07/1992
Typha domingensis	Narrow-leaf Bulrush				12/12/1990
Urochloa praetervisa	Large Arm-grass				5/03/1981
Verbena officinalis	Common Verbena			#	24/07/1992
Verbena supina var. supina	Trailing Verbena			#	26/03/2007
Vittadinia cervicularis var. cervicularis	Waisted New Holland Daisy				26/10/1992
Vittadinia eremaea	Desert New Holland Daisy				26/10/1992
Wahlenbergia communis	Tufted Bluebell				27/03/2007
Wahlenbergia gracilenta	Annual Bluebell				9/06/2013
Wahlenbergia tumidifructa	Swollen-fruit Bluebell				13/11/1996
Waitzia acuminata var. acuminata	Orange Immortelle				4/08/1949
Westringia rigida	Stiff Westringia				13/07/1954
Wurmbea australis	Inland Nancy				31/07/1991
Wurmbea citrina	Green-flower Nancy				1/08/1991
Xanthium spinosum	Bathurst Burr			#	26/03/2007
Zygochloa paradoxa	Sandhill Cane-grass				16/02/1997
Zygophyllum sp.	Twinleaf				27/03/2007

Conservation status: **Aus**: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA**: South Australia (*National Parks and Wildlife Act 1972*).
Conservation codes: **CE**: Critically Endangered. **EN/E**: Endangered. **VU/V**: Vulnerable. **R**: Rare. *: Introduced.

Appendix 2. Fauna species recorded in the BDBSA within the Study Area (DEW 2018).

	CLASS	SPECIES	COMNAME	AUS	SA	Last sighting date
*	AVES	*Columba livia*	Feral Pigeon			8/05/2002
*		*Passer domesticus*	House Sparrow			7/05/2002
*		*Spilopelia chinensis*	Spotted Dove			23/09/1993
*		*Struthio camelus*	Common Ostrich			26/09/2000
*		*Sturnus vulgaris*	Common Starling			11/09/2007
*		*Turdus merula*	Common Blackbird			1/09/1999
*	MAMMALIA	*Canis lupus familiaris*	Feral Dog			1/09/2016
*		*Capra hircus*	Goat (Feral Goat)			12/07/2015
*		*Equus caballus*	Horse (Brumby)			1/01/1985
*		*Felis catus*	Domestic Cat (Feral Cat)			7/09/2016
*		*Mus musculus*	House Mouse			9/12/2012
*		*Oryctolagus cuniculus*	Rabbit (European Rabbit)			1/09/2016
*		*Ovis aries*	Sheep (Feral Sheep)			12/09/2007
*		*Vulpes vulpes*	Fox (Red Fox)			12/09/2007
	AMPHIBIA	*Neobatrachus pictus*	Burrowing Frog			28/03/1978
		Neobatrachus sudellae	Sudell's Frog			14/12/2010
	AVES	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater			10/09/2007
		Acanthiza apicalis	Inland Thornbill			2/09/2007
		Acanthiza chrysorrhoa	Yellow-rumped Thornbill			2/09/2007
		Acanthiza uropygialis	Chestnut-rumped Thornbill			10/09/2007
		Accipiter cirrocephalus	Collared Sparrowhawk			19/12/2000
		Acrocephalus australis	Australian Reed Warbler			6/10/2001
		Actitis hypoleucos	Common Sandpiper		R	19/01/2001
		Aegotheles cristatus	Australian Owlet-nightjar			10/09/2007
		Anas castanea	Chestnut Teal			1/02/1998
		Anas gracilis	Grey Teal			12/12/2009
		Anas rhynchotis rhynchotis	Australasian Shoveler		R	12/12/1999
		Anas superciliosa	Pacific Black Duck			17/04/2011
		Anhinga novaehollandiae	Australasian Darter		R	18/08/2000
		Anthus australis	Australian Pipit			7/09/2016
		Aphelocephala leucopsis	Southern Whiteface			1/09/2016
		Apus pacificus	Pacific Swift (Fork-tailed Swift)			21/01/2001
		Aquila audax	Wedge-tailed Eagle			2/09/2016
		Ardea alba	Great Egret			7/02/2001
		Ardea ibis	Cattle Egret		R	13/05/1986
		Ardea pacifica	White-necked Heron			13/10/2000
		Ardeotis australis	Australian Bustard		V	1/12/1998
		Arenaria interpres	Ruddy Turnstone		R	9/10/1993
		Artamus cinereus	Black-faced Woodswallow			7/09/2016
		Artamus cyanopterus	Dusky Woodswallow			10/09/2007
		Artamus leucorynchus	White-breasted Woodswallow			6/03/2001
		Artamus personatus	Masked Woodswallow			26/03/2007
		Artamus superciliosus	White-browed Woodswallow			6/10/2001

	CLASS	SPECIES	COMNAME	AUS	SA	Last sighting date
		Aythya australis	Hardhead			22/10/2011
		Barnardius zonarius	Australian Ringneck			10/09/2007
		Biziura lobata	Musk Duck		R	2/09/2007
		Cacatua sanguinea	Little Corella			2/09/2007
		Cacomantis pallidus	Pallid Cuckoo			6/10/2001
		Calamanthus (Calamanthus) campestris	Rufous Fieldwren			20/06/2004
		Calidris acuminata	Sharp-tailed Sandpiper			1/11/2000
		Calidris ferruginea	Curlew Sandpiper	CR		3/09/1994
		Calidris ruficollis	Red-necked Stint			1/11/2000
		Certhionyx variegatus	Pied Honeyeater			26/03/2007
		Chalcites basalis	Horsfield's Bronze Cuckoo			11/09/2007
		Chalcites osculans	Black-eared Cuckoo			26/03/2007
		Charadrius ruficapillus	Red-capped Plover			19/01/2001
		Chenonetta jubata	Maned Duck			12/02/2010
		Cheramoeca leucosterna	White-backed Swallow			2/09/2016
		Chlidonias hybrida	Whiskered Tern			2/01/2001
		Chroicocephalus novaehollandiae	Silver Gull			2/09/2007
		Cincloramphus cruralis	Brown Songlark			26/10/2001
		Cincloramphus mathewsi	Rufous Songlark			6/10/2001
		Cinclosoma castanotum	Chestnut-backed Quailthrush (Chestnut Quailthrush)		ssp	4/03/1979
		Cinclosoma cinnamomeum	Cinnamon Quailthrush			1/02/2001
		Circus assimilis	Spotted Harrier			1/03/2000
		Cladorhynchus leucocephalus	Banded Stilt		V	6/10/2000
		Climacteris affinis	White-browed Treecreeper		R	4/08/1900
		Colluricincla harmonica	Grey Shrikethrush			10/09/2007
		Coracina maxima	Ground Cuckooshrike			11/09/2007
		Coracina novaehollandiae	Black-faced Cuckooshrike			10/09/2007
		Corvus bennetti	Little Crow			2/09/2007
		Corvus coronoides	Australian Raven			2/09/2007
		Corvus sp.	crows			9/09/2004
		Coturnix pectoralis	Stubble Quail			24/05/1992
		Cracticus torquatus	Grey Butcherbird			10/09/2007
		Cuculus optatus	Oriental Cuckoo			12/11/1993
		Cygnus atratus	Black Swan			19/03/2012
		Daphoenositta chrysoptera	Varied Sittella			7/09/2003
		Dicaeum hirundinaceum	Mistletoebird			10/09/2007
		Dromaius novaehollandiae	Emu			26/08/2015
		Egretta garzetta	Little Egret		R	9/10/1993
		Egretta novaehollandiae	White-faced Heron			2/09/2007
		Elanus axillaris	Black-shouldered Kite			8/05/2002
		Elseyornis melanops	Black-fronted Dotterel			2/09/2007
		Eolophus roseicapilla	Galah			1/09/2016
		Epthianura albifrons	White-fronted Chat			2/09/2016
		Epthianura aurifrons	Orange Chat			7/09/2003

	CLASS	SPECIES	COMNAME	AUS	SA	Last sighting date
		Epthianura tricolor	Crimson Chat			10/09/2007
		Erythrogonys cinctus	Red-kneed Dotterel			6/10/2001
		Eurostopodus argus	Spotted Nightjar			1/10/2000
		Falco berigora	Brown Falcon			10/09/2007
		Falco cenchroides	Nankeen Kestrel			10/09/2007
		Falco longipennis	Australian Hobby			26/09/2000
		Falco peregrinus	Peregrine Falcon		R	1/04/1998
		Falco subniger	Black Falcon			1/12/1998
		Fulica atra	Eurasian Coot			22/10/2011
		Gallinago hardwickii	Latham's Snipe		R	19/01/2001
		Gallinula tenebrosa	Dusky Moorhen			1/08/1998
		Gallirallus philippensis mellori	Buff-banded Rail			17/10/2000
		Gavicalis virescens	Singing Honeyeater			1/09/2016
		Gelochelidon nilotica	Gull-billed Tern			23/04/2007
		Geopelia cuneata	Diamond Dove			26/10/2001
		Geopelia placida	Peaceful Dove			8/05/2002
		Grallina cyanoleuca	Magpielark			2/09/2007
		Gymnorhina tibicen	Australian Magpie			10/09/2007
		Haliastur sphenurus	Whistling Kite			2/09/2007
		Hieraaetus morphnoides	Little Eagle			12/07/2000
		Himantopus leucocephalus	White-headed Stilt			2/09/2007
		Hirundo neoxena	Welcome Swallow			2/09/2016
		Hydroprogne caspia	Caspian Tern			1/06/1999
		Lalage tricolor	White-winged Triller			10/09/2007
		Limosa limosa	Black-tailed Godwit		R	1/02/1998
		Lophochroa leadbeateri mollis	Major Mitchell's Cockatoo (EP, GR, NW)		SP	1/03/1999
		Malacorhynchus membranaceus	Pink-eared Duck			4/10/2002
		Malurus lamberti	Variegated Fairywren			28/03/2007
		Malurus leucopterus	White-winged Fairywren			10/09/2007
		Malurus splendens	Splendid Fairywren			4/03/1979
		Malurus splendens callainus	Turquoise Fairywren			10/09/2007
		Manorina flavigula	Yellow-throated Miner	ssp	ssp	1/09/2016
		Megalurus gramineus	Little Grassbird			6/10/2001
		Melanodryas cucullata	Hooded Robin		ssp	1/11/2000
		Melanodryas cucullata westralensis	Hooded Robin (EP, GR, NW)			7/09/2016
		Melopsittacus undulatus	Budgerigar			1/09/2016
		Merops ornatus	Rainbow Bee-eater			7/02/2001
		Microcarbo melanoleucos	Little Pied Cormorant			5/11/2000
		Microeca fascinans	Jacky Winter		ssp	4/03/1979
		Milvus migrans	Black Kite			2/09/2016
		Neophema chrysostoma	Blue-winged Parrot		V	1/05/1999
		Neophema splendida	Scarlet-chested Parrot		R	29/08/1993
		Neopsephotus bourkii	Bourke's Parrot			10/09/2007
		Ninox boobook	Southern Boobook			7/05/2002

	CLASS	SPECIES	COMNAME	AUS	SA	Last sighting date
		Northiella haematogaster (NC)	Bluebonnet		ssp	1/09/2016
		Nycticorax caledonicus	Nankeen Night Heron			1/03/1999
		Nymphicus hollandicus	Cockatiel			18/10/2001
		Ocyphaps lophotes	Crested Pigeon			1/09/2016
		Oreoica gutturalis	Crested Bellbird			10/09/2007
		Oxyura australis	Blue-billed Duck		R	9/11/2000
		Pachycephala rufiventris rufiventris	Rufous Whistler			10/09/2007
		Pardalotus rubricatus	Red-browed Pardalote			1/08/2000
		Pardalotus striatus	Striated Pardalote			14/09/2000
		Pelecanus conspicillatus	Australian Pelican			6/12/2000
		Peltohyas australis	Inland Dotterel			1/02/2000
		Petrochelidon ariel	Fairy Martin			6/10/2001
		Petrochelidon nigricans	Tree Martin			4/10/2002
		Petroica goodenovii	Red-capped Robin			2/09/2007
		Phalacrocorax carbo	Great Cormorant			4/10/2002
		Phalacrocorax sulcirostris	Little Black Cormorant			13/02/2001
		Phalacrocorax varius	Great Pied Cormorant			1/07/2000
		Phaps chalcoptera	Common Bronzewing			10/09/2007
		Phaps histrionica	Flock Bronzewing		R	12/12/2013
		Platalea flavipes	Yellow-billed Spoonbill			3/09/1994
		Plegadis falcinellus	Glossy Ibis		R	1/01/1999
		Pluvialis squatarola	Grey Plover			26/11/1991
		Podargus strigoides	Tawny Frogmouth			10/09/2007
		Podiceps cristatus	Great Crested Grebe		R	1/12/1999
		Poliocephalus poliocephalus	Hoary-headed Grebe			10/09/2007
		Pomatostomus superciliosus	White-browed Babbler			7/09/2016
		Porphyrio porphyrio	Purple Swamphen			1/01/1998
		Porzana fluminea	Australian Crake (Australian Spotted Crake)			6/10/2001
		Porzana pusilla	Baillon's Crake			19/01/2001
		Porzana tabuensis	Spotless Crake		R	1/10/2000
		Psephotellus varius	Mulga Parrot			10/09/2007
		Psephotus haematonotus	Red-rumped Parrot			26/09/2000
		Psophodes cristatus	Chirruping Wedgebill			1/01/2001
		Ptilotula penicillata	White-plumed Honeyeater			21/04/2003
		Purnella albifrons	White-fronted Honeyeater			27/03/2007
		Pyrrholaemus brunneus	Redthroat			3/08/1900
		Recurvirostra novaehollandiae	Red-necked Avocet			4/10/2002
		Rhipidura albiscapa	Grey Fantail			5/09/2000
		Rhipidura leucophrys	Willie Wagtail			10/09/2007
		Stictonetta naevosa	Freckled Duck		V	27/12/2004
		Stiltia isabella	Australian Pratincole			19/01/2001
		Tachybaptus novaehollandiae	Australasian Grebe			30/05/2001
		Tadorna tadornoides	Australian Shelduck			1/09/1998

	CLASS	SPECIES	COMNAME	AUS	SA	Last sighting date
		Taeniopygia guttata	Zebra Finch			2/09/2016
		Threskiornis moluccus	Australian White Ibis			1/05/1994
		Threskiornis spinicollis	Straw-necked Ibis			1/10/1998
		Todiramphus pyrrhopygius	Red-backed Kingfisher			1/09/2016
		Todiramphus sanctus	Sacred Kingfisher			7/10/2000
		Tribonyx ventralis	Black-tailed Nativehen			16/10/2011
		Tringa glareola	Wood Sandpiper		R	19/01/2001
		Tringa nebularia	Common Greenshank			4/10/2002
		Tringa stagnatilis	Marsh Sandpiper			1/02/2001
		Turnix velox	Little Buttonquail			1/03/1998
		Tyto delicatula delicatula	Eastern Barn Owl			23/06/2004
		Vanellus miles	Masked Lapwing			2/09/2007
		Vanellus tricolor	Banded Lapwing			27/03/2007
	MAMMALIA	*Antechinomys laniger*	Kultarr			18/12/2010
		Austronomus australis	White-striped Free-tailed Bat			2/09/2016
		Leggadina forresti	Central Short-tailed Mouse (Forrest's Mouse)			23/10/1981
		Leporillus sp.	stick-nest rats			16/09/2012
		Macropus fuliginosus	Western Grey Kangaroo			17/07/2015
		Macropus robustus	Euro			1/09/2016
		Macropus rufus	Red Kangaroo			2/09/2016
		Mormopterus sp.				2/09/2016
		Notomys alexis	Spinifex Hopping-mouse			16/08/2011
		Nyctophilus geoffroyi	Lesser Long-eared Bat			2/09/2016
		Planigale gilesi	Giles' Planigale (Paucident Planigale)			13/11/1996
		Pseudomys australis	Plains mouse	VU	V	12/12/2010
		Pseudomys bolami	Bolam's Mouse			10/12/2013
		Scotorepens balstoni	Inland Broad-nosed Bat			18/11/1987
		Sminthopsis crassicaudata	Fat-tailed Dunnart			18/12/2011
		Sminthopsis dolichura	Little Long-tailed Dunnart			16/10/1974
		Sminthopsis macroura	Stripe-faced Dunnart			20/12/2010
		Tachyglossus aculeatus	Short-beaked Echidna	ssp		26/11/2003
	REPTILIA	*Anilios bituberculatus*	Rough-nosed Blind Snake			17/12/2009
		Anilios endoterus	Centralian Blind Snake			16/12/2010
		Antaresia stimsoni	Stimson's Python			25/10/1994
		Aspidites ramsayi	Woma		R	10/10/1990
		Brachyurophis fasciolatus	Narrow-banded Snake			3/11/2008
		Brachyurophis semifasciatus	Half-girdled Snake			6/01/2000
		Cryptoblepharus australis	Desert Wall Skink			17/08/1991
		Cryptoblepharus cf plagiocephalus (NC)	Desert Wall Skink			9/10/1991
		Ctenophorus chapmani	Prickly Dragon			14/09/2007
		Ctenophorus cristatus	Crested Dragon			11/09/2007
		Ctenophorus fionni	Peninsula Dragon			11/09/2007
		Ctenophorus fordi	Mallee Dragon			11/12/2013
		Ctenophorus nuchalis	Central Netted Dragon			22/12/2011

	CLASS	SPECIES	COMNAME	AUS	SA	Last sighting date
		Ctenophorus pictus	Painted Dragon			14/11/1996
		Ctenotus brooksi	Sandhill Ctenotus			31/12/1990
		Ctenotus inornatus	Brown Ctenotus			27/09/1991
		Ctenotus leae	Centralian Coppertail			20/03/1998
		Ctenotus olympicus	Saltbush Ctenotus			11/09/2007
		Ctenotus orientalis	Spotted Ctenotus			5/12/1982
		Ctenotus pantherinus	Leopard Skink			11/04/1982
		Ctenotus regius	Eastern Desert Ctenotus			1/09/2016
		Ctenotus schomburgkii	Sandplain Ctenotus			11/12/2013
		Ctenotus spaldingi	Eastern Striped Skink			1/10/1984
		Ctenotus strauchii	Short-legged Ctenotus			25/10/1981
		Ctenotus taeniatus	Eyrean Ctenotus			14/12/2007
		Ctenotus uber (NC)	Spotted Ctenotus			12/11/1996
		Delma australis	Barred Snake-lizard			28/11/1988
		Delma butleri	Spinifex Snake-lizard			28/11/1988
		Demansia reticulata	Desert Whipsnake			6/11/1995
		Diplodactylus conspicillatus (NC)	Fat-tailed Gecko			17/12/2009
		Diplodactylus tessellatus	Tessellated Gecko			21/12/2006
		Diporiphora winneckei (NC)	Canegrass Dragon			22/11/1992
		Egernia stokesii	Gidgee Skink			5/08/1991
		Eremiascincus richardsonii	Broad-banded Sandswimmer			14/11/1996
		Gehyra purpurascens	Robust Tree Dtella			7/09/2016
		Gehyra sp.				20/12/2010
		Gehyra variegata (NC)	Tree Dtella			13/09/2007
		Gehyra variegata complex				28/01/1980
		Hemiergis millewae	Rusty Earless Skink			5/12/1982
		Heteronotia binoei	Bynoe's Gecko			2/09/2016
		Lerista bougainvillii	Bougainville's Skink			12/11/1996
		Lerista desertorum	Great Desert Slider			14/01/2007
		Lerista dorsalis	Southern Four-toed Slider			14/11/1996
		Lerista edwardsae	Myall Slider			26/04/1997
		Lerista labialis	Eastern Two-toed Slider			1/09/2016
		Lerista sp.				23/10/1989
		Lerista terdigitata	Southern Three-toed Slider			4/12/1982
		Lerista timida	Dwarf Three-toed Slider			11/09/2007
		Lucasium damaeum	Beaded Gecko			12/09/2007
		Lucasium stenodactylum (revised)	Sandplain Gecko			9/12/2013
		Menetia greyii	Dwarf Skink			1/09/2016
		Morethia adelaidensis	Adelaide Snake-eye			12/11/1996
		Morethia boulengeri	Common Snake-eye			1/09/2016
		Nephrurus deleani	Pernatty Knob-tailed Gecko		R	25/02/2000
		Nephrurus levis	Smooth Knob-tailed Gecko			12/12/2012
		Parasuta spectabilis	Mallee Black-headed Snake			16/05/1984
		Pogona vitticeps	Central Bearded Dragon			2/09/2016

	CLASS	SPECIES	COMNAME	AUS	SA	Last sighting date
		Pseudechis australis	Mulga Snake			27/02/2005
		Pseudonaja mengdeni	Gwardar			23/10/1990
		Pseudonaja modesta	Five-ringed Snake			1/09/2016
		Pseudonaja nuchalis (NC)	Western Brown Snake			20/11/1995
		Pygopus nigriceps	Black-headed Scaly-foot			5/11/1999
		Rhynchoedura ornata (NC)	Beaked Gecko			8/12/2012
		Rhynchoedura ornata (revised)	Western Beaked Gecko			8/12/2013
		Simoselaps bertholdi	Desert Banded Snake			11/09/2007
		Simoselaps sp.				15/03/1988
		Strophurus ciliaris	Northern Spiny-tailed Gecko			17/10/1996
		Strophurus intermedius	Southern Spiny-tailed Gecko			14/09/2007
		Suta suta	Curl Snake			18/12/2004
		Tiliqua occipitalis	Western Bluetongue			19/03/1999
		Tiliqua rugosa	Sleepy Lizard			1/09/2016
		Tympanocryptis intima	Smooth-snouted Earless Dragon			13/12/2011
		Tympanocryptis lineata	Five-lined Earless Dragon			9/12/2013
		Tympanocryptis tetraporophora	Eyrean Earless Dragon			14/11/1996
		Underwoodisaurus milii	Common Barking Gecko			1/09/2016
		Varanus gilleni	Pygmy Mulga Goanna			14/06/1994
		Varanus gouldii	Sand Goanna			11/12/2013

Conservation status: **Aus**: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA**: South Australia (*National Parks and Wildlife Act 1972*).

Conservation codes: **CE**: Critically Endangered. **EN/E**: Endangered. **VU/V**: Vulnerable. **R**: Rare. *: Introduced.

Appendix 3. Vegetation Associations Rangeland Assessment Sites and Unit Biodiversity Scores Summary

Rangeland site #	Assoc	Description	UBS	PL Name
1	1	*Acacia papyrocarpa* (Western Myall) Open Woodland	49.00	Mt. Arden
2	6	*Acacia aneura* (Mulga) / *Acacia papyrocarpa* (Western Myall) Mixed Woodland	57.59	Mt. Arden
3	2	*Acacia aneura* (Mulga) Mixed Woodland	52.40	Mt. Arden
4	1	*Acacia papyrocarpa* (Western Myall) Open Woodland	73.62	Mt. Arden
5	1	*Acacia papyrocarpa* (Western Myall) Open Woodland	61.42	Mt. Arden
6	3	*Casuarina pauper* (Black Oak) / *Acacia aneura* (Mulga) Open Woodland	58.23	Kootaberra
7	4	*Casuarina pauper* (Black Oak) Woodland	56.79	Kootaberra
8	2	*Acacia aneura* (Mulga) Mixed Woodland	55.59	Kootaberra
9	5	*Callitris glaucophylla* (Northern Cypress Pine) Woodland	47.65	Kootaberra
10	2	*Acacia aneura* (Mulga) Mixed Woodland	53.59	Kootaberra
11	6	*Acacia aneura* (Mulga) / *Acacia papyrocarpa* (Western Myall) Mixed Woodland	46.46	Kootaberra
12	7	*Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrub land	50.26	Kootaberra
13	1	*Acacia papyrocarpa* (Western Myall) Open Woodland	51.30	Kootaberra
14	8	*Acacia aneura* (Mulga) +/- *Alectryon oleifolius* (Bullock Bush) Shrubland	49.73	Kootaberra
15	1	*Acacia papyrocarpa* (Western Myall) Open Woodland	54.64	Oakden Hills
17	2	*Acacia aneura* (Mulga) Mixed Woodland	61.91	Oakden Hills
18	9	*Maireana sedifolia* (Pearl Bluebush) Low Open Shrubland	52.44	Oakden Hills
19	10	*Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)	69.96	Oakden Hills
20	1	*Acacia papyrocarpa* (Western Myall) Open Woodland	37.08	Oakden Hills
21	11	*Atriplex vesicaria* (Bladder Saltbush)+/- *Maireana astrotricha* (Low Bluebush) Mixed Low Open Shrubland	55.76	Oakden Hills
22	14	*Tecticornia* spp. (Samphire) +/- *Atriplex vesicaria* (Bladder Saltbush) Low shrubland	61.22	Oakden Hills
23	7	*Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrub land	45.04	Oakden Hills
24	12	*Acacia aneura* (Mulga), *Acacia ramulosa* (Horse Mulga) Woodland over *Acacia ligulata* (Sandhill Wattle)	66.00	Arcoona
25	10	*Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)	68.56	Arcoona
26	13	*Acacia ligulata* (Sandhill Wattle) / *Dodonaea viscosa* (Sticky Hop-bush) Shrubland	60.17	Arcoona
27	14	*Tecticornia* spp. (Samphire) +/- *Atriplex vesicaria* (Bladder Saltbush) Low shrubland	52.28	Arcoona
28	7	*Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrub land	50.16	Arcoona
29	15	*Casuarina pauper* (Black Oak) Creekline	58.68	Arcoona
30	16	*Atriplex vesicaria* (Bladder saltbush) +/- *Eragrostis australasica* (Swamp Canegrass) Low Open Shrubland	42.99	Arcoona
31	17	*Maireana aphylla* (Cotton bush) Low Shrubland	35.56	Arcoona
32	7	*Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrub land	48.97	Arcoona
33	19	*Maireana astrotricha* (Low bluebush) Low Open Shrubland	47.73	Arcoona
34	13	*Acacia ligulata* (Sandhill Wattle) / *Dodonaea viscosa* (Sticky Hop-bush) Shrubland	40.70	Purple Downs
35	7	*Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrub land	69.48	Purple Downs
36	5	*Callitris glaucophylla* (Northern Cypress Pine) Woodland	53.85	Purple Downs
37	7	*Atriplex vesicaria* (Bladder Saltbush) / *Tecticornia medullosa* (Samphire) Shrub land	46.15	Purple Downs

Rangeland site #	Assoc	Description	UBS	PL Name
38	10	*Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)	70.02	Purple Downs
39	5	*Callitris glaucophylla* (Northern Cypress Pine) Woodland	51.92	Purple Downs
40	18	*Melaleuca pauperiflora* ssp. *mutica* Shrubland +/- *Acacia ligulata* (Sandhill Wattle)	45.72	Purple Downs
41	5	*Callitris glaucophylla* (Northern Cypress Pine) Woodland	51.92	Purple Downs
42	13	*Acacia ligulata* (Sandhill Wattle) / *Dodonaea viscosa* (Sticky Hop-bush) Shrubland	34.04	Purple Downs
43	5	*Callitris glaucophylla* (Northern Cypress Pine) Woodland	45.41	Purple Downs
44	19	*Maireana astrotricha* (Low bluebush) Low Open Shrubland	52.46	Roxby Downs
45	11	*Atriplex vesicaria* (Bladder Saltbush)+/- *Maireana astrotricha* (Low Bluebush) Mixed Low Open Shrubland	46.83	Roxby Downs
46	12	*Acacia aneura* (Mulga), *Acacia ramulosa* (Horse Mulga) Woodland over *Acacia ligulata* (Sandhill Wattle)	48.57	Roxby Downs
47	10	*Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)	45.60	Roxby Downs
48	2	*Acacia aneura* (Mulga) Mixed Woodland	61.05	Roxby Downs
49	10	*Acacia papyrocarpa* (Western Myall) Woodland over *Atriplex vesicaria* (Bladder Saltbush)	47.13	Roxby Downs
50	19	*Maireana astrotricha* (Low bluebush) Low Open Shrubland	48.49	Roxby Downs
51	12	*Acacia aneura* (Mulga), *Acacia ramulosa* (Horse Mulga) Woodland over *Acacia ligulata* (Sandhill Wattle)	52.65	Roxby Downs
52	9	*Maireana sedifolia* (Pearl Bluebush) Low Open Shrubland	53.77	Roxby Downs
53	11	*Atriplex vesicaria* (Bladder Saltbush)+/- *Maireana astrotricha* (Low Bluebush) Mixed Low Open Shrubland	55.28	Roxby Downs
54	20	*Chenopodium nitrariaceum* (Nitre Goosefoot) Open Shrubland	41.01	Roxby Downs
55	11	*Atriplex vesicaria* (Bladder Saltbush)+/- *Maireana astrotricha* (Low Bluebush) Mixed Low Open Shrubland	59.14	Roxby Downs
56	11	*Atriplex vesicaria* (Bladder Saltbush)+/- *Maireana astrotricha* (Low Bluebush) Mixed Low Open Shrubland	72.20	Roxby Downs

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Appendix D2. Ecological Impact Assessment

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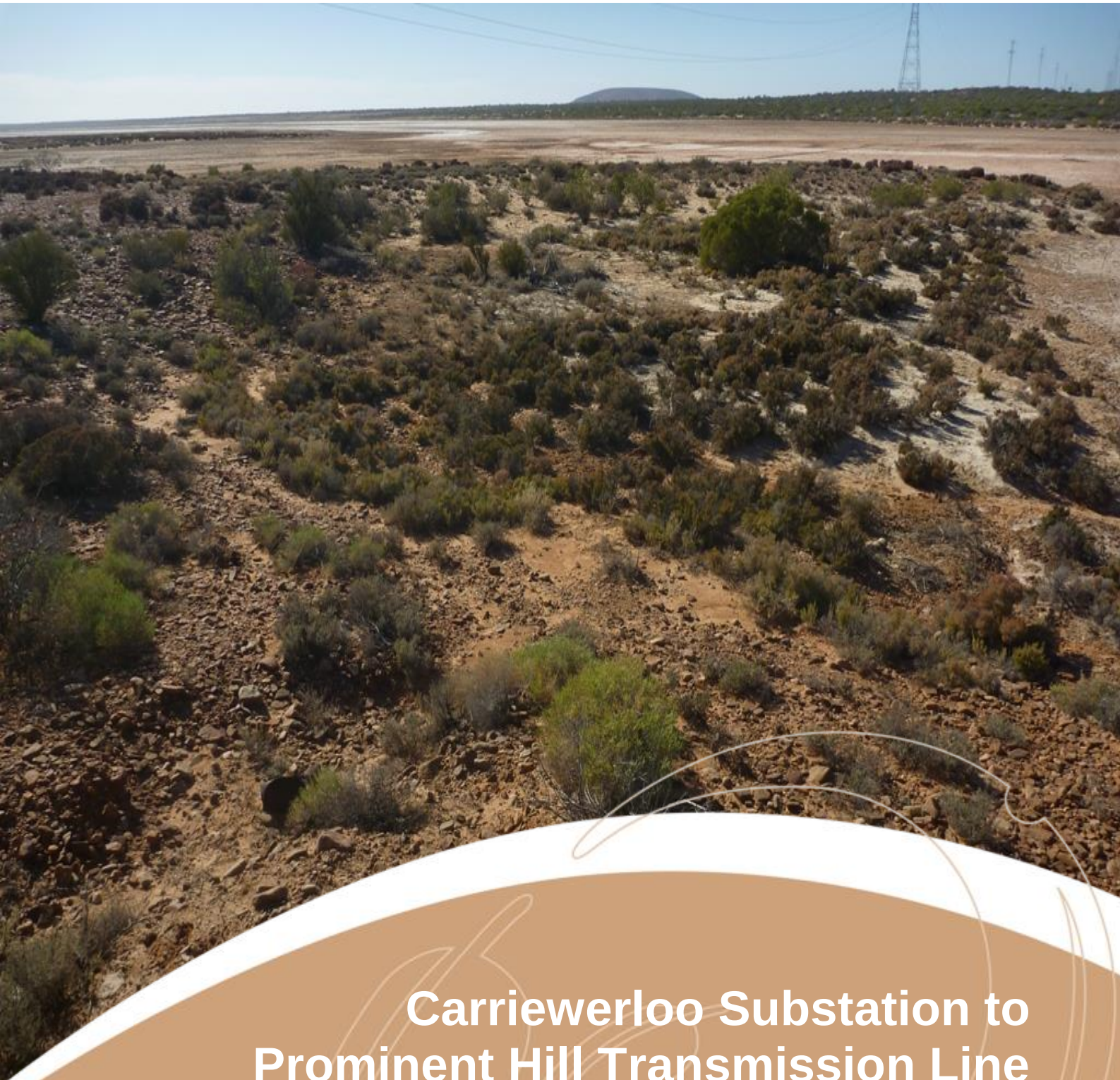

Carriewerloo Substation to Prominent Hill Transmission Line

Ecological Impact Assessment

Carriewerloo Substation to Prominent Hill Transmission Line Ecological Impact Assessment

29 June 2018

Final Report

Prepared by EBS Ecology for OZ Minerals

EBS Ecology Project Number: E81110

CITATION: OZ Minerals (2018) Carriewerloo Substation to Prominent Hill Electricity Transmission Line Development Application, Appendix D2 Ecology Impact Assessment. Developed by EBS Ecology for OZ Minerals. June 2018. Adelaide.

Cover photograph: Lake Windabout view southeast with Mt. Gunson in Background.

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1 ASSESSMENT APPROACH

This report presents the ecological impact assessment for OZ Minerals' proposed Carriewerloo Substation to Prominent Hill Electricity Transmission Line.

1.1 Overview

The ecological impact assessment approach was based on three main components:

- The identification of potential impacts based on an assessment of the potential for a linkage between a source, a pathway and an ecological receptor.
- The quantification of the significance of the potential impact based on an assessment of three factors related to the receptor and the nature of the impact:
    - Resilience
    - Receptor importance
    - Duration
- The quantification of the level of uncertainty within the impact assessment based on an estimation of the quality of the following three aspects of the assessment:
    - Inputs
    - Method and model
    - Sensitivity

The process is described in further detail in the Development Application. Potential impact events are subsequently rated and classified, with impact significance ratings of less than 48 determined to be not significant and those over 48, significant.

To support the quantification of impact significance and uncertainty, potential impacts have been grouped broadly by receptor, and the impacts on the baseline ecological environment as a result of the changes to pathways are described in this Ecological Impact Assessment report.

1.2 Baseline Ecology

An assessment of the baseline ecological environment was presented in the Ecological Baseline Assessment (EBS Ecology, 2018). The impact assessment presented herein was undertaken with reference to the baseline ecological environment.

1.3 Project Area

The Project Area consists of the 500 m transmission line corridor, which includes the proposed alignment and a 250 m buffer either side (Figure 1).

The Study Area for the desktop component of the ecological baseline assessment (i.e. database searches, review of existing biological surveys, data and mapping) included a 5 km buffer along both sides of the

proposed transmission line alignment (i.e. 10 km corridor). Anything broader than this is designated as the Regional Study Area.

1.4 Sensitivity Assumptions

1.4.1 Clearance Parameters

The construction disturbance footprint will be influenced by factors to be determined in detailed design, including structure size, location and spacing, access track details and construction methodology (e.g. stringing methods). Existing tracks and other disturbed areas will be used where possible, however for assessment purposes, clearance for construction has been based on a worst-case scenario, using the following assumptions:

- Clearance at tower bases of 50 m x 50 m every 450 m for 275 kV towers and 40 m x 40 m every 300 m for 132 kV poles/towers
- Clearance of a 5 m access track and a 5 m stringing easement along the full length
- Clearance of two 50 m x 50 m machine areas for stringing conductors at strain towers (assumed 100 strain towers).
- Ten laydown yards of 1 ha and four larger yards of up to 10 ha.

These assumptions give a conservative clearance footprint of 470 ha.

The clearance parameters are predominantly related to the period of construction, with the majority of the stringing easement (if required), areas surrounding individual towers and laydown yards and camp facilities to be rehabilitated and allowed to naturally regenerate from the surrounding indigenous vegetation. The total duration of the construction phase is expected to be less than two years at which point all clearance and construction related impacts would have occurred. Following rehabilitation of areas of temporary disturbance, the operational disturbance footprint is expected to be in the order of 150 ha or less.

1.4.2 Construction Parameters

Construction impacts such as vehicle type and frequency, camp compound structures and illumination, general noise and associated infrastructure impacts were made based on general knowledge of other projects of similar type and magnitude as well the project description in the Development Application.

The timespan of the project is expected to be less than two years to completion from the start of construction. Construction activities at any given location are likely to occur for less than 12 months.

2 IMPACT ASSESSMENT

Broadly, the ecological receptors were categorised separately or addressed as a whole where necessary to adequately capture all of the potential impacts and allow a receptor specific quantification of impact significance. These categories included:

- Native flora and fauna, including communities and habitats
- State (National Parks and Wildlife Act-listed) flora and fauna species
- Commonwealth (Environment Protection and Biodiversity Conservation Act) listed flora and fauna species

Impacts to the above-described receptors as a result of the project were described in terms of changes in abundance and/or diversity over the baseline conditions.

2.1 Flora

2.1.1 Land Clearance

The transmission line footprint is approximately 237 km in length and is projected to have a worst-case disturbance area of approximately 470 ha as noted above. The majority of the tower and stringing easement clearance would be allowed to regenerate naturally.

Native flora

Given the two pre-existing transmission line alignments, this level of clearance is not expected to significantly increase the level of fragmentation of vegetation communities due to the narrow linear shape of the project footprint. Vegetation communities within surrounding landscapes were intact and resources such as seed, soil cover and litter which aid natural regeneration were available.

Vegetation communities within the disturbance footprint were well represented within the wider region. None of the vegetation communities identified across the length of the alignment was considered conservation significant under relevant national and state legislation. While common, recovery times for vegetation communities observed are on the longer time scale due to the perennial nature of the dominant overstorey and the reliance on adequate rainfall to allow germination and subsequent establishment of these communities following rehabilitation.

State-listed flora

One species of conservation significance at State level was observed within the Study Area, *Santalum spicatum* (Sandalwood). Sandalwood were generally observed as very sparsely present. It is highly unlikely that any single individual would fall within the clearance envelope for the Project. This species has a low resilience to clearance having been largely cleared historically due to the species value as a natural therapy. It is a slow growing, fire-sensitive species and individuals may take many years to reach maturity and have low natural recruitment so are highlighted as being particularly sensitive (Florabank, 2018), (A. Sinel, *pers, obs*). Given the low numbers of this species and the pre-construction surveys planned during detailed design, significant impact to this species is not expected.

It is possible that some ephemeral and annual species listed as conservation significant at state level may be present within the Study Area but were not observable during the field survey due to dry conditions in the lead up to the survey. Annual and ephemeral species typically respond to episodic rainfall events and are able to regenerate within the Project Area when conditions prove suitable. These species are associated with common habitats and would not be expected to be significantly impacted.

Commonwealth-listed flora

No vegetation communities of Commonwealth conservation significance were observed during the baseline survey within the Study Area. One EPBC listed flora species was identified as possibly present:

Frankenia plicata (Endangered, EPBC Act).

Frankenia plicata was considered most likely to occur within the Study Area in areas of well drained soils, potentially on the fringes of saline ephemeral salt pans where highly saline conditions occur. This species

was not observed as part of the baseline survey despite targeted searches in the most likely areas such as sandy banks on the fringes of Lake Windabout and Pernatty Lagoon. Other known records from the region occur on a wide range of habitats such as an observation east of the Project Area in a stream channel on low hills system dominated by *Acacia papyrocarpa* and *Casuarina pauper* as well as another record on the outskirts of Woomera located in chenopod shrublands on sandy loam soils. Given the nearby existing records occur on two distinct habitats, the presence of individuals is difficult to dismiss. Some individuals could potentially be impacted as part of the project, however targeted surveys during detailed design and micro-siting of track and tower locations will avoid significant impact to this species if present. Impact to *Frankenia plicata* would be an unplanned event (not a planned or likely impact) and is addressed by a risk assessment in the Impact Assessment Framework Tables appendix of the Development Application.

Table 1. Summary of land clearance impact significance to native flora.

Potential Impact Description	Impact significance				Impact uncertainty		
	Resilience	importance	Duration	Significance	Input	Methodology	Sensitivity
Land clearance associated with the construction of project infrastructure causes a regional loss of abundance and diversity of native flora	1	1	3	3	A	A	A
Land clearance associated with the construction of project infrastructure impacts flora species or communities of State conservation significance.	1	4	3	12	B	A	B

2.1.2 Exotic Flora

Weed incursions can potentially compete with and inhibit the regeneration of native species, altering community structures and dynamics, including the resources available to dependent native species and communities. Outbreaks of invasive flora species also have the potential to act as new bases from which to spread further into the wider Regional Study Area.

The largest single risk to native flora species associated with exotic flora is *Cenchrus ciliaris* (Buffel Grass) (Biosecurity SA, 2012). This species aggressively and rapidly colonises preferred habitats where it forms dense monocultures, displaces native vegetation, changes fire regimes and threatens refugia. The cover of Buffel Grass is negatively associated with species richness because the seed banks of native forbs and grasses will gradually be depleted. Buffel Grass presence also increases the risk to fire susceptible communities such as *Callitris glaucophylla* (Native Pine) woodlands, which have been significantly reduced in abundance and distribution since European settlement partly due to fire and the increased grazing from introduced species.

Buffel Grass was not noted on the field survey but is known from the broader area, particularly within the Stuart Highway corridor.

The proposed transmission line alignment generally runs adjacent to existing service corridors including high voltage power lines, pipelines, roads and optic fibre installations. Given the presence of this existing disturbance, the risk of the introduction of new invasive weed species through an additional easement is reduced.

Weed hygiene practices such as vehicle wash-downs and inspections during construction as well as post-construction weed surveillance and control programs (where required) will be implemented.

Introduction of invasive flora is an unplanned event (not a planned or likely impact) and is addressed by a risk assessment in the Impact Assessment Framework Tables appendix of the Development Application.

2.1.3 Fire

Fire is an integral part of ecological communities in arid regions. However, it is only intermittently that the vegetation will have significant biomass at a density that allows for the spread and movement of fire through the landscape within the Project Area vegetation communities. Many species may benefit from fire to allow or aid regeneration. Other communities however are much altered when fire spreads and with additional impacts such as grazing and exotic species placing pressure on regenerative growth, are highly threatened by fire. Subsequently, uncontrolled fires could impact abundance and diversity of flora species within the Regional Study Area.

Fire resulting from construction and operation of the transmission line is an unplanned event (not a planned or likely impact) and is addressed by a risk assessment in the Impact Assessment Framework Tables appendix of the Development Application.

2.1.4 Changes to surface hydrology

Track construction has the potential to alter the surface hydrology of the landscape by redirecting the surface flows causing a localised loss of flora species condition. There may be a two-way effect to this pathway.

- Some habitats are reliant on run off to maintain their place within the landscape. A loss of these intermittent flows can lead to degradation of these communities;
- Some communities are intolerant of flooding or extended period of wetting. Redirection of water to environments that do not usually receive them, commonly results in mortality.

The disruption of normal runoff events can restrict the extent and resilience of communities reliant on runoff and these were observed within the Study Area in the form of *Casuarina pauper* (Black Oak) drainage line communities in the Stony Tableland area.

The allowance of flows to continue naturally through design controls such as maintaining existing hydrology by not altering existing track drainage profiles significantly or creating new tracks that alter the surface drainage profile would reduce the effect (and impact) to negligible. During construction, ensuring the soil surface is maintained at pre-existing levels and that run off does not collect in disturbed areas or is directed into new areas also reduces any potential impact.

Alteration of surface water flows from construction and operation of the transmission line is an unplanned event (not a planned or likely impact) and is addressed by a risk assessment in the Impact Assessment Framework Tables appendix of the Development Application.

2.1.5 Erosion and sedimentation

There is the potential for an increase in total suspended solids associated with water run-off from stockpiles and disturbed areas. The stone cover which stabilises the soil profile in the central part of the Study Area (i.e. the Arcoona Plateau), once removed, leaves the highly sodic unstable soils at risk of transportation across the landscape. In areas where construction occurs in close proximity to the minor creeklines and runoff lacks time to settle out prior to entering the creek system, there is the potential for sediments to smother vegetation downstream, particularly small herbaceous species which are of lower prevalence in the makeup of vegetation communities. This may lead to a reduction in overall local diversity. The restricted nature of the disturbance footprint and management of surface water runoff from disturbed areas, including implementation of sediment and erosion controls, ensures that the effects to surrounding vegetation are not likely to be significant.

An increase in total suspended solids in runoff can lead to a decrease in richness and diversity of aquatic species. The infrequent nature of run-off events in the region results in low baseline aquatic ecology values, and suspended solid levels during runoff events are naturally high. These factors, coupled with the management of surface water run-off from disturbed areas, ultimately results in the potential for little impact to aquatic species.

Erosion of tracks and other disturbed areas, if unmanaged, can lead to alteration of the land surface and impact to flora species. Numerous existing access tracks within the central part of the Study Area show evidence of serious degradation, particularly in areas of high soil sodicity. Areas of erosion that have not been appropriately managed have resulted in loss of flora species and creation of areas known as scalds which are typified as sites of no functional capacity such as infiltration, nutrient cycling or stability and have lost all topsoil due to high speed of water run-off and directional turbulence. Use of existing tracks where possible and appropriate location, construction and management of tracks will aid in the prevention of significant effects.

Table 2. Summary of erosion and sedimentation significance to native flora.

Potential Impact Description	Impact significance				Impact uncertainty		
	Resilience	importance	Duration	Significance	Input	Methodology	Sensitivity
Erosion and runoff from stockpiles and disturbed surfaces leads to alteration of the land surface and increased sedimentation of surface water impacting on the abundance and/or diversity of native flora	1	1	3	3	B	A	A
Erosion and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water at impacting on the abundance and/or diversity of aquatic ecology.	1	1	3	3	B	B	B

2.1.6 Dust

Dust generated from construction or vehicle movement along tracks can impact the health and resilience of flora species through reduced transpiration at the leaf surface increasing heat at the leaf surface, reduction in photosynthesis capability and damage to leaf cuticles from sharp edges of dust particles. Dust is an inherent risk associated with rangelands and while there is an accepted background airborne dust presence generally, in terms of the Project, the primary source is expected to be the movement of light and heavy vehicles. The nature of desert and arid area vegetation, in particular the characteristics of their stomata, suggests that they are, in general, more tolerant of higher dust concentrations than vegetation in other, more temperate climates (Chaston and Doley, 2006). Based on the relatively short time span of the construction phase of the project and the mobile nature of the construction front, it is expected that the overall impact is low.

Table 3. Summary of dust significance to native flora.

Potential Impact Description	Impact significance				Impact uncertainty		
	Resilience	importance	Duration	Significance	Input	Methodology	Sensitivity
Dust generated from construction activities and movement along tracks leads to a loss of native flora species abundance, richness and diversity	1	1	3	3	B	A	B

2.1.7 Saline water from dust suppression

Dust suppression (e.g. on the access track) using saline groundwater may be carried out in some locations. The build-up of salt can cause the decline of some plant species due to excessive heat retention at the leaf surface or physical impacts such as leaf cuticle damage can affect photosynthesis and heat exchange. *Dodonaea viscosa* ssp. *angustissimus* (Sticky Hop-bush) is a species particularly susceptible to this pathway (Nasr *et al*., 2012). Any impacts from the project are likely to be extremely limited, given the short duration of construction at any given location and relatively low levels of vehicle movement.

Table 4. Summary of saline water from dust suppression significance to native flora.

Potential Impact Description	Impact significance				Impact uncertainty		
	Resilience	importance	Duration	Significance	Input	Methodology	Sensitivity
Saline emissions from operational supply deposit onto native vegetation reducing vegetation health and impacts on the abundance and/or diversity or terrestrial flora	1	1	1	3	B	A	B

2.2 Fauna

2.2.1 Clearance

Native fauna

Land clearance associated with the Project is expected to impact on the individuals occupying that particular area. The habitat and distribution of the species impacted are extensive, and therefore land clearance would play an insignificant role in the context of local or regional populations based on the sheer abundance and distribution of the species living within these areas.

State-listed fauna

The vegetation clearance is likely to impact a very small part of the overall vegetation communities that support habitats for conservation listed fauna species possible within the Project Area.

The State Rare Pernatty Knob-tailed Gecko (*Nephrurus deleani*) relies on specific *Dodonaea viscosa* (Sticky Hop-bush) / *Acacia ligulata* (Sandhill Wattle) dune habitat within parts of the Oakden Hills and Pernatty sections of the Project Area (Ehmann and Watson, undated). The level of clearance anticipated as part of this project is not expected to significantly reduce the habitat availability or fragment any existing communities in the long term.

It is very unlikely that the narrow and linear nature of the clearance for this project will significantly impact on any fauna species of State significance.

Commonwealth-listed fauna

There were three habitats within the project that were identified as high value potential habitat for EPBC listed species. Samphire saltmarsh communities are potentially habitat for the Commonwealth listed endangered species Night Parrot (*Pezoporus occidentalis*) even though this species is highly unlikely to be present. The lack of known records from this region and geographical fragmentation of suitable habitat mean that the impact of the Project is likely to have a very small impact overall on any potential habitat for this species.

Areas of *Eragrostis australasica* (Swamp Canegrass) ephemeral swamp are known refuge habitat for the Commonwealth Vulnerable species Plains Mouse (*Pseudomys australis*) (Brandle *et al*., 1999) These occur as disjunct patches within the stony tableland habitat. Often, these communities occupy areas of perched water on otherwise flat areas following rain. As a result, the soil is exceptionally heavy and is prone to extensive cracking during dry periods. This provides the ideal habitat for Plains Mouse with deep cracks protecting the animals from heat and cold temperature extremes until suitable seasonal conditions occur for the species to feed and reproduce as an irruptive lifecycle. The extent of the Project in relation to the areas known to provide habitat are very small. As a result, the Project is expected to play no role in impacting this species.

Areas of *Maireana aphylla* (Cotton Bush) located in the northern section of the Project Area potentially support populations of the Commonwealth listed vulnerable species Thick-billed Grasswren (*Amytornis modestus*). The Thick-billed Grasswren occurs in chenopod shrublands in the arid and semi-arid zones, especially shrublands dominated by *Maireana* spp. (Bluebush) and *Atriplex* spp. (Saltbush), sometimes

with widely scattered trees (Higgins *et al*., 2001; in DSEWPaC, 2012). The location of poles and conductors in relation to the preferred habitats for this species is unlikely to have an impact on the presence / absence of this species.

Table 5. Summary of land clearance significance to native fauna.

Potential Impact Description	Impact significance				Impact uncertainty		
	Resilience	importance	Duration	Significance	Input	Methodology	Sensitivity
Land clearance associated with the construction of project infrastructure causes a regional loss of abundance and diversity of native fauna	1	1	3	3	B	A	A
Land clearance associated with the construction of project infrastructure causes a regional loss of abundance and diversity of State listed native fauna	1	4	3	12	B	A	B
Land clearance associated with the construction of project infrastructure causes a regional loss of abundance and diversity of EPBC listed native fauna	1	5	3	15	B	A	B

2.2.2 Exotic flora

Weed incursions can reduce habitat value for native fauna. Although not identified in the field survey, Buffel Grass is known from the broader area particularly within the Stuart Highway corridor. This species presents the largest single risk associated with exotic flora species (Biosecurity SA, 2012). Establishment of Buffel Grass could make existing habitat unsuitable for some fauna species through excessive ground cover, increased fire risk and increasing competition from species which prefer the altered habitat.

There is some risk that Buffel Grass could impact on areas which are suitable for the Commonwealth listed Vulnerable Thick-billed Grasswren (*Amytornis modestus*). Outbreaks in these areas would however be conspicuous and easy to control in comparison to environments such as creeklines where the risk of spread downstream is considerable. The State Rare Pernatty Knob-tailed Gecko (*Nephrurus deleani*) relies on a specific habitat availability within part of the project footprint that is particularly susceptible to infiltration of invasive flora species. Weed hygiene practices such as vehicle wash-downs and inspections during construction as well as post-construction weed surveillance and control programs (where required) will be implemented.

The introduction of invasive flora is considered an unplanned event (not a planned or likely impact) and is addressed by a risk assessment in the Impact Assessment Framework Tables appendix in the Development Application.

2.2.3 Pest fauna (feral animals)

The presence of human activity can result in an increase in numbers of exotic fauna species. The transmission line is adjacent to existing linear infrastructure which reduces this significantly. There is potential for an increase in numbers of exotic fauna species in areas such as camps, particularly if food and waste are inappropriately managed. There is a direct inverse relationship between high exotic species richness and indigenous fauna species richness. It is recognised that predators are largely unselective in their approach to hunting and that conservation significant species are highly susceptible to increased predator abundance. The location of camps in disturbed areas away from significant habitat areas for conservation significant species and the appropriate management of food and waste reduces this risk significantly.

Introduction or increased abundance of feral fauna is an unplanned event (not a planned or likely impact) and is addressed by a risk assessment in the Impact Assessment Framework Tables appendix in the Development Application.

2.2.4 Vehicle movement

Transport and vehicle interaction with native fauna leading to a reduction in fauna abundance and/or diversity is a potential risk. The speed at which vehicles would travel along access tracks in the Project Area is expected to be relatively low (i.e. 40km/h or less).

Highly mobile species such as Kangaroos (*Macropus* spp.) and Emus (*Dromaius novaehollandiae*) are less likely to be impacted as part of the project than small species such as Skinks (Scincidae), Dragon Lizards (Agamidae) and Goannas (*Varanus* spp.). These species are susceptible due to a preference for sunning themselves on exposed areas such as tracks and being often slow to move before temperatures allow swift responsiveness. Geckos (Gekkonidae), are largely nocturnal and less likely to be impacted.

Small fauna species are least likely to be impacted with genera from the Dasyurid and Rodent families generally cautious of areas of higher activity and moving around at night to avoid predators. Construction traffic speed limits, speed limit signage, limiting speed possible on tracks and limiting windows of vehicle movement to avoid periods of highest animal activity i.e. 8pm- 6am are all methods that can reduce fauna interactions with vehicles.

Interaction between vehicles and fauna is an unplanned event (not a planned or likely impact) and is addressed by a risk assessment in the Impact Assessment Framework Tables appendix and the Development Application.

2.2.5 Noise disturbance from construction

Ongoing surveys at mine sites in the wider region indicates that species in general are very tolerant of noise and disturbance with impact sites at mine sites consistently showing similar trends in abundance and species richness to that of control sites over 5 km from noise and mine operation disturbance (EBS Ecology, 2016). It would be expected that noise derived from this project would have a very minimal impact in the short term and no impact over a longer period.

Table 6. Summary of construction noise significance to native fauna.

Potential Impact Description	Impact significance				Impact uncertainty		
	Resilience	importance	Duration	Significance	Input	Methodology	Sensitivity
Generation of noise from construction machinery changes the habits of native fauna, resulting in a regional loss of abundance and diversity of native fauna	1	1	2	2	B	C	B
Generation of noise from blasting (if required) changes the habits of native fauna, resulting in a regional loss of abundance and diversity of native fauna	1	1	2	2	B	C	B

2.2.6 Powerline infrastructure

There are a number of potential impacts related to distribution power lines. Many species of birds are especially vulnerable to collisions with high voltage transmission lines because of the height of these structures with respect to flight altitude, and because of their low visibility. Migratory species which utilise the salt lakes and lagoons as temporary stopovers when water is available are at elevated risk of interacting with conductors and towers.

The presence of existing distribution line infrastructure potentially reduces the risk of additional bird strikes as the lines are located within close proximity to each other and species may have adapted to avoid these areas over time. It is likely that with the current two other transmission lines crossing areas where a higher likelihood of interaction with migratory species exists, an additional line will not increase the overall collision risk by 33%, but very marginally increase any risk if it exists. There is a definite lack of studies within Australia that relate to collision risk. A number of studies conducted in the US such as Loss, Will & Marra, (2014) and Manville, (2005) indicate that collision risks do exist with transmission lines, however quantification of this is not directly transferable in regards to the density and quantity of transmission lines between the relative countries.

One study by Yee, (2008) showed that bird flight diverters reduced the incidence of bird strikes, particularly on wide spans where the shadow effect of towers was reduced. Subsequently the use of bird flight diverter markers on lines in areas where migratory bird species are more likely to interact with lines such as salt lakes and lagoons may reduce the risk further.

Any injuries or deaths as a result of interaction with the Project would be as a result of an unplanned event (electrocution of birds striking or roosting on transmission lines), and this is addressed by a risk assessment in the Impact Assessment Framework Tables and the Development Application.

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Appendix D3. EPBC Act Significant Impact Assessment

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EPBC Act Protected Matters Significant Impact Assessments

Carriewerloo Substation to Prominent Hill Electricity Transmission Line

OZ Minerals

IW104000-0000-NE-RPT-004 | FINAL

16 July 2018

EPBC Act Protected Matters Significant Impact Assessments

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Executive Summary

OZ Minerals propose to develop a 237 km transmission line from the Solar Reserve Aurora project (north-west of Port Augusta) to the west of Olympic Dam. This transmission line, referred to as the Carriewerloo Substation to Prominent Hill Electricity Transmission Line, would then connect to OZ Minerals' existing infrastructure from Olympic Dam to Prominent Hill.

This report presents the findings of a detailed assessment of Protected Matters listed under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) which are relevant to the Carriewerloo Substation to Prominent Hill Electricity Transmission Line. The assessment involved a review of the likelihood of occurrence of Protected Matters in the area, followed by a detailed assessment of the potential for significant impacts upon those Protected Matters that were considered likely to be present within the study area, or as possible occurrences within the study area.

No Threatened Ecological Communities were identified within the study area.

A single plant species was identified as potentially present based on a review of the Protected Matters database, *Frankenia plicata*. A second plant species, *Senecio megaglossus* was included in the assessment as a result of historic record in the vicinity of the project area. Each of these species was considered unlikely to be present, or only present as scattered individuals rather than as part of an important population of the species. With the implementation of the proposed mitigation measures, including micro-placement of footings and track alignments to avoid any Protected Matters present, no significant impacts are anticipated to any of these plant species as a result of the project.

Eight threatened fauna species, including seven birds and a single mammal were identified as potentially present in the study area, based upon a review of the Protected Matters database. Of these, five were considered to possibly be present, or likely to be present, including the Thick-billed Grasswren (eastern), Western Grasswren (Gawler Ranges), Curlew Sandpiper, Night Parrot and Plains Mouse. With the implementation of proposed mitigation measures, including key habitat avoidance for specific species, no significant impacts are anticipated to any of these fauna species as a result of the project, since the development does not significantly reduce the area of occupancy, fragment any populations, or substantially reduce the size of a population. Existing infrastructure in the area means that the introduction of new weed species or an increase in pest numbers as a result of the project is unlikely.

Fifteen migratory species were assessed in the review (two of which were also threatened species). Avoidance of ground impacts to ephemeral lakes and wetland habitat, and inclusion of reflectors along transmission lines in proximity to such habitats would reduce the probability of bird collisions with lines, and therefore no significant impacts are expected to migratory species as a result of the project.

Important note about your report

This report has been prepared on behalf of, and for the exclusive use of, Jacobs' Client; OZ Minerals, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and OZ Minerals. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party

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The sole purpose of this report and the associated services performed by Jacobs is to document results of desktop assessments of potential impacts upon EPBC listed species for the proposed transmission line project (the Carriewerloo Substation to Prominent Hill Electricity Transmission Line). The report is based on a desktop review of available data and documents. The scope of services, as described in this report, was developed with the Client; OZ Minerals.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs collected and reviewed data and information sourced from OZ Minerals and/or as was available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report.

Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

1. Introduction

1.1 Background

OZ Minerals Limited (OZ Minerals) propose to develop a 237 km transmission line from the Solar Reserve Aurora project (north-west of Port Augusta) to the west of Olympic Dam, to secure the power supply to OZ Minerals' Prominent Hill mine. This transmission line, referred to as the Carriewerloo Substation to Prominent Hill Electricity Transmission Line, would then connect to OZ Minerals' existing 132 kV line from Olympic Dam to Prominent Hill. In addition, this new electricity transmission line will provide an alternative source of power for the 132 kV Carrapateena transmission line currently being constructed by ElectraNet for the OZ Minerals Carrapateena mine. The location of the proposed transmission line is shown on **Figure 1** below.

A, referral under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) is proposed to be submitted for the project. This report presents high level desktop findings (including review of a recent field survey undertaken by EBS Ecology (OZ Minerals, 2018; Appendix D1 of this Development Application)) for species and ecological communities which are protected under the EPBC Act (as Protected Matters) that are relevant to the project. Target Protected Matters are those which are considered to potentially occur along the proposed transmission line alignment, or those which have previously been identified within close proximity to the alignment. An assessment of the likelihood of occurrence for each Protected Matter is made, and consideration of the potential for significant impacts is undertaken for those considered 'likely' to be present, or those whose presence is considered 'possible'.

The Carriewerloo Substation to Prominent Hill Electricity Transmission Line project consists of the following:

- a new 275 kV line the Solar Reserve Aurora Project (Carriewerloo Substation) to the Mount Gunson South substation.
- From the Mount Gunson South substation, a new 132 kV line will extend to connect to the existing 132 kV Prominent Hill line to the west of Olympic Dam.
- The proposed route alignment from the Solar Reserve Aurora Project to Mount Gunson South substation runs on the west of the BHP line until Mount Gunson South substation where it crosses and remains on the east of the BHP line until Olympic Dam. South of Olympic Dam it crosses for a second time before connecting to the existing 132 kV Prominent Hill line.
- The current transmission line alignment avoids the Woomera Prohibited Area entirely and is aligned as close as possible to BHP's existing line, property boundaries and already disturbed areas.
- The project includes access tracks, laydown areas and possibly construction camps / depots (locations to be determined). At this stage, a 5 m access track is assumed along the entire length as a worst case, as well as a cleared 5 m stringing easement along the centreline (also as a worst case). Tower bases will be in the order of 50 m x 50 m for the 275 kV line and 40 m x 40 m for the 132 kV line. Tower spacing is nominally 500 m for the 275 kV line and 300 m for the 132 kV line.

It is noted that the proposed transmission line extends for a further 35 km to the south of the development described above, but this southern portion of the alignment is being developed by Solar Reserve. Solar Reserve are undertaking their own development approvals process for this portion of the line, and this section is therefore not the subject of this assessment. The portion of the alignment under consideration here (the OZ Minerals project) will be from the Solar Reserve site to Olympic Dam only.

This desktop study has focused on EPBC listed flora and fauna species and ecological communities and includes an assessment of the likelihood of their occurrence on or adjacent to the proposed

alignment. This report describes potential impacts on listed species arising from the construction and operation of the transmission line and provides high level mitigation measures proposed to avoid or reduce potential impacts. An assessment of the potential residual impacts against the EPBC Significance Criteria has also been provided, assuming the mitigation measures outlined are implemented.

1.2 Objectives of Study

The purpose of this study was to:

- Identify species or ecological communities protected under the EPBC Act which may be present within the footprint of, or in close proximity to, the Carriewerloo Substation to Prominent Hill Electricity Transmission Line.
- For each species or community identified as likely to be present, or as possibly present, to undertake as assessment of whether significant impacts are considered likely to result from the proposed development.

2. Desktop Study Methodology

The study area for this desktop study includes the proposed transmission line alignment plus a 5 km buffer either side. The alignment of the proposed transmission line is shown on Figure 1 below.

The desktop study reviewed information from a range of sources including:

- An EPBC Act Protected Matters database search covering the proposed transmission line alignment and study area (i.e. the 5 km buffer either side of the alignment)
- A Biological Database of South Australia (BDBSA) search extract covering the proposed transmission line alignment and study area.
- A review of relevant reports, reference materials and published papers from the project region, including:
    - the ecological baseline assessment undertaken for the Carriewerloo Substation to Prominent Hill transmission line by EBS Ecology (OZ Minerals, 2018; Appendix D1 of this Development Application);
    - environmental assessments of potential impacts for existing linear infrastructure projects located adjacent to the proposed transmission line for much of the alignment (including flora and fauna studies outlined in BHP Billiton (2009) such as WMC (1997), Brandle (1998), Slaytor (1999) and others;
    - other publications and government documents relating to individual species, or recovery plans for threatened species;
    - vegetation mapping of the study area in previous reports including the Olympic Dam Expansion EIS (BHP Billiton, 2009);
    - review of publicly available imagery;
    - threatened species profiles, reference texts and published material.

This assessment presents information on the flora and fauna species that are known to, or have the potential to, occur within the study area given the habitat types present. Flora and fauna identified as potentially occurring through conservative database searches were assessed for their actual likelihood to occur within the study area. The likelihood of occurrence has been defined as:

- Likely – based on the presence of suitable habitat and multiple recent database records from the study area or immediate proximity within the last twenty years;
- Possible – suitable habitat is present for the species, but no or very limited recent (last twenty years) database historic record(s) exist from the study area or proximity;
- Unlikely – there is a lack of suitable habitat for the species (or community) and a lack of proximate historic records which indicate previous or current occurrence.

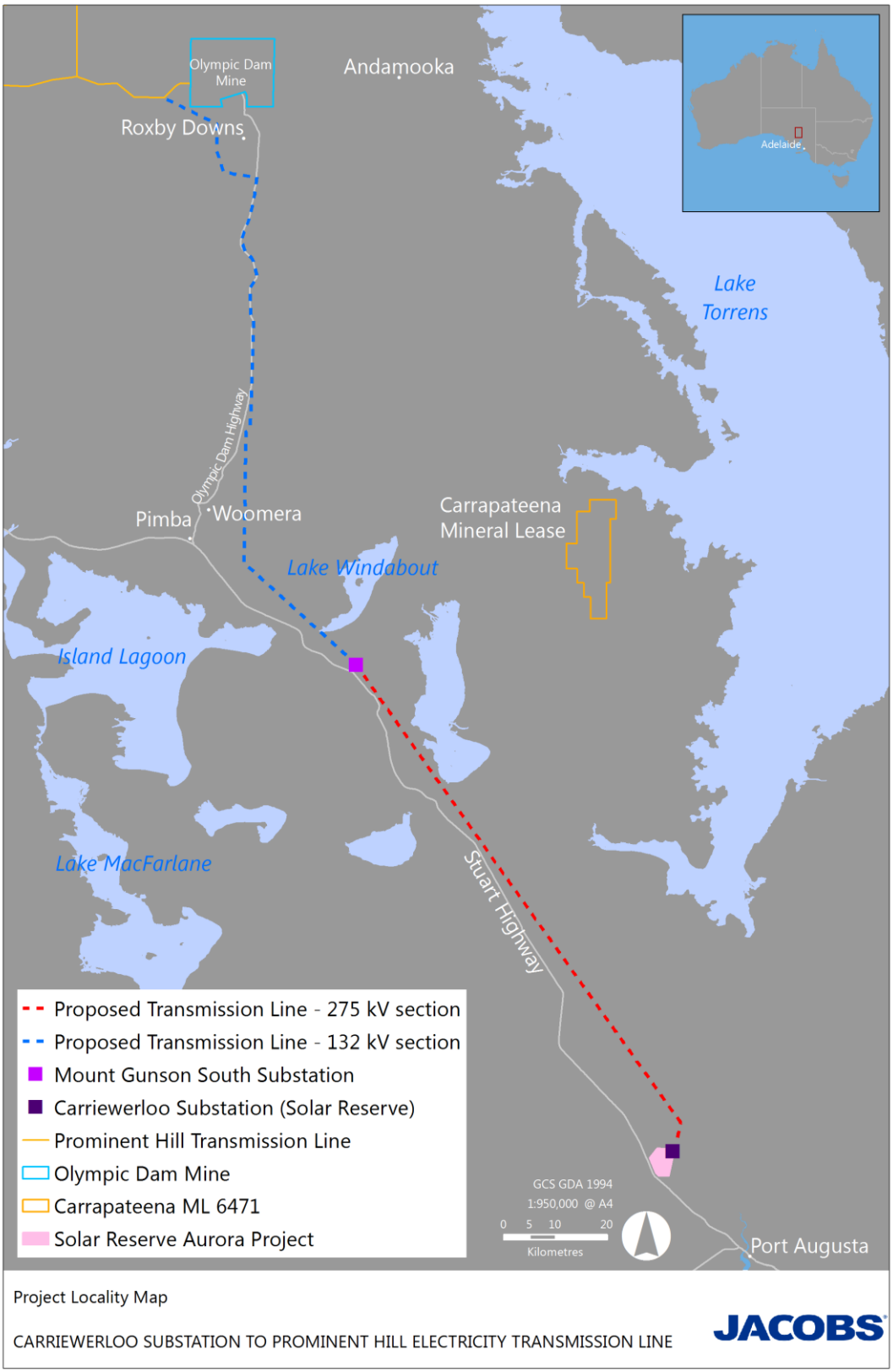

Figure 1: Carriewerloo Substation to Prominent Hill Transmission Line: Project Locality Map

3. Results

3.1 EPBC Threatened Ecological Communities

No Threatened Ecological Communities (TECs) were identified by the review of the EPBC Act Protected Matters database, accessed via the online search tool. Previous assessments of the broader study area (BHP Billiton, 2009) and the ecological baseline assessment undertaken for this project by EBS Ecology (OZ Minerals, 2018; Appendix D1 of this Development Application) also did not identify any TECs within the area. As such, TECs are not considered further in this report.

3.2 EPBC Threatened Flora Species

The EPBC Protected Matters Search Tool (PMST) output for the study area (the proposed transmission line alignment and a 5 km buffer) indicated that a single threatened plant species, or its preferred habitat, has the potential to occur, namely; *Frankenia plicata* (Southern Sea-heath). An additional EPBC listed species, *Senecio megaglossus* (Large-flower Groundsel) was not identified by the review of the Protected Matters database (via the PMST), however it was identified in the BDBSA from a single record in 1999 approximately 5.2 km to the south of the southern extent of the project (the Carriewerloo Substation). *Senecio megaglossus* has therefore been included in the assessment undertaken in this report.

BDBSA records for threatened flora species (and listed migratory and fauna species) are shown in Figure 2 to Figure 5 below. The likelihood of occurrence for EPBC listed flora species and justification for the likelihood of occurrence is summarised in Table 1 below.

Table 1: EPBC Listed Threatened flora potentially occurring within the study area

Species Name	Common Name	EPBC Act[1]	NPWS Act[2]	Likelihood of Occurrence	Justification[3]
Plants					
Frankenia plicata	Southern Sea-heath	EN	V	Possible	EPBC PMST suggests species or species habitat likely to occur. Review of historic records (Atlas of Living Australia, 2018) indicates a distribution largely confined to the south western portion of the Lake Eyre Basin (approximately 500 km north west of the alignment), and two isolated small populations to the west of Lake Torrens on the Arcoona Plateau (approximately 43 km east of the northern portion of the alignment and 30 km east of the central portion of the alignment) in SA. There is also a single BDBSA record from 1989 near Woomera in the Gairdner Torrens floristic region, approximately 9km west of the alignment. Low mat-forming shrub. Preferred habitat is minor drainage lines and outwash plains with stony surfaces and loamy sand or clay sand soils. Most records are from the Stony Plains bioregion (to the north of the study area), particularly the Breakaways and Stuarts Range north east of Coober Pedy (DEWHA 2008). Suitable habitat may be present on the footslopes and outwash plains of the

Species Name	Common Name	EPBC Act[1]	NPWS Act[2]	Likelihood of Occurrence	Justification[3]
					Arcoona Plateau in the northern portion of the proposed alignment. No BDBSA records in study area and not detected in previous surveys (BHP Billiton 2009) and recent survey of the transmission line by EBS Ecology (OZ Minerals, 2018; Appendix D1 of this Development Application). Not detected during extensive survey effort and during targeted survey at the Carrapateena site, approximately 50 km to the north-east of the alignment. Nearest BDBSA record is from 1999 for the outskirts of the Woomera township approx. 16km west of the northern end of the proposed alignment
Senecio megaglossus	Large-flower Groundsel	VU	E	Possible	Not identified by the EPBC protected matters search, but a single 1999 BDBSA record exists from a "Spinifex (*Triodia* sp.) slope" approx. 5.2 km to the south of the southern-most extent of the alignment. Not identified during ground survey of project area by EBS Ecology (OZ Minerals, 2018; Appendix D1 of this Development Application). A perennial shrub with large, showy yellow flowers. Most records pre-date 1990 and are from rocky gorge and valley slopes in a variety of vegetation types including mallee scrub particularly in the vicinity of Port Augusta and the western footslopes of the Flinders Ranges (DEWHA 2008). Vegetation mapping undertaken by BHP Billiton (2009) indicates that preferred habitat for the Large-flower Groundsel includes rocky slopes and rocky creek banks and drainage lines supporting grasslands associated with *Triodia*, *Callitris columellaris* and *Eucalyptus camaldulensis* open woodland over sparse shrubs, or tall open shrublands of *Pittosporum* sp. *Cassinia* sp. or *Bursaria* sp. This habitat type is not found within the study area.

[1]*Environment Protection and Biodiversity Conservation Act 1999* Status: Endangered (EN), Vulnerable (VU);
[2]South Australian *National Parks and Wildlife Act 1972* Status: Endangered (E); Vulnerable (V); Rare (R);
[3]Biological Database of South Australia (BDBSA), Protected Matters Search Tool (PMST).

3.3 Threatened Fauna Species

The EPBC PMST output identified eight EPBC listed threatened fauna species (including seven bird and one mammal species) as potentially occurring (or suitable habitat occurring) within the study area. The location of BDBSA records for threatened fauna species within the vicinity of the study area are shown in Figure 2 to Figure 5 below. An assessment of the likelihood of occurrence of these species and justification for the likelihood assessment is provided in Table 2 below.

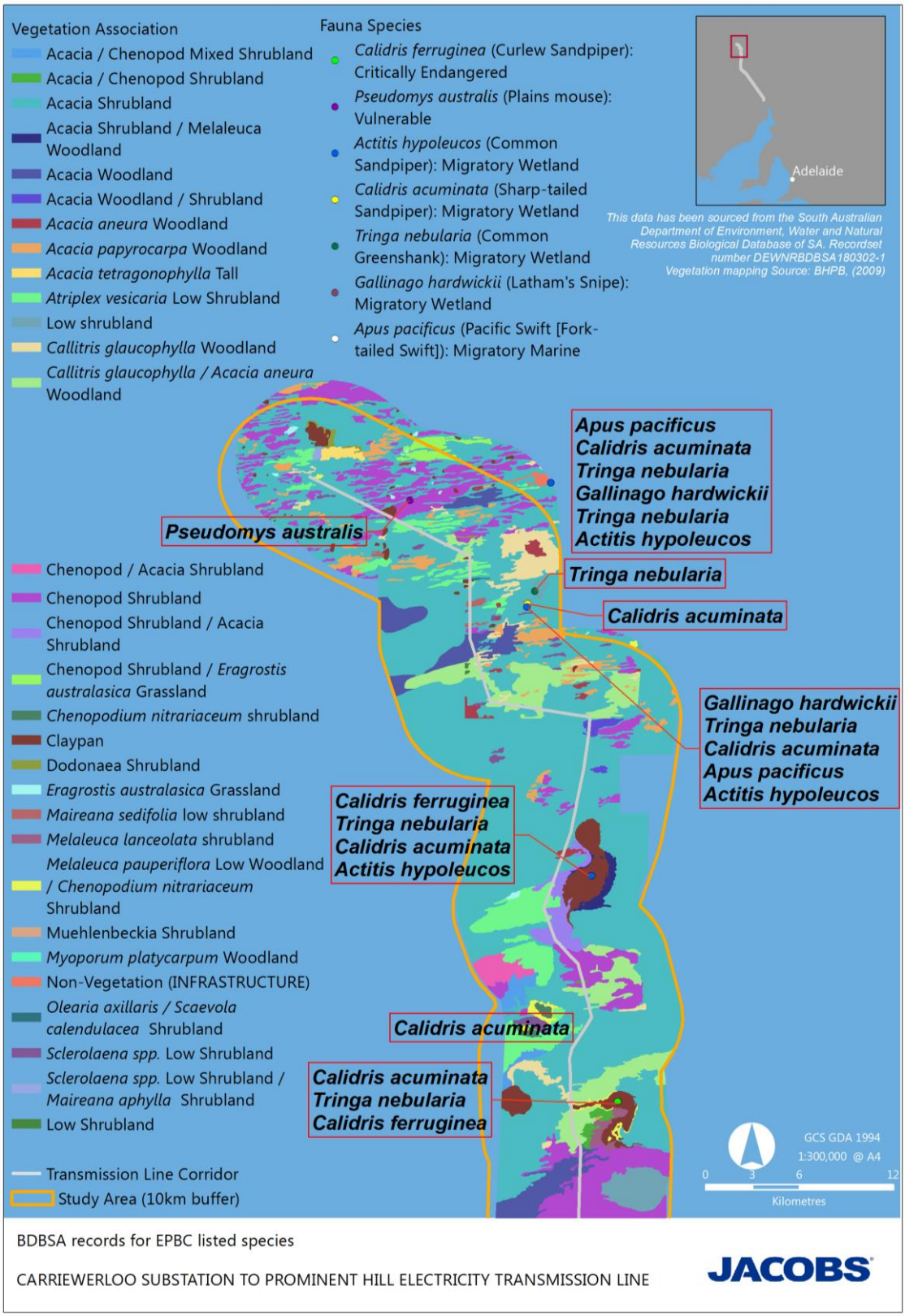

Figure 2: BDBSA records for EPBC listed threatened and migratory species (northern portion of alignment)

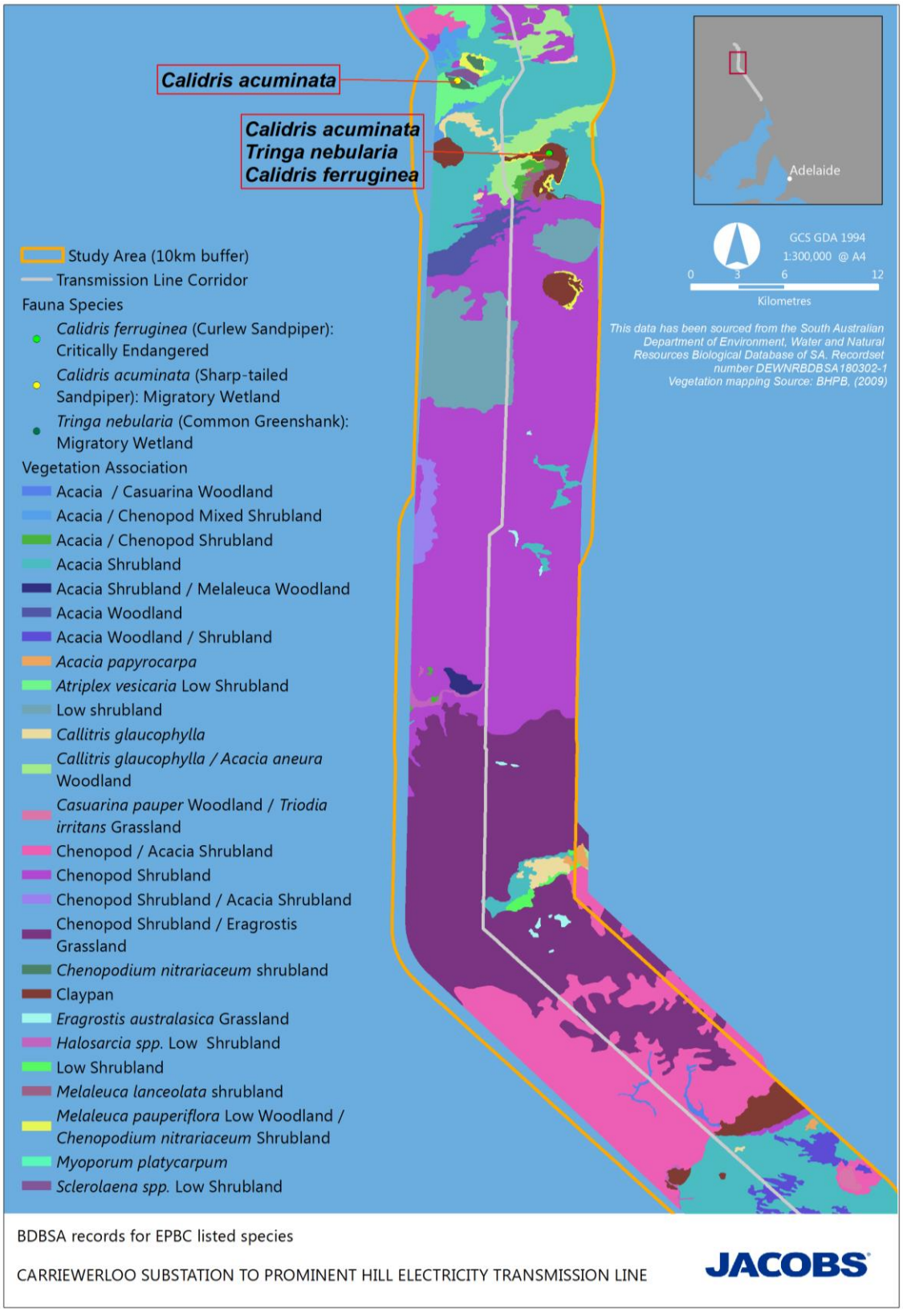

Figure 3: BDBSA records for EPBC listed threatened and migratory species (central north portion of alignment)

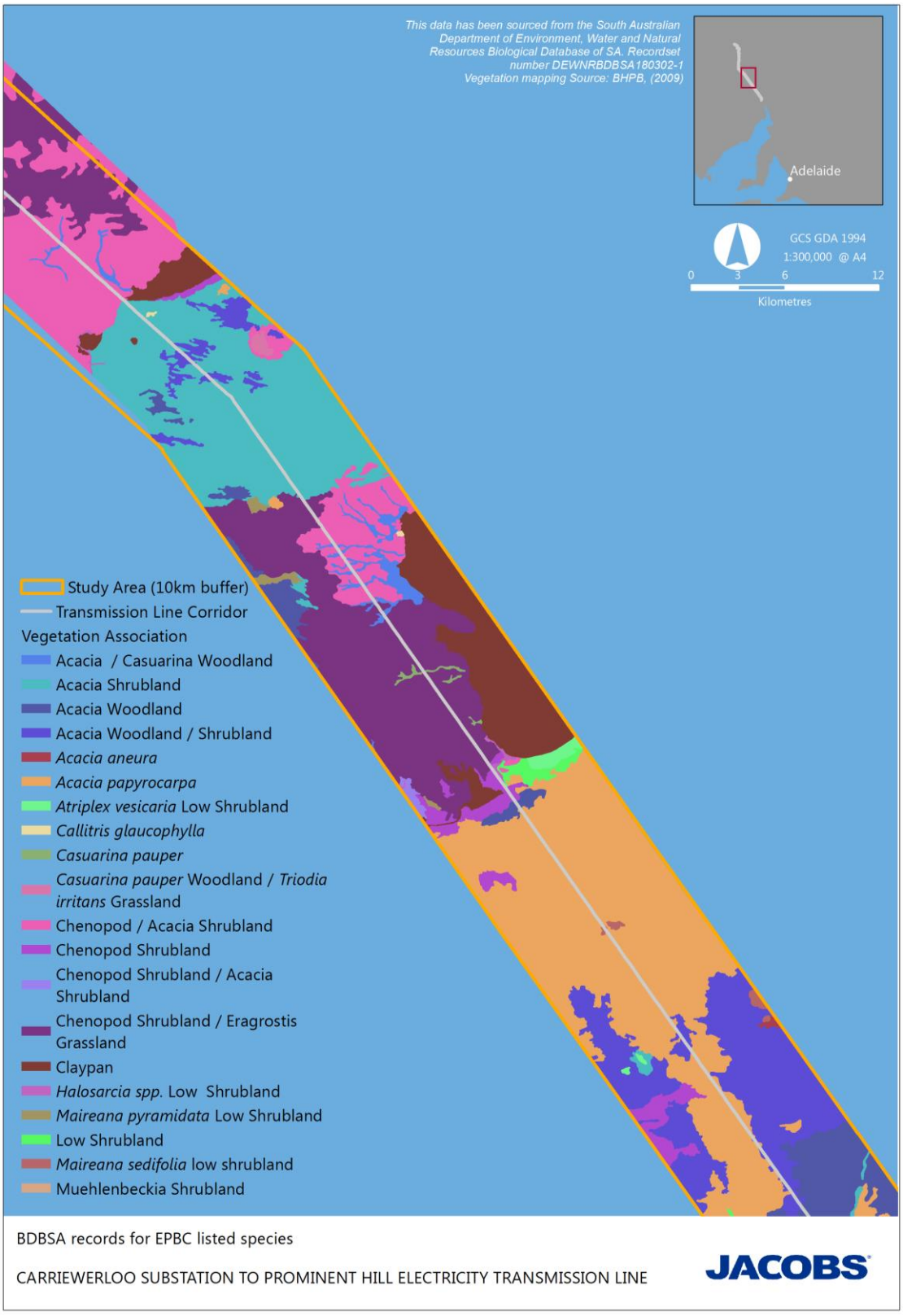

Figure 4: BDBSA records for EPBC listed threatened and migratory species (central south portion of alignment)

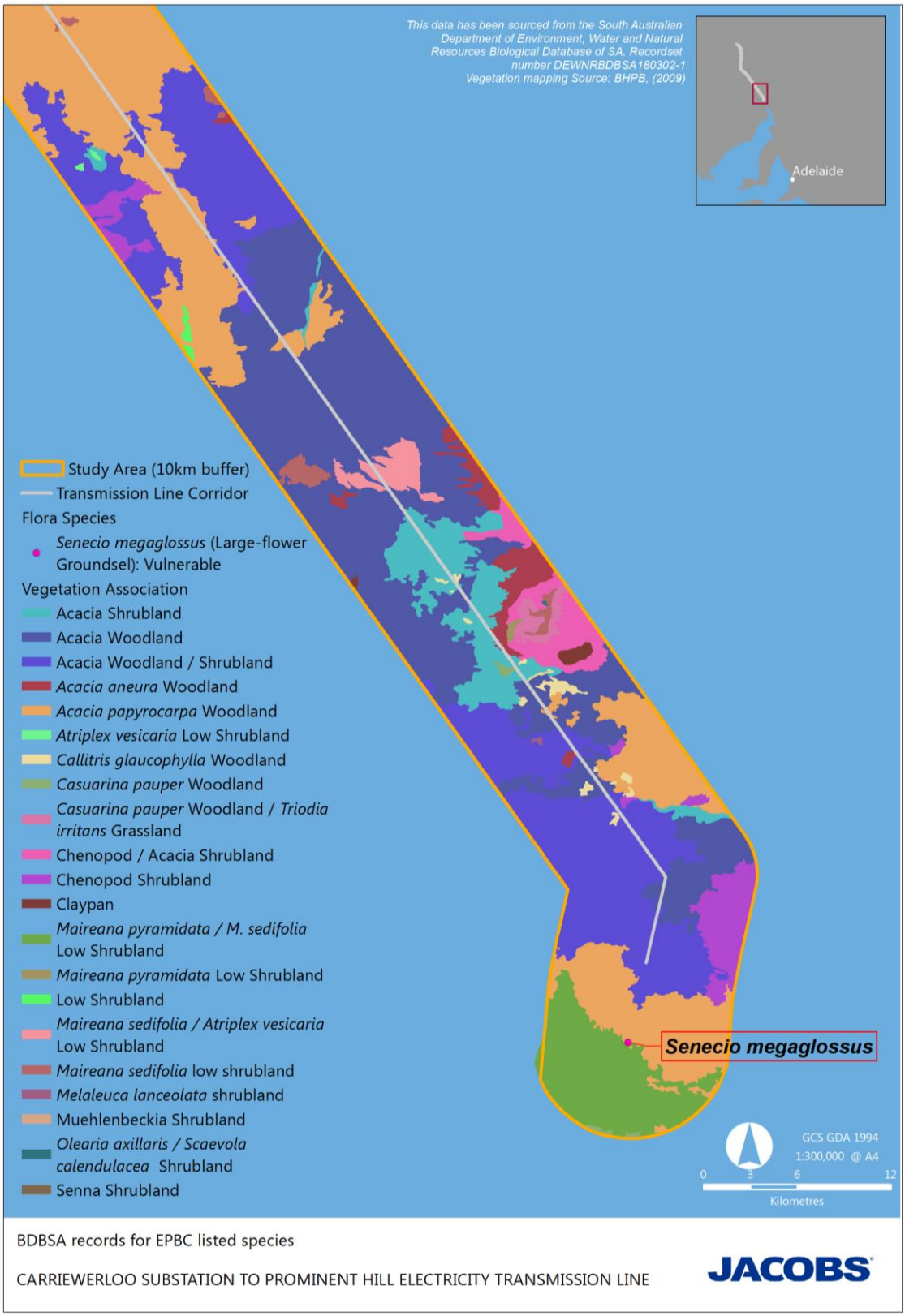

Figure 5: BDBSA records for EPBC listed threatened and migratory species (south portion of alignment)

Table 2: EPBC listed threatened fauna potentially occurring within the study area

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Justification[3]
Birds					
Amytornis modestus	Thick-billed Grasswren (eastern)	VU	V	Possible	EPBC PMST suggests species or habitat likely. However, there are no BDBSA records within study area. Records for the species exist to the north of the project area (BHP Billiton 2009), and an extensive study undertaken by Black et al. (2011) identified four discrete known populations of the species outside of the project area; west of Lake Eyre and Lake Torrens (North West), around the edges of the Northern Flinders Ranges (Flinders) and north-east of Lake Eyre (Eyre) and south-west of Lake Frome (Frome). Preferred habitat of the eastern subspecies is arid and semi-arid zone chenopod shrublands, especially shrublands dominated by saltbush *Atriplex* spp. (Saltbush) and *Maireana* spp. (Bluebush, Blackbush), sometimes with widely scattered trees (Higgins et al. 2001). In SA they have been recorded in habitats that include *Sclerolaena* spp. (Bindii)., *Salsola kali* (Roly-poly), *Tecticornia* spp. (Glasswort / Samphire). and various daisies including *Rhodanthe* spp., *Calotis hispidula* and *Craspedia* spp. The preferred habitat is however known to be taller and denser chenopods that occur on drainage lines (DOEE 2018a, NPWS 2002, Black et al. 2011). The northern portion of the alignment traverses the currently known broader distribution of the species and includes isolated sections of preferred taller Chenopod shrubland and Lignum habitat in minor drainage lines (DEWNR veg mapping).
Amytornis textilis myall	Western Grasswren (Gawler Ranges)	VU		Possible	EPBC PMST suggests species or habitat likely within the project area. The SPRAT profile for the species indicates that the alignment almost entirely avoids the area indicated as 'species or species habitat likely to occur', but the southern portion of the alignment traverses the area indicated as 'species or species habitat may occur'. No BDBSA records within study area. The species is restricted to the Eyre Peninsula between Whyalla and the Gawler Ranges, west to south of the study area, with records northwest, west to southwest of Whyalla / Port Augusta (Black et al. 2009, Black et al. 2011). There are no records to the east of the Stuart Highway where the alignment runs (Black et al. 2009). This subspecies is restricted to SA, scattered and widespread from the Eyre Peninsula to Whyalla, Middleback and the Gawler Ranges. This species prefers open chenopod shrublands that surrounds minor drainage

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Justification[3]
					lines supporting *Acacia tetragonophylla* (Dead Finish), *Maireana pyramidata* (Blackbush) and *Lycium australe* (Australian Boxthorn) / *Acacia papyrocarpa* (Western Myall) / *Casuarina cristata pauper* (Black Oak) open woodland and, less commonly on stony hillsides with *Triodia spp*. (Spinifex) hummock grassland (DOE 2018b). Study area traverses preferred *Maireana pyramidata* (Blackbush) +/- *Lycium australe* (Australian Boxthorn) low shrubland and *Acacia papyrocarpa* (Western Myall) low woodland in the southern portion of the alignment (Black et al. 2009).
Calidris ferruginea	Curlew Sandpiper	CE, MW		Possible	EPBC PMST suggests species or habitat likely. Migratory wader, shorebird. Breeds in Siberian high arctic coastal tundra, migrates to Africa, Asia and regular spring/summer migrant to Australia (Geering et al. 2008). Preferred habitat includes exposed intertidal mudflats and less frequently inland freshwater wetlands, saltworks and mudflats (Geering et al. 2008, Simpson and Day 2010). Alignment traverses near smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that provide foraging habitat when holding water. Two BDBSA records from smaller ephemeral freshwater lakes (Lake Mary and Lake Coorlay) on the Arcoona Plateau in 1993 and 1994 respectively. No BDBSA records since 1994.
Leipoa ocellata	Malleefowl	VU	V	Unlikely	EPBC PMST suggests species or habitat likely. Terrestrial ground-dwellling species which makes large conspicuous nesting mounds. Preferred habitat includes scrubland and woodland dominated by malllee (Benshemesh 2007, DOE 2018c). Preferred nesting and foraging habitat of mallee sand plains and sand dunes not present in the study area. Acacia tall shrubland that occurs to the south of the Arcoona Plateau in the central portion of the alignment provides marginal nesting and foraging habitat. Recorded in mallee dune habitats on the southern Eyre Peninsula. No BDBSA records for the study area.
Numenius madagascariensis	Eastern Curlew	CE, MW		Unlikely	EPBC PMST suggests species or habitat may occur. Migratory wader / large shorebird. Breeds in NE Asia, Siberia and spring migrant to

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Justification[3]
					Australia, with a major stronghold in Queensland (Geering et al. 2008). Mostly recorded in coastal habitat including sand spits, intertidal mudflats on exposed seagrass beds, coastal estuaries and mangroves (Geering et al. 2008, Simpson and Day 2010). No BDBSA records for the study area and no records for inland SA (ALA 2018).
Pezoporus occidentalis	Night Parrot	EN		Possible	EPBC PMST suggests extinct. Nocturnal / elusive ground-dwelling bird, listed as extinct in SA, however recent evidence suggests a population possibly utilising Samphire low shrubland habitat northeast of Lake Eyre (Night Parrot Recovery Team 2018a), approximately 250 km to the north of the northern point of the proposed transmission line. Extant breeding populations in Qld and WA recorded in *Triodia* spp. (Spinifex) hummock grassland on stony plains and / or chenopod shrublands. Other habitat species include *Sclerolaena* spp*., Maireana* spp*. (Saltbush* spp*.), Astrebla* spp. (Mitchell grass*),* shrubby samphire and chenopod associations, scattered trees and shrubs, *Acacia aneura* (Mulga) woodland (TSSC 2016b, DOE 2018d). Vegetation mapping of the project area (BHP Billiton 2009) indicates areas of potential foraging habitat (Samphire low open shrubland, Chenopod shrubland, areas of Mulga, *Sclerolaena* and *Astrebla*) within the study area, and the site occurs in areas mapped as potential Night Parrot Habitat (Night Parrot Recovery Team 2018b). It is noted however, that these areas are based on broad vegetation mapping data that covers most of arid South Australia, and a recent targeted survey for Night Parrot, as well as extensive general bird survey effort at the OZ Minerals Carrapateena site over a number of years failed to detect any evidence of Night Parrot across these habitat types. BDBSA records indicate *Triodia* hummock grassland to be present on Euro Bluff approx. 1.5km east of the proposed alignment, which aligns with habitat types of recent records. There are no BDBSA records for the study area, and extensive bird survey effort and targeted surveys failed to detect this species at the Carrapateena Mine site approximately 50 km to the northeast. Whilst there are no BDBSA records, the species is known to be difficult to detect, there are renewed observations across its range and there is potential foraging/nesting habitat within the vicinity of the study area, therefore possibility of presence cannot be 100% excluded.

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Justification[3]
Rostratula australis	Australian Painted Snipe	EN		Unlikely	EPBC PMST suggests species or habitat may occur. Medium shorebird. Endemic to Australia, widespread, but rarely observed. Prefers inland swamps and temporary water regimes, marshes with moderate cover. Can be nomadic, appearing in response to rainfall (Geering et al. 2008, Simpson and Day 2010.). Preferred habitat of well vegetated margins and shallow water and shorelines of wetlands not prevalent in the study area. No BDBSA records for the study area, closest record 50km west of study area (ALA 2018).
Mammals					
Pseudomys australis	Plains Rat / Mouse	VU	V	Possible	EPBC PMST suggests species or species habitat likely to occur within the northern portion of the project area. Small arid zone rodent. Prefers gibber (stone-covered) plains, mid slopes with boulders, small stones and gilgais. Primary habitat is considered to be within drainage channels, depressions and deep cracking clays (Brandle et al. 2008, Moseby 2012), but evidence suggests that during population expansions the habitat usage may be more broad temporarily, followed by a retraction to preferred refugia habitat during drier periods. Current known populations largely restricted to the Stony Plains Bioregion in SA, extending into the NT. The species now occupies a north/south band of stony plain habitat to the west of Lake Eyre extending from Pernatty Station in SA to Andado Station in the NT (Moseby, 2012) Preferred Chenopod shrubland / tussock grassland cracking clay habitat present in broad interdune swales immediately south of Olympic Dam and on the Arcoona Plateau in the northern portion of the alignment. Recorded for stony tableland habitat on the Arcoona Plateau following good seasons in 2012 and 2013 approximately 45 km east of the study area (EBS 2014) Single BDBSA record (2010) from study area in interdune swale approx 13 km SW of Olympic Dam and approx. 300 m north of the proposed transmission line alignment.

[1]*Environment Protection and Biodiversity Conservation Act 1999* Status: Critically Endangered (CE); Endangered (EN), Vulnerable (VU); Migratory Marine (MM); Migratory Terrestrial (MT); Migratory Wetland (MW);
[2]South Australian *National Parks and Wildlife Act 1972* Status: Endangered (E), Rare (R), Vulnerable (V);
[3]Biological Database of South Australia (BDBSA), Protected Matters Search Tool (PMST), Atlas of Living Australia (ALA).

3.4 EPBC Listed Migratory Species

The EPBC search also identified 12 EPBC listed Migratory bird species of which two species are also listed as threatened species (therefore discussed in Section 3.3 above). Three additional EPBC listed Migratory species; namely *Arenaria interpres* (Ruddy Turnstone), *Limosa limosa* (Black-tailed Godwit) and *Tringa glareola* (Wood Sandpiper) and were not identified in the EPBC PMST output, however were identified by historic records in the BDBSA data, and have therefore been included in this assessment.

The EPBC Migratory species are listed together with an assessment of the likelihood of their occurrence (or suitable habitat occurring) in Table 3: below (excluding the two migratory species which are also threatened, which are covered above in Table 2).

Table 3: Likelihood Assessment of EPBC listed Migratory Species

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Justification[3]
Apus pacificus	Fork-tailed Swift	MM		Possible	EPBC PMST suggests species or species habitat likely within study area. Highly mobile, migratory, almost entirely aerial species, flying <1 m to 1000 m above the ground. This species seldom recorded on the ground (Pizzey and Knight 2012, Simpson and Day 2010 (DOTE 2015b). Primarily occurs over inland plains in Australia, but sometimes recorded over coastal cliffs. Feeds on insects whilst flying, roosts on the wing. The entire global population can visit Australia during summer, where it is widespread throughout Australia. In SA, occurs west of Spencer Gulf, Coastal Eyre Peninsula, Flinders Ranges, Maree, Lake Eyre and Innamincka (DOTE 2015b). Species unlikely to utilize terrestrial habitat within the study area, but may occur as an overfly visitor. 2 BDBSA flyover records (1999 and 2000).
Actitis hypoleucos	Common Sandpiper	MW		Possible	EPBC PMST suggests species or habitat likely. Migratory wader / shorebird. Breeds in northern hemisphere (Eurasia), migrates to Africa, regular summer migrant to Australia (more common in northern than southern Australia (Geering et al. 2008, Simpson and Day 2010). Alignment traverses near smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that may provide foraging habitat when holding water. Nine BDBSA records, none since 2001.
Calidris acuminata	Sharp-tailed Sandpiper	MW		Possible	EPBC PMST suggests species or habitat known.

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Justification[3]
					Migratory wader / shorebird. Breeds in Siberia, migrates to New Guinea and Australia. Prefers coastal and inland areas, non-tidal fresh or brackish wetlands (Geering et al. 2008, Simpson and Day 2010). Alignment traverses near smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that may provide foraging habitat when holding water. 20 BDBSA records with no records since 2000.
Calidris melanotos	Pectoral Sandpiper	MW		Possible	EPBC PMST suggests species or habitat may occur. Migratory wader / shorebird. Breeds in North America and Siberia. Prefers freshwater or brackish wetlands, grassy or lightly vegetated coastal and inland swamps (Geering et al. 2008). Study area includes smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that provide foraging habitat when holding water No BDBSA records for study area.
Charadrius veredus	Oriental Plover	MW		Unlikely	EPBC PMST suggests species or habitat may occur. Predominantly land based migratory wader / shorebird. Species breeds in China and Mongolia, spring non-breeding migrant to northern Australia (Sept -Mar). Prefers short dry grasslands inland, rarely feeds on wet habitats, but will inhabit mudflats, beaches and coastal habitat during hot conditions and when they first arrive (Geering et al. 2008, DOE 2018e). Limited habitat within the study area. No BDBSA records in study area; nearest record 15 km west of southern end of the alignment (1996).
Gallinago hardwickii	Latham's Snipe	MW		Likely	EPBC PMST suggests species or habitat may occur. Migratory wader / marsh dweller. Breeds in Japan and summer non-breeding migrant to Australia, primarily along the east coast (Geering et al. 2008, Simpson and Day 2010). Prefers tussock grass and low dense sedges surrounding freshwater wetland, permanent and ephemeral wetlands. Can also occur in habitats with saline or brackish water (Geering et al. 2008). Recorded within the study area in shallow freshwater lakes or swamps on the Arcoona Plateau; three BDBSA records.

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Justification[3]
Motacilla cinerea	Grey Wagtail	MT		Unlikely	EPBC PMST suggests species or habitat may occur. Uncommon migratory wagtail (DOE 2015). Breeds in Europe and Asia and rarely spring/summer non-breeding migrant to Australia (Pizzey and Knight 2012). Prefers higher altitudes, near fast-running water, rocky substrates, lakes and marshes (DOE 2015). Has occurred previously in northern Australia from the Kimberley to SE QLD (Simpson and Day 2010). No records for inland SA (ALA 2018). No BDBSA records for the study area.
Motacilla flava	Yellow Wagtail	MT		Unlikely	EPBC PMST suggests species or habitat may occur. Uncommon migratory wagtail (DOE 2015). Breeds in Europe, Africa and Alaska and occasional spring/summer non-breeding migrant to Australia (Pizzey and Knight 2012). Habitat includes well-watered open grasslands, fringes and wetlands. Roosts in mangroves and other dense vegetation (D0E 2015). One record for inland SA (Coober Pedy) (ALA 2017). BDBSA records for the study area.
Pandion haliaetus	Osprey	MW		Unlikely	EPBC PMST suggests species or habitat may occur. Raptor. Prefers open water foraging habitat and tall woodland nesting habitat (Pizzey and Knight 2012). Preferred habitat of open water bodies not present within study area. No BDBSA records for the study area
Tringa nebularia	Common Greenshank	MW		Likely	EPBC PMST suggests species or habitat likely occurs. Migratory wader / shorebird. Breeds in northern hemisphere from Europe to Siberia, summer migrant to Australia, Africa and Asia. Prefers intertidal mudflats, fresh and saltwater wetlands of coast and inland (Geering et al. 2008). Alignment traverses near smaller freshwater lakes on the Arcoona Plateau and larger ephemeral saline lakes (Lake Windabout and Pernatty Lagoon) that provide foraging habitat when holding water Twenty BDBSA records from swamps and freshwater lakes in the northern portion of the study area and no records since 2002.

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Justification[3]
Arenaria interpres	Ruddy Turnstone	MM	R	Possible	Not identified in EPBC PMST, but historic BDBSA record (1993) (Olympic Dam EIS, BHP Biliton 2009). Breeds in Siberia, rarely occurs in inland Australia; where it may inhabit shallow waters and sewage ponds. This species typically inhabits coastal habitats where seaweed wrack covers sandy shores and/or rocks, tidal flats (Simpson and Day 2010, Mehkhorst et al. 2017). Has been recorded inland at Lake Coorlay (1993) (BDBSA 2018), adjacent the alignment. Dams and areas of shallow open water within the study area could provide occasional foraging habitat for the species.
Limosa limosa	Black-tailed Godwit	MM	R	Possible	Not identified in EPBC PMST, but historic BDBSA record (1998). Migratory wader / shorebird. Breeds in northern hemisphere (Eurasia) and regular summer migrant to Australia. Most common in coastal habitats with large intertidal mudflats and/or sandflats. However, the species also frequents inland Australia, on mudflats and in water less than 10 cm deep (belly depth), around muddy lakes and swamps, fresh and brackish wetlands (Geering et al. 2008, Simpson and Day 2010, Menkhorst et al. 2017). Has been historically recorded within arid zone areas such as Lake Coorlay, (BDBSA 2018), adjacent the alignment. Dams and areas of shallow open water within the study area could provide foraging habitat for the species.
Tringa glareola	Wood Sandpiper	MM	R	Possible	Not identified in EPBC PMST, but BDBSA record (2001). Small migratory shorebird, breeds in Siberia to Europe and migrates to Africa, southern Asia and Australia (Geering et al. 2008). More common in northern Australia, the species mainly occurs on inland freshwater wetlands with vegetation and rarely on mudflats on mud or shallow water. Occurs between August and April (Geering et al. 2008, Menkhorst et al 2017). Pastoral dams and inland waterbodies may provide foraging habitat for this species within the study area.

[1]*Environment Protection and Biodiversity Conservation Act 1999* Status: Critically Endangered (CE); Endangered (EN), Vulnerable (VU); Migratory Marine (MM); Migratory Terrestrial (MT); Migratory Wetland (MW).
[2]South Australian *National Parks and Wildlife Act 1972* Status: Rare (R); Vulnerable (V); Endangered (E)
[3]Biological Database of South Australia (BDBSA), Protected Matters Search Tool (PMST), Atlas of Living Australia (ALA).

4. EPBC Significant Impact Assessment

4.1 Significant Impact Assessment Criteria

The Significant Impact Criteria relevant to this project are those outlined by DoE (2013), which are summarized in Table 4 below for Critically Endangered and Endangered species, Vulnerable species and Migratory species.

For species listed as Vulnerable, the term 'important population' is used to define a number of the significant impact criteria. For the purpose of this significant impact assessment, we consider 'important populations' of a species to be 'key' or 'core' populations which are defined as strongholds within relevant SPRAT profiles (DOE), or by recent relevant population studies for the target species. A small, isolated population, remote from a core population (or meta-population) as a result of historic habitat fragmentation would also represent an important population. Examples of populations considered to not represent important populations would be small portions of much larger and/or predominantly continuous populations, or discrete populations as part of a larger patchy population distribution as a result of natural habitat variability and islanding of microhabitat features.

Table 4: EPBC Significant Impact Criteria (Critically Endangered, Endangered, Vulnerable and Migratory Species).

Criteria	EPBC Significant Impact Criteria (Critically Endangered and Endangered Species)	EPBC Significant Impact Criteria (Vulnerable Species)	EPBC Significant Impact Criteria (Migratory Species)
A	Lead to a long-term decrease in the size of a population	Lead to a long-term decrease in the size of an important population of a species	Substantially modify (including by fragmenting, altering fire regimes, nutrient cycles or hydrological cycles), destroy or isolate an area of important habitat for a migratory species
B	Reduce the area of occupancy of the species	Reduce the area of occupancy of an important population	Result in invasive species that are harmful to a migratory species becoming established in an area of important habitat for migratory species
C	Fragment an existing population into two or more populations	Fragment an existing important population into two or more populations	Seriously disrupt the life cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of a population of a migratory species
D	Adversely affect habitat critical to the survival of a species	Adversely affect habitat critical to the survival of a species	
E	Disrupt the breeding cycle of a population	Disrupt the breeding cycle of an important population	
F	Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	
G	Result in invasive species that are harmful to the endangered or critically endangered species becoming established in the endangered or critically endangered species' habitat?	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	
H	Introduce disease that may cause the species to decline?	Introduce disease that may cause the species to decline?	

Criteria	EPBC Significant Impact Criteria (Critically Endangered and Endangered Species)	EPBC Significant Impact Criteria (Vulnerable Species)	EPBC Significant Impact Criteria (Migratory Species)
I	Interfere with the recovery of the species	Interfere substantially with the recovery of the species	

4.2 Significant Impact Assessment

Table 5 below presents an assessment of the likelihood that the proposed development would result in significant impacts to EPBC listed flora and fauna which were considered 'likely' to occur, or as 'possible' occurrences within the study area during the desktop review undertaken here. No threatened ecological communities were considered here as none were considered likely (or possible) to occur. The assessment was based on the significant impact criteria outlined in Table 4 above (which were sourced from DoE (2013)).

Table 5: EPBC Listed threatened flora Significant Impact Assessment (for species considered 'likely' or as 'possible' occurrences in study area)

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
Threatened Flora						
Frankenia plicata (Southern Sea-heath)	EN	V	Possible	Clearance of individual plants or potential habitat for tower footings and access track. Introduction of invasive weed species or disease.	Undertake site clearance walkover as part of land disturbance permitting prior to construction on outwash plains on southern foot-slopes of Arcoona Plateau, and along alignment route in proximity of Woomera, the location of a historic record for the species to confirm footing and clearance locations do not disturb species. Flag off any population detected plus 50 m buffer and avoid clearance and disturbance to any populations present via fine tuning alignment or footing locations. Implement weed hygiene practices, including vehicle hygiene, during construction and implement post construction and annual weed control surveillance and control programs.	**Significant impacts considered not likely** A: Not Likely. Few populations have been recorded in the region. Historic records predominantly known from the south western portion of the Lake Eyre Basin in SA well to the north of the project within minor drainage lines and run-off areas off stony plains and stony hills (well drained soils), and two isolated small populations to the west of Lake Torrens on the Arcoona Plateau. The species was not detected during the recent survey of the alignment (OZ Minerals, 2018; Appendix D1 of this Development Application). If detected, mitigation measures proposed, including micro-aligning the access track and micro-positioning of towers would enable disturbance to any population to be avoided. The development would not stop future recruitment or gene flow. As such, the proposed action is considered unlikely to lead to a long term reduction in the size of a population of this species. B: Not Likely. As above, key population in SA have been recorded from the south western portion of Lake Eyre, with a single record from near Woomera. Mitigation measures proposed are expected to enable avoidance of disturbance to any populations that are identified along the alignment, and therefore no reduction to the area of occupancy is expected. C: Not Likely. As above, no known populations of the species are present along the alignment. Baseline surveys did not detect the species (OZ Minerals, 2018; Appendix D1 of this Development Application), and targeted surveys prior to construction in key habitats are proposed. Disturbance to any population detected would be avoidable with mitigation measures proposed, and therefore fragmentation of an existing population is considered highly unlikely. D: Not Likely. Suitable habitat may be present on the footslopes and outwash plains of the Arcoona Plateau in the northern portion of the alignment, and other minor drainage lines with

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						stony surface and well drained soils. Given the absence of historic records of the species along the alignment, these habitats are not considered critical to the survival of the species. With mitigation measures proposed, the action will not significantly impact on species habitat. E: Not Likely. The majority of historic records of the species are to the north of the project area around the south western portion of the Lake Eyre Basin, so considered unlikely that a population exists in the project area. Reproduction of *Frankenia plicata* would not be disrupted by a transmission line or access track if present and avoided during construction. Mitigation measures proposed enable any populations present to be identified and avoided, so the action will not disrupt the breeding cycle of the species. F: Not Likely. The majority of records for this species are to the north of the project area. The transmission line will span the majority of habitat intersected (with the exception of tower/pole footing locations). The access track will result in habitat clearance and modification, but it is not expected to be of sufficient extent to cause this species to decline (given at this stage there are no records of the species in the project area). G and H: Not Likely. The majority of historic records of the species are to the north of the project area around the south western portion of the Lake Eyre Basin, so considered unlikely that a significant population exists in the project area. As such, any introduction of weeds would not result in establishment and degradation of *Frankenia plicata* habitat. Area not in a high risk *Phytophthora* area. Management measures include weed controls during and post construction as well as vehicle hygiene practices, so establishment of new weed species or diseases in the project area is not considered likely. The action is therefore not expected to result in the introduction of invasive species or disease which are harmful to this threatened species. I: Not Likely. The proposed action does not interfere with any recovery actions for this species. Key threats include trampling my livestock. Studies undertaken as part of this project will assist with further defining the distribution of this species. With

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						management measures proposed, this action is not expected to further impact upon, or interfere with recovery of the species.
Senecio megaglossus (Large-flower Groundsel)	VU	E	Possible	Clearance of individual plants or potential habitat for tower footings and access track. Introduction of invasive weed species or disease.	Undertake site clearance walkover as part of land disturbance permitting prior to construction across any preferred stony slope habitat with *Triodia* sp. in the southern portion of alignment to confirm footing locations do not disturb this species (noting that vegetation mapping (BHP Billiton, 2009) and the recent ecological survey of the project area (OZ Minerals, 2018; Appendix D1 of this Development Application) did not detect this species and did not indicate this preferred vegetation community is present on the alignment). If identified as present, further documentation of regional distribution to better understand population wide significance of any potential impacts. Flag off and avoid disturbance to any populations present via fine tuning alignment or footing locations. Implement weed hygiene practices during construction and implement post	**Significant impacts considered not likely** A: Not Likely. Vegetation mapping (BHP Billiton, 2009) indicates that preferred habitat for the Large-flower Groundsel (rocky slopes and rocky creek banks and drainage lines supporting grasslands associated with *Triodia*, *Callitris columellaris* and *Eucalyptus camaldulensis* open woodland over sparse shrubs, or tall open shrublands of *Pittosporum* sp. *Cassinia* sp. or *Bursaria* sp.) is not found within the study area. The baseline surveys of the alignment (OZ Minerals, 2018; Appendix D1 of this Development Application) did not identify the species, and mitigation measures (e.g. micro-positioning of the footings) will ensure that no disturbance occurs to any population and the action is therefore unlikely to lead to a long term reduction in the size of an important population. Numerous populations of this species have been identified, with confirmed numbers growing between 1986 and 1994 (and potentially beyond). If an 'important population' is present along the alignment, the baseline survey would likely have identified it. Nature of development enables avoidance through micro-positioning of footings and access tracks. B: Not Likely. No 'important populations' known from within the project area or identified during recent basline flora surveys of the alignment (OZ Minerals, 2018; Appendix D1 of this Development Application). A single specimen is recorded in the BDBSA from 5.2 km to the south of the southern extent of the alignment from a rocky slope supporting *Triodia*. Disturbance to any population detected would be avoidable with mitigation measures proposed, and will therefore not lead to a reduction in the area of occupancy of an important population. C: Not Likely. As above, no known 'important populations' of the species are present along the alignment. Baseline surveys did not detect the species, and targeted surveys prior to construction in key habitats are proposed to enable footling locations to avoid if present. Disturbance to any population detected would be avoidable with mitigation measures

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
					construction and annual weed control surveillance and control programs.	proposed, and therefore fragmentation of an existing important population is considered very unlikely. D: Not Likely. Vegetation mapping (BHP Billiton, 2009) indicates that preferred habitat for the Large-flower Groundsel (rocky slopes and rocky creek banks and drainage lines supporting grasslands associated with *Triodia*, *Callitris columellaris* and *Eucalyptus camaldulensis* open woodland over sparse shrubs, or tall open shrublands of *Pittosporum* sp. *Cassinia* sp. or *Bursaria* sp.) is not found within the study area. Therefore, no disturbance is expected to habitat critical for the survival of the species. No preferred habitat identified during the baseline survey undertaken in 2018. Mitigation measures proposed enable avoidance of impacts via micro-placement of footings and re-routing of access tracks. The action is therefore highly unlikely to significantly impact on habitat critical to the species survival. E: Not Likely. No population is known from the project area, so highly likely that no important population exists in the area. Reproduction of Large-flower Groundsel would not be disrupted by a transmission line or access track if present and avoided during construction. Mitigation measures proposed enable any populations present to be identified and avoided, so the action will not disrupt the breeding cycle of the species. F: Not Likely. No population currently known from project area. Mitigation measures proposed allow for detection of any population which may be present, and for avoidance of disturbance to those populations (if present). Transmission line proposed will not largely modify or decrease availability of habitat once constructed. The action is therefore not expected to modify or decrease the availability or quality of habitat to the extent that any population of Large-flower Groundsel (if present) is likely to decline, let alone the species as a whole. G: Not Likely. Vegetation mapping (BHP Billiton, 2009) indicates that preferred habitat for the Large-flower Groundsel (rocky slopes and rocky creek banks and drainage lines supporting grasslands associated with *Triodia*, *Callitris columellaris* and *Eucalyptus camaldulensis* open woodland over sparse shrubs, or tall open shrublands of *Pittosporum* sp. *Cassinia* sp. or

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						Bursaria sp.) is not found within the study area. As such, any introduction of weeds would not result in establishment and degradation of Large-flower Groundsel habitat. Management measures include weed controls during and post construction, so establishment of new weed species in the project area is not considered likely. In addition, there are currently no known populations of Large-flower Groundsel in the project area. The action is therefore not expected to result in the introduction of invasive species which are harmful to this threatened species. H: Not Likely. Species not currently known from project area, so not likely to be impacted by introduction of any disease. Management measures in place include vehicle hygiene to control weeds and disease. Area not in a high risk *Phytophthora* area. With mitigation measures, the action will not result in the introduction of diseases that may cause the species to decline. I: Not Likely. Species not currently present in the project area. Numbers of identified populations of this species have been increasing. With management measures proposed, this action is not expected to further impact upon, or interfere with recovery of the species.
Threatened Fauna						
Amytornis modestus (Thick-billed Grasswren, eastern)	VU	V	Possible	Clearance of potential habitat for tower footings and access track. Introduction of invasive weed species resulting in habitat degradation.	Where practicable, avoid construction of towers in preferred tall Chenopod shrubland and Lignum communities (note this vegetation type is typically found in minor drainage lines and swamps not suited to tower construction). Flag off any preferred habitat identified adjacent to the track alignment and ensure no disturbance beyond the essential clearance footprint for the access track.	**Significant impacts considered not likely** A: Not Likely. Whilst the northern portion of the transmission line alignment intersects the known range of the species and includes some isolated sections of preferred habitat of taller dense shrubland, there are no historical BDBSA records from within the study area, and as such, it is not considered that an important population of the species exists in the area. The proposed action consists of a transmission line which will span above the preferred habitat of this species, along with a low traffic volume, 5 m wide, maintenance access track which the species will readily cross. Clearance of preferred habitat within the study area will be regionally insignificant when compared with the species distribution, with the key threat of widespread habitat degradation through grazing pressure a more significantly concern for the species. Preferred habitat loss will

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
					Implement weed hygiene practices during construction and implement post construction weed surveillance and control programs.	be minimised with mitigation measures proposed, and this coupled with the lack of evidence for the presence of a significant population means the action is not expected to lead to a long term decrease in the size of a known important population. B: Not Likely. Key populations occur north and northeast of the study area (Black et al. 2011). Whilst the northern portion of the transmission line alignment intersects the known range of the species and includes some isolated sections of preferred habitat of taller dense shrubland, there are no historical BDBSA records from within the study area, and as such, it is not considered that an important population of the species exists in the project area. Once constructed, the proposed action is not expected to hinder movement of the species across the landscape, or cause a reduction in area of occupancy (aside from minor habitat loss for maintenance track and transmission line footings). With mitigation measures proposed, majority of clearance of preferred habitat should be avoided. Therefore, the area of occupancy areas of an important populations will not be reduced. C: Not Likely. Once constructed, the proposed action is not expected to hinder movement of the species across the landscape, as the transmission line will span well above any habitat utilised by the species, and the maintenance track will support only very low volumes of traffic and is proposed to be only 5 m wide. Key populations occur to the north and northeast of the study area, and there are no known important populations present. Clearance of a 5m strip for access track is unlikely to lead to fragmentation of any important population if present. D: Not Likely. Whilst the northern portion of the alignment traverses the currently known broader distribution of the species and includes isolated sections of preferred taller Chenopod shrubland and Lignum habitat in minor drainage lines (DEWNR veg mapping), the majority of the proposed alignment is not within the preferred habitat for this species, and no known populations have been recorded within the study area. Stronghold populations of the species are well documented by Black et al. (2011) and occur to the north of the project area,

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						and to the northeast across Lake Torrens. Mitigation measures proposed enable avoidance of important habitats via micro-placement of footings and fine tuning of the access track alignment. Areas of tall dense shrubland will be avoided wherever practicable. Once constructed, the proposal is not expected to impact movement across the landscape or breeding activity. As such, no adverse impacts are expected to habitat which is considered critical for the survival of the species. E: Not Likely. No important population of this species is known from within the study area, and therefore, any clearance of potential habitat associated with the maintenance track or transmission line footings is unlikely to disrupt the breeding cycle of the species as a whole. Once constructed, the transmission line or maintenance track are not expected to disrupt movement across the landscape for this species, so impacts to breeding are not anticipated. F: Not Likely. As above, given key populations are known to occur to the north and northeast of the study area, clearance of currently utilised habitat within the study area is expected to be minimal (if any), and it is therefore not expected that any decrease in quality or quantity of habitat would lead to a decline of the species (from the four key known populations identified by Black et al. (2011)). G and H: Not Likely. The known important populations of the species occur to north of the project area, to the west Lake Eyre and Lake Torrens, so it is considered unlikely that a significant population of Thick-billed Grasswrens exists in the project area. As such, any introduction of weeds would not result in establishment and degradation of preferred habitat. The project area not in a high risk *Phytophthora* area. Management measures include weed controls during and post construction as well as vehicle hygiene practices, so establishment of new weed species or diseases in the project area is not considered likely. The action is therefore not expected to result in the introduction of invasive species or disease which are harmful to this threatened species.

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						I: Not Likely. Key objectives of recovery of this species involve managing feral predators (cats, foxes) and control of grazing impacts from introduced species which cause broad-scale habitat degradation. The four key populations within SA occur north and northeast of the study area and will not be impacted by the project. Therefore, with mitigation measures proposed, the proposed action will not substantially interfere with the recovery of the species.
Amytornis textilis myall (Western Grasswren, Gawler Ranges)	VU		Possible	Clearance of potential habitat for tower footings and access track. Introduction of invasive weed species resulting in habitat degradation.	Where practicable, avoid construction of towers in preferred habitat of denser stands of Chenopod shrubland around drainage lines (noting that the proximity of this community type to minor drainage lines and swamps means these areas are generally not suited to tower construction). Flag off any preferred habitat identified adjacent to the track alignment and ensure no disturbance beyond the essential clearance footprint for the access track. Implement weed hygiene practices during construction and implement post construction weed surveillance and control programs.	**Significant impacts considered not likely** A: Not Likely. The key population of this species occurs west to south of the study area (NPWS 2002, Black et al. 2011) and there are no records of the species on the eastern side of the Stuart Highway where the alignment runs. The action involves minimal clearance of the potential habitat in proximity to the edge of the species known range. With mitigation measures, the action is unlikely to lead to a long term decrease in the size of an important population (which is well defined by Black et al. 2009) of this species. B: Not Likely. The study area occurs outside of the known (well documented by Black et al. (2009)) area of occupation of this species. With mitigation measures proposed, the action will not reduce the area of occupancy. C: Not Likely. Important and well documented populations occur largely to the south and west of the project area, so the population will not be traversed by the project. Clearance of a 5m strip cleared for a low traffic volume access track and a transmission line spanning above utilised habitat would be unlikely to lead to fragmentation of important populations of this species regardless. D: Not Likely. No clearance of habitat critical for survival of the species will occur as the required clearance is outside of the known area of occupancy. Important populations and associated habitat occur to the west and south of the study area (Black et al. 2009). Clearance of non-critical habitat will not influence the survival of the species. E: Not Likely. No important population of this species is known from within the study area, and therefore, any clearance of

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						potential habitat associated with the maintenance track or transmission line footings is unlikely to disrupt the breeding cycle of the species as a whole. Once constructed, the transmission line or low traffic volume maintenance track are not expected to disrupt movement across the landscape for this species, so impacts to breeding are not anticipated. F: Not Likely. Given key populations are known to occur west to south of the study area, minimal (if any) clearance of utilised habitat within the study area is unlikely to significantly impact habitat extent and quality leading to a decline in the species. G and H: Not Likely. The known important populations of the species occur to the west and south of the project area, on the western side of the Stuart Highway, so it is considered unlikely that a significant population of Western Grasswrens exists in the project area. As such, any introduction of weeds would not result in establishment and degradation of preferred habitat. The project area not in a high risk *Phytophthora* area. Management measures include weed controls during and post construction as well as vehicle hygiene practices, so establishment of new weed species or diseases in the project area is not considered likely. The action is therefore not expected to result in the introduction of invasive species or disease which are harmful to this threatened species. I: Not Likely. Key objectives of recovery of this species involve conserving extant populations. The key populations within SA occur west to south of the study area in the Gawler Ranges and on the Eyre Peninsula and this population will not be impacted by the project. Therefore, with mitigation measures, the proposed action will not substantially interfere with the recovery of the species.
Calidris ferruginea (Curlew Sandpiper)	CE, MW		Possible	Injury or mortality from collisions with powerline conductors. Injury or mortality from collisions with vehicles traversing access track.	Attach reflectors to powerline conductors at regular intervals on sections of the alignment adjacent to potential foraging habitat (ephemeral freshwater swamps and salt lakes).	**Significant impacts considered not likely** A: Not Likely. Migratory shorebird with global population of approximately 1,350,000 individuals (Bamford et al. 2008). Breeding occurs outside of Australia in the high arctic coastal tundra of central and eastern Siberia (Geering et al. 2008). In Australia, the population is estimated at 118,000 individuals and foraging occurs on exposed intertidal mudflats and less

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
					Proposed transmission line alignment largely avoids traversing foraging habitat, except at the eastern edge of Lake Windabout, where it is adjacent to two existing transmission lines. Micro-align access road to avoid traversing foraging habitat. Implement weed hygiene practices during construction and implement post construction weed surveillance and control programs.	frequently on inland freshwater wetlands (Geering et al. 2008). The species is widespread in coastal and subcoastal areas east of Streaky Bay including the Coorong. Key sites for migratory shorebirds within the east Asian-Australasian flyway are listed by DoE (2018) and the project or study area does not intersect any of these sites. With only occasional and low numbers of historic records of the species in the study area, it is considered that key populations of the species do not occur within the study area. (Potential) collision with powerlines in the study area is therefore not expected to result in a long term decrease in the size of the Australian, or global population (of over 100,000 and 1.3 million respectively). Mitigation measures proposed can readily avoid potential foraging habitat of ephemeral lakes, and collisions with power lines are not expected to be a common cause of mortality. As such, populations of this species will not decrease in size as a result of the proposed action. B: Not Likely. The area of occupancy is widespread within Australia (and globally) for this migratory species which breeds outside of Australia. Given no preferred habitat occurs within the project footprint, and potential foraging habitats can be easily avoided, the area of occupancy for this species is not likely to be reduced. C: No. The area of occupancy is widespread within Australia for this migratory species which breeds outside of Australia. Given there is no breeding habitat, no preferred habitat or habitat critical to the survival of the species within the project area, and the project area does not represent a stronghold for the species, the population will not be fragmented in any way. D: No. The area of occupancy is widespread within Australia for this migratory species which breeds outside of Australia. Given there is no breeding habitat, no preferred habitat or habitat critical to the survival of the species within the works footprint, habitat that is critical to the survival of this species will not be adversely affected.

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						E: No. Given the species does not breed in Australia (i.e. breeds in the Arctic Tundra of Siberia (Geerling et al. 2008), the breeding cycle of the population will not be impacted. F: No. There is no preferred habitat (i.e. intertidal mudflats, Geering et al. 2008) within the works footprint. Therefore, quality habitat important to the survival of the species will not be modified, destroyed or removed to the extent that the species will decline. G: Not Likely. The migratory species breeds outside of Australia and prefers intertidal mudflats when visiting Australia. These habitats do not occur within the study area, therefore post construction weed control program and construction adjacent to existing services corridor are unlikely to result in new invasive species. H: Not Likely. Preferred habitats do not occur within the study area, and key populations do not occur within the study area. The proposed construction and operation activities are not expected to introduce a disease that would affect this species. I: Not Likely. There is no specific recovery plan for this species. Conservation actions relate to loss of key habitat within the East China Sea. Australian conservation actions relate to reducing impacts from human disturbance, habitat loss, and invasive plants at key feeding grounds. Key feeding grounds do not occur within the study area, therefore, with mitigation measures, the proposed action will not interfere with the recovery of the species.
Pezoporus occidentalis (Night Parrot)	EN		Possible	Minor clearance of Samphire and other Chenopod low open shrubland which represents potential foraging habitat, particularly where adjacent to *Triodia* spp. hummock grassland nesting habitat.	Minimise clearance of potential foraging habitat particularly in section adjacent to potential nesting habitat found on Euro Bluff. Avoid clearance for footings in potential breeding habitat of *Triodia* spp. hummock grassland, if identified.	**Significant impacts considered not likely** A to H: Not Likely. Previously considered extinct or near extinct. Recently confirmed extant populations occur in Qld and WA. No key populations have been identified within SA, with the exception of a feather observed at Kalamurina in SA (northeast of Lake Eyre) approximately 250km from the project location. A vast amount of arid-zone habitat has been identified as potential habitat for the species. The proposed project involves minor clearance of potential foraging habitat that is dominant in the study area and present more broadly across the region. The project will not involve clearance of (currently known) preferred

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						Triodia spp. nesting habitat. Therefore, with mitigation measures the proposed action will not lead to a long-term decrease in the size of a population of the Night Parrot, will not reduce the potential area of occupancy and will not fragment an existing population. Habitat that is critical to the survival of this species occurs across WA, SA and Qld. An existing population is not confirmed in SA, therefore the minor clearance of potential foraging habitat will not fragment the habitat or adversely affect critical habitat to the survival of the species. Given that a population is not known and preferred nesting habitat does not occur within the project area, the breeding of this species will not be disrupted, or availability of preferred breeding habitat decreased. Given the vast amount of potential foraging habitat across SA, with mitigation measures proposed, the proposed action is unlikely to result in establishment of invasive species that will impact potential habitat or introduce disease that will impact the species. Low flying species unlikely to be impacted by collisions with transmission line conductors. Low risk of collisions with vehicles on access track as no night traffic anticipated on access track. I: Not Likely. A recovery plan is not currently in place for this species. However, recovery actions are the objective of the Night Parrot Recovery Team, given the species has only been rediscovered in two Qld National Parks and in WA (DOEE 2018d), with only a feather being located in SA. General objectives relate to detecting more populations of Night Parrot to better understand distribution and habitat preference. Most of arid SA has the potential to provide habitat for the species (Night Parrot Recovery Team 2018b), and feral predatory animals are expected to be the key threat to this ground dwelling and nesting species. No key populations or key breeding habitats have been identified within the survey area, and it is therefore considered unlikely that the regionally minor clearance for this project (that is adjacent previously disturbed areas) will impact any recovery actions for this species.
Pseudomys australis	VU		Possible	Clearance of potential habitat for tower footings and access track.	Use available high resolution imagery to identify potential refuge areas within the	**Significant impacts considered not likely**

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
(Plains Mouse)				Introduction of invasive weed species resulting in habitat degradation.	project area. Undertake site clearance walkover as part of land disturbance permitting prior to construction to facilitate avoidance of any identified refuge habitat of deep cracking clay gilgais or broad run-on interdune swales. Where practicable, avoid construction of towers in potential refuge habitat (noting that the "run on" nature of this habitat/soil type is typically not suited to tower construction and will be avoided in final designs). Flag off any potential refuge habitat identified adjacent to the track alignment and ensure no disturbance beyond the essential clearance footprint for the access track. Develop clear protocols for management of waste during construction to avoid an increase in, or attraction of, feral pest animals to the project area.	A: Not Likely. This species has a highly irruptive life cycle and uses a broader range of habitat types during irruptive cycles. The potential habitat for this species during these periods is widespread across the Arcoona Plateau traversed by the northern portion of the study area. The vegetation clearance footprint within this habitat will be comparatively minor and represents a very small portion of available habitat regionally. In addition, mitigation measures including identification and avoidance of potential refuge habitat (important to the species survival during non-boom years or drought periods) when positioning towers and the access track will mean the action is unlikely to lead to a long term decrease in an important population of this species. B: Not Likely. Only the northern portion of the alignment intersecting with any historic records, noting that this species has a highly irruptive life cycle and that during boom years, records can be collected well outside of refuge habitats or important population strongholds. General habitat use during irruptive cycles is broad spread across huge areas in the region and in no way confined to the project area. Regionally insignificant clearance within potential habitat for tower and access track construction and therefore the action is unlikely to lead to a significant reduction to the area of occupation of an important population of this species. C: Not Likely. 5m strip cleared for access track and clearance for tower footings is considered unlikely to inhibit movement nor restrict gene flow of this species across the landscape, and therefore the action is considered unlikely to cause fragmentation of any population, and no important population is documented from the project area or identifiable from historic records. D: Not Likely. Potential habitat is widespread for this species on the Arcoona Plateau and with mitigation measures proposed to avoid clearance or impacts to important refuge habitat of drainage channels and depressions with deep cracking clays, the action is unlikely to significantly impact habitat critical for survival of the species.

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						E: Not Likely. Minimal clearance of potential refuge habitat will occur with the implementation of proposed mitigation measures, and once constructed, the development is unlikely to stop movement across the landscape or interrupt the species breeding cycle. F: Not Likely. Minimal clearance of potential habitat important for the species (i.e. refuge habitat) is anticipated with implementation of proposed control measures, and the action is therefore unlikely to significantly impact on habitat extent and quality which would lead to a decline in the species population. G and H: Not Likely. No known important populations of the species occur in the project area, so it is considered unlikely that a significant population of Plains Mouse exists in the project area. As such, any introduction of weeds is not considered likely result in establishment and degradation of preferred habitat. The project area not in a high risk *Phytophthora* area. Management measures include weed controls during and post construction as well as vehicle hygiene practices, so establishment of new weed species or diseases in the project area is not considered likely. Existing tracks exist within the project area, so the proposal is not expected to result in an increase in abundance of feral predator species. The action is therefore not expected to result in the introduction of invasive species or disease which are harmful to this threatened species. I: Not Likely. Recovery actions for this species include better understanding of locations and distributions of important populations and critical habitat, and to better understand threats to current populations. The proposed actions will not interfere with the recovery of the species.
Migratory Waders (Functional Group)						
Actitis hypoleucos (Common Sandpiper) *Calidris acuminata* (Sharp-tailed Sandpiper), *Calidris melanotos* (Pectoral Sandpiper),	MW		Possible	Injury or mortality from collisions with powerline conductors.	Attach reflectors to powerline conductors at regular intervals on sections of the alignment adjacent to potential foraging habitat	**Significant impacts considered not likely** A: Not likely. The proposed alignment largely avoids impacts to ephemeral wetlands which may represent foraging habitat for migratory wader species. Where the alignment passes Lake Windabout, two existing transmission lines are present and

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
Charadrius veredus (Oriental Plover), *Gallinago hardwickii* (Latham's Snipe), *Tringa nebularia* (Common Greenshank), *Arenaria interpres*, (Ruddy Turnstone), *Limosa limosa* (Black-tailed Godwit), *Tringa glareola* (Wood Sandpiper)				Injury or mortality from collisions with vehicles traversing access track.	(ephemeral freshwater swamps and salt lakes). Proposed transmission line alignment largely avoids traversing foraging habitat, except at the eastern edge of Lake Windabout, where it is adjacent to two existing transmission lines. Micro-align access road to avoid traversing foraging habitat. Implement weed hygiene practices during construction and implement post construction weed surveillance and control programs.	mitigation measures are proposed to reduce the incidence of bird collisions with power lines. The majority of waders breed overseas, or in significant areas of wetland or intertidal habitat which will not be influenced by this project. As such, the action will not substantially modify, destroy or isolate an area of important habitat for a migratory wader species. B: Not likely. Mitigation measures proposed will control the spread of weed species during construction of the project and post construction. Existing service corridors and tracks run through the project area, meaning that new invasive species are unlikely. The project will not impact on important habitat features to migratory wader species, such as inland ephemeral lakes or wetland areas. C: Not likely. The project is not located in an area where an ecologically significant proportion of a population of migratory species exists. Potential foraging habitat will be avoided. The project will not seriously disrupt the life cycle of an ecologically significant proportion of the populations of migratory species.
Migratory Marine Avifauna						
Apus pacificus (Fork-tail Swift)	MM		Possible	Injury or mortality from collisions with powerline conductors.	None proposed.	**Significant impacts considered not likely** A: Not likely. Given the species migratory, breeding in eastern Asia, the proposed transmission line is not anticipated to impact the breeding of this species. The species is almost exclusively aerial, feeding on the wing above a variety of habitats (from inland open plains to wooded areas) across large portions of Australia during summer months (DOTE 2015). Generally flies well above the height of the proposed transmission lines, up to 1000m. The proposed action will therefore not substantially modify, destroy or isolate an area of important habitat for this migratory species. B: No. Weed control programs during and post construction would minimise the likelihood of new invasive species being introduced to the project area. In addition, invasive species that are harmful to this species are unknown, given the aerial nature of the species. The broad distribution of this species across multiple continents also makes weed invasions as a result of

Species Name	EPBC Act[1]	NPW Act[2]	Likelihood of Occurrence	Potential Impacts from proposed action	Proposed Mitigation Measures	Significant Impact Assessment (following mitigations) against significant impact criteria
						the project highly unlikely to result in significant impacts to this species. C: Not likely. Given the species is a non-breeding migrant to Australia, the action, will not seriously disrupt the life cycle of an ecologically significant proportion of the populations of this migratory species.

[1]*Environment Protection and Biodiversity Conservation Act 1999* Status: Critically Endangered (CE); Endangered (EN), Vulnerable (VU); Migratory Marine (MM); Migratory Terrestrial (MT); Migratory Wetland (MW);[2]South Australian *National Parks and Wildlife Act 1972* Status: Endangered (E), Rare (R), Vulnerable (V).

5. Potential Impacts and mitigations

The following provides a broad overview of potential impacts and outlines mitigation measures proposed to avoid or reduce residual risks to wildlife populations and important habitat. Potential impacts and mitigation measures specific to individual listed species (or groups of species) are provided in the tables above.

5.1 Vegetation Clearance

Vegetation clearance will be required for the construction of the pads for the high voltage towers each with a construction footprint of up to approximately 50 m x 50 m (or 2,500 m^2) for the 275kV portion of the line, and 40 m x 40 m (1,600 m^2) for the 132kV portion. Spacing between tower may vary with terrain and design requirements and range between 500 m to 300 m. A 5 m wide graded access track will be installed adjacent to the transmission line (assuming the worst case that existing tracks cannot be used), and a partially cleared 5 m wide cleared stringing easement may be required temporarily along the centre line.

The preliminary design alignment is located several hundred metres from the shorelines of ephemeral lakes and swamps, however it traverses across approximately 300 m to the west of the south-western corner of Lake Windabout. Direct impacts to lake beds and shorelines will be avoided by positioning towers away from the lakes themselves and aligning the access track to skirt around these features.

Mitigation measures will include site clearance walkovers as part of the land disturbance permitting process and construction environmental management planning prior to and construction activities to identify and 'flag off' any important habitat. This will target known or potential core habitat for EPBC listed species to enable micro-positioning of footings and access tracks where practicable. Vegetation clearance in these areas will be avoided or minimised where possible during the design phase by locating towers and the access track in alternative locations. It is noted that important habitat for several EPBC listed species coincides with drainage lines and run-on areas which are typically not suitable as sites for tower or access track construction, as these areas are prone to flash flooding during high rainfall events. In general, habitat types present are well represented across the broader landscape, and do not provide critical refuge for any of the species discussed here.

It is noted that for the majority of species that are considered as likely to be present, or as 'possible' to occur within the survey area, habitats for the species are readily available within SA and across Australia. Given that the footprint for the project will impact a very small proportion of the available habitat, significant impacts to EPBC listed species and their habitats are not likely.

The proposed transmission line alignment generally runs adjacent to existing service corridors including high voltage power lines, pipelines, roads and optic fibre installations thereby minimising cumulative impacts and reducing potential for population fragmentation of existing wildlife populations. The existing infrastructure in the area reduces the risk of the introduction of new invasive weed species or pests, or facilitating increased predator levels, as the 'threatening processes' are already in place in the project area.

5.2 Bird collisions with overhead power line conductors

Bird collision with powerline conductors may occur resulting in injury or death and mortalities from direct impact or occasional electrocution. Previous reports regarding powerline construction in areas adjacent to the proposed alignment suggest a heightened risk in sections adjacent to the Arcoona Lakes found at the southern base of the Arcoona Plateau (BHP Billiton, 2009). These saline lakes and ephemeral freshwater lakes located further north on the Arcoona Plateau itself and the ephemeral wetlands in the broader swales of the dunefield in the northern section of the alignment also support large water bird populations following inundation and powerline conductors traversing adjacent to these features also pose an increased risk of bird collisions.

The proposed transmission line alignment traverses adjacent to several smaller freshwater lakes and depressions on the Arcoona Plateau and two large saline ephemeral lakes at the base of the Arcoona Plateau. These provide habitat for a range of wader species including EPBC listed threatened and migratory species. Mitigation measures proposed include the installation of reflectors at regular intervals on

transmission conductors in the vicinity of lake habitat, to increase visibility of the lines, including at night, to assist in reducing the risk of collisions by birds. Such reflectors are widely employed to reduce risk of bird strike and to increase visibility of power lines.

5.3 Weed Hygiene and pest species

The introduction of weeds, disease or improved accessibility to an area by feral predators all represent potential project risks to conservation significant species in the project area. The proposed transmission line alignment generally runs adjacent to existing service corridors including high voltage power lines, pipelines, roads and optic fibre installations, and as such, there is a reduced the risk of the introduction of new invasive weed species or pests. Regardless, best-practice construction hygiene procedures are proposed, including:

- Ensure that any machinery and vehicles arriving on construction site has been inspected for any foreign soil or plant matter/weed material and has been washed down before entering the work site
- Weeds should be controlled within the work area according to the requirements of the Natural Resource Management Act (2004)
- All noxious weeds which are cleared as part of the project must be disposed of appropriately
- Conduct post construction weed survey and control program with particular focus on any weed infestations identified in pre-construction surveys

5.4 Wildlife collisions with vehicles

Vehicles traversing access tracks pose a risk to wildlife as a result of direct collisions. In this instance, following completion of construction, it is envisaged that vehicle traffic will be very infrequent and impacts on wildlife are anticipated to be rare occurrences, not resulting in significant alterations to any populations. Best-practice construction traffic management procedures are proposed, including all vehicles remaining on tracks, speed restrictions appropriate to the road or track conditions and effective signage where potential ecological constraints exist to raise awareness and further control speeds in these areas. Site induction processes to include awareness training regarding the conservation significance of flora and fauna species in the area.

5.5 Noise and Dust

Elevated noise and dust levels will occur during construction of the transmission line however this impact will be localised and temporary and will cease once construction is complete.

6. Conclusion

This report presents the findings of a detailed assessment of EPBC listed Protected Matters which are relevant to the Carriewerloo Substation to Prominent Hill Electricity Transmission Line. The assessment involved a review of the likelihood of occurrence of Protected Matters in the area, followed by a detailed assessment of the potential for significant impacts upon those Protected Matters which were considered likely to be present within the study area, or as possible occurrences within the study area. The significant impact assessment addressed the significant impact criteria for Endangered, Vulnerable and Migratory species outlined by DoTE (2013).

No Threatened Ecological Communities were identified within the study area.

A single plant species was identified as potentially present based on a review of the Protected Matters database, *Frankenia plicata*. A second plant species, *Senecio megaglossus* was included in the assessment as a result of a nearby historic record. On the basis that both species are very unlikely to be present, and with the implementation of the proposed mitigation measures, including micro-placement of footings and track alignments to avoid any Protected Matters present, no significant impacts are anticipated to any of these plant species as a result of the project.

Eight threatened fauna species, including seven birds and a single mammal were identified as potentially present in the study area, based upon a review of the Protected Matters database. Of these, five were considered to possibly be present, or likely to be present, including the Thick-billed Grasswren (eastern), Western Grasswren (Gawler Ranges), Curlew Sandpiper, Night Parrot and Plains Mouse. With the implementation of proposed mitigation measures, including key habitat avoidance for specific species, no significant impacts are anticipated to any of these fauna species as a result of the project.

A total of fifteen migratory species were assessed in the review (12 from PMST output, plus 3 from BDBSA output). Avoidance of impacts to ephemeral lakes and wetland habitat, and inclusion of reflectors along transmission lines in proximity to such habitats would reduce the probability of bird collisions with lines, and no significant impacts are expected for migratory species as a result of the project.

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Appendix E. Visual Assessment

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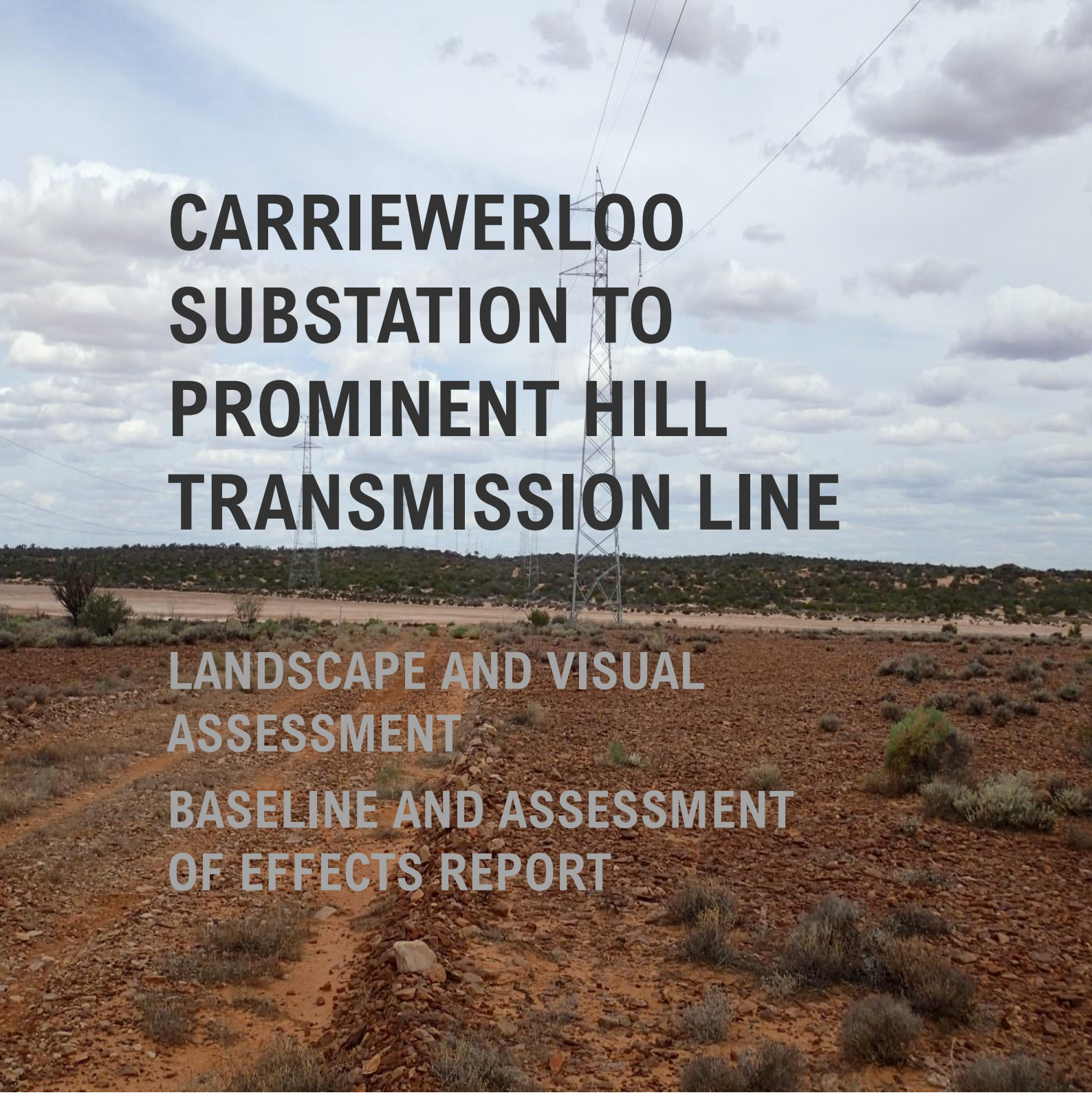

CARRIEWERLOO SUBSTATION TO PROMINENT HILL TRANSMISSION LINE

LANDSCAPE AND VISUAL ASSESSMENT

BASELINE AND ASSESSMENT OF EFFECTS REPORT

4TH JULY 2018
ND2230

PREPARED FOR OZ MINERALS LIMITED

URBIS

URBIS STAFF RESPONSIBLE FOR THIS REPORT WERE:

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Project Code	ND2230
Report Number	Visual and Landscape report

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INTRODUCTION

Urbis has been engaged by OZ Minerals Limited (OZ Minerals) to undertake a Visual Baseline Assessment and a Visual Assessment of Effects of the proposed Carriewerloo Substation to Prominent Hill Electricity Transmission Line (the Project).

The objective of the Visual Baseline Assessment is:

- to describe the visual environment in which the Project is set, suitable for the purposes of conducting an Assessment of Effects which is suitable for use in a Socio-Economic Impact Assessment.

The objective of the Visual Assessment of Effects is:

- to quantify the nature of the change to the baseline visual environment as a result of activities and the presence of infrastructure associated with the Project.

DEFINITION OF THE STUDY AND PROJECT AREA

The transmission line corridor (the Project Area) is defined as a 500 m corridor.

The Study Area for the Visual Baseline Assessment and Assessment of Effects reports is confined to a 5 km buffer either side of the centre line the proposed transmission line corridor.

Areas extending beyond the Study Area are defined as being within the Regional Study Area. The Regional Study area is only of relevance where sensitive receptors or viewpoints may have views towards the Project Area.

For the purposes of Project planning, the transmission line has been split into two sections (refer to ***Figure 1***):

- Northern Asset 1 Project Area – from the Solar Reserve Aurora project site to the Mount Gunson South Substation.
- Northern Asset 2 Project Area – from Mount Gunson South Substation to Olympic Dam.

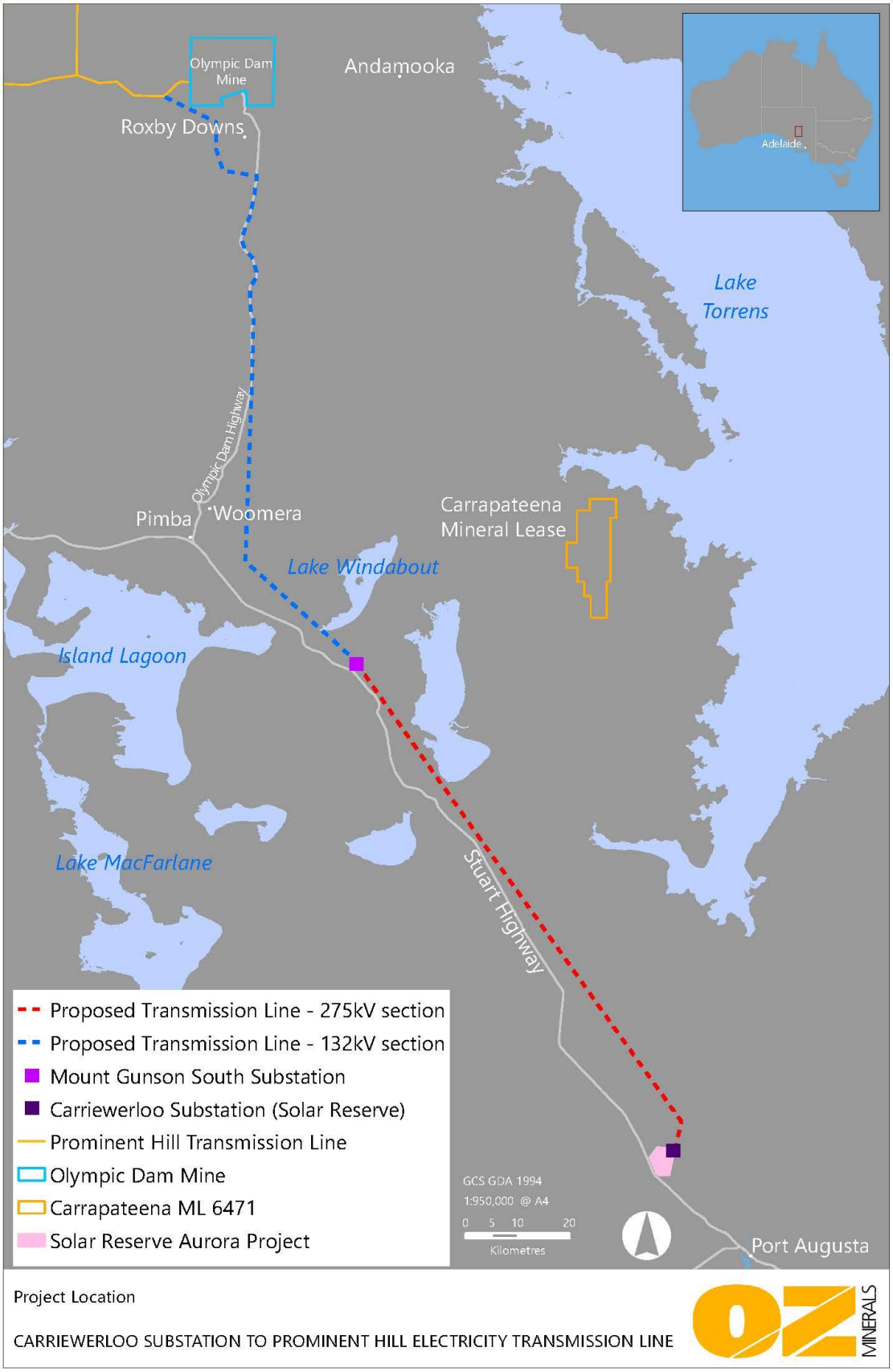

Figure 1 – Project Location

1. APPROACH TO ASSESSMENT OF LANDSCAPE AND VISUAL EFFECTS

1.1. LANDSCAPE ASSESSMENT

The following describes the approach undertaken for the baseline landscape assessment.

1.1.1. Landscape Units

Landscape units are defined by the general homogeneity of an area, with the character derived from such physical characteristics as:

- Topography.
- Vegetation.
- Drainage patterns.
- Geology.
- Land use patterns.

1.1.2. Landscape Scenic Quality

The scenic quality of the setting will be assessed to assist with the determination of potential landscape effects. The scenic quality of landscapes generally increases with an increase in:

- Topographic variation.
- The presence geological features.
- The presence of permanent water bodies.
- Patterning of vegetation texture and density.

Landscapes lacking most of the above characteristics would be rated of low scenic quality, while those that exhibit the most of them would be rated as high.

1.1.3. Landscape Absorptive Capability

The definition of landscape absorptive quality is closely related to that of visual modification levels. It is generally applied at a broader scale than visual modification and is an assessment of how well a landscape setting is able to accommodate change or a development.

The key factors considered in determining absorptive capability are topography and vegetation. In areas of flatter topography, overlooking is not possible and a low and thin band of vegetation is able to screen views to a development from a given viewpoint. In areas of undulating or elevated topography, overlooking can occur and vegetation needs to be higher and denser to achieve effective screening. Intervening undulating topography also has the potential to block views in certain landscapes.

1.2. VISUAL IMPACT / EFFECTS

The key components of the visual impact assessment methodology are:

- Visual modification – How does the Project contrast or integrate with the landscape character of the surrounding setting and what is the ability of the setting to accommodate change?
- Sensitivity – How sensitive will viewers be to the Project based on their anticipated user experience and their proximity to it?

1.2.1. Visual modification to the existing setting

The visual modification level of a proposed development can be best measured as an expression of the visual interaction, or the level of visual contrast between the Proposal and the existing visual environment (Zube et al., 1976).

A high degree of visual modification will result if the major components of the development contrast strongly with the existing landscape.

A low or very low degree of visual modification occurs if there is little or minimal visual contrast and a high level of integration of form, line, shape, pattern, colour or texture values between the development and the environment in which it sits. In this situation, the development may be noticeable, but does not markedly contrast with the existing modified landscape.

Throughout the visual catchment (the area from which the Project can be seen) the degree of modification will generally decrease as the distance from the Project to various viewing locations increases.

1.2.2. Visual Sensitivity

Visual sensitivity is a measure of how critically a change to the existing landscape will be viewed from various use areas (Brush and Shafer, 1975). Different activities undertaken within the landscape setting have different sensitivity levels. For example, tourists who are using the surrounding landscape as a part of the holiday experience will generally view changes to the landscape more critically than agricultural or mine workers in the same setting. Similarly, individuals will view changes to the visual setting of their residence more critically than changes to the visual setting of the broader setting in which they travel or work.

The visual sensitivity to the Project depends on a range of viewer characteristics. The primary characteristics used in this study are:

- Land use.
- Distance of the Project from viewers.

The visual sensitivity of land uses was assessed as it will assist in determining the potential visual effect of the project. As distance from the viewer to the Project increases, the level of sensitivity reduces.

Typical levels of viewer sensitivity for the Study Area or Regional Study Area are outlined in ***Table*** 1.

VISUAL SENSITIVITY - LAND USE AREA	FOREGROUND		MIDDLEGROUND		BACKGROUND
	Local Setting		Sub- Regional Setting		Regional Setting
	0 - 0.5 km	0.5 – 1 km	1 - 2 .5 km	2.5 - 5 km	> 5 km
National Parks*	H	H	H	M	M
Townships / Settlements	H	H	H	M	L
Tourism / Accommodation	H	H	H	M	L
Recreation Areas	H	M	M	L	L
Highways/Tourist Routes	H	M	M	L	L
Tourist Rail (The Ghan)	H	M	M	L	L
Local Roads	L	L	L	VL	VL
Agricultural Areas	L	L	L	VL	VL
Mining / Resource Extraction	VL	VL	VL	VL	VL
Legend - H = High, M = Moderate, L = Low, VL = Very Low					

Source: United States Department of Agriculture Forest Service (1995)

**For National Parks, visual sensitivity levels drop to low beyond 10kms.*

Table 1 – Typical Visual (viewer) Sensitivity

1.2.3. Approach to Assessment of Effects

The methodology employed by Urbis is based on the Visual Management System (VMS) (United States Department of Agriculture [USDA] Forest Service, 1974) methodology. The basis of this methodology is that the visual effect of a proposed development is determined by evaluating the degree of visual modification/fit of the development in the context of the visual sensitivity of surrounding land use areas, from which a proposed development may be visible. The visual effect resulting from the combination of visual modification and visual sensitivity, or viewer sensitivity, is illustrated in ***Table 2*.**

Level of Visual Effect VL = Very Low, L = Low, M = Moderate, H = High		**Visual Sensitivity**		
		H	M	L
Level of Visual Modification	H	H	H	M
	M	H	M	L
	L	M	L	L
	VL	L	VL	VL

Table 2 – Visual Effect Matrix

1.3. LIMITATIONS OF THE ASSESSMENT

The baseline assessment has been undertaken at a desktop level utilising available aerial photography and Google “Streetview” images, supplemented by some recent site photography.

2. COMPONENTS OF THE PROJECT

2.1. ALIGNMENT

The Project consists of an above-ground 275 kV electricity transmission line running from a new proposed substation at Saltbush Hill to the existing Mount Gunson South substation, and a 132 kV electricity transmission line connecting the Mount Gunson South substation to the existing 132 kV Prominent Hill line to the west of the Olympic Dam Special Mining Lease (SML).

2.2. TRANSMISSION TOWERS / POLES

Towers and poles support the transmission line and are generally made of steel, concrete or aluminium. A range of tower and pole structures can be used for electricity transmission depending on the voltage of the line and the function of the structure.

The Project is expected to primarily use two types of structures: lattice towers and steel monopoles. Lattice towers consist of a steel lattice framework, while monopoles consist of a single pole. Further information on these types of towers is provided in the discussion below.

2.2.1. 275 kV line

Lattice towers are expected to be used for the 275 kV line. These towers would typically be 50 to 60 m in height for a 275 kV line, with the taller height generally required for longer spans.

The design of the lattice towers will be site-dependent, and will vary depending on the position of the conductors and the loads that the tower has to bear. A large proportion of the towers (where the line is straight) will be suspension towers and have an identical design, while larger or more heavily constructed (strain or angle) towers will be used for turning the line through an angle, dead-ending (terminating) a line, or where increased spans or increased clearances and strength are required (for example at road and rail crossings).

Examples and schematics of lattice towers, representative of the towers that are likely to be used, are shown in ***Plate 1***.

Plate 1 – Lattice Towers (132 kV on right, 275 kV on left) (Source: ElectraNet)

Tower spacing for the 275 kV line is anticipated to be 450 to 500 m. This distance may change in locations which involve road crossings, turning of the alignment and environmental crossings, where larger spans (using larger towers) may be used.

2.2.2. 132 kV line

Steel monopoles or possibly smaller lattice towers will be used for the 132 kV line. Examples and schematics of monopoles or smaller lattice towers, representative of the towers that are likely to be used, are shown in ***Plate 2***.

Plate 2 – Example 132 kV pole and tower (Source: ElectraNet)

2.2.3. Construction and maintenance

At each structure location, there will be a need for a flat cleared laydown area to enable tower or pole footing construction and structure erection, including line stringing and tensioning. An example can be seen in ***Plate 3***. Depending upon terrain and structure type, the clearance areas can range from approximately 20 m x 20 m to 50 m x 50 m. Cleared sites will typically be left to naturally regenerate with original topsoil respread back over the area.

An access track approximately 5 m wide to the base of each tower is required. Existing roads and tracks will be used wherever possible. Where there is no existing track, a new track generally paralleling the transmission line would be constructed, typically by light grading. Capping with imported material may be required in limited areas.

Plate 3 – Indicative Pole Construction Area (Source: ElectraNet)

3. BASELINE REPORT - THE EXISTING LANDSCAPE

3.1. PROJECT CONTEXT

The southern extent of the Project Area is located at Solar Reserve's Aurora project, approximately 20 km north of Port Augusta, and extends from here approximately 237 km to the north, terminating 16 km to the north west of the township of Roxby Downs.

At its closest, the southern extent of the Project Area is located 25 km to the west of the Flinders Ranges National Park. Approximately mid-way along its extent, the Project Area is located between Lake Gairdner, 75 km to the west, and Lake Torrens, 55 km to the east. Both lakes are designated National Parks. All National Park areas are considered to be high value landscapes with high visual sensitivity users.

3.2. EXISTING POLICY

The transmission line alignment traverses three Development Plan areas. These are:

- Land Not Within a Council Area (Flinders).
- Land Not Within a Council Area Eyre, Far North, Riverland and Whyalla.
- Roxby Downs (Municipality) Development Plan.

Key objectives of these plans relating to the protection of landscape and scenic values are outlined below.

3.2.1. Land Not Within a Council Area (Flinders) Development Plan

The Project alignment is wholly within the Pastoral Zone. The relevant objective of this zone is:

- The preservation of the natural environment and character of the zone.

3.2.2. Land Not Within a Council Area Eyre, Far North, Riverland and Whyalla

The transmission line alignment is wholly within the Remote Areas Zone. The relevant objectives of this zone include:

- A zone accommodating the remote areas of the state suited to pastoral, conservation, mining and
- remote townships, settlements and Aboriginal lands, and accommodating defence related facilities.
- Development of the zone to reflect the sustained growth in mining, petroleum exploration and related activities, recognising the significance of mineral deposits throughout the region.
- Development that contributes to the desired character of the zone.

3.2.3. Roxby Downs (Municipality) Development Plan

The transmission line crosses two zones under this Development Plan: Buffer Zone and Rural Landscape Zone.

The objective of the Buffer Zone is:

- To preserve the 'natural open character of the zone and the regeneration of the natural vegetation'.

The objective of the Rural Landscape Zone is:

- 'The preservation of the natural open character of the zone and the regeneration of the natural vegetation, with recreational uses occurring in suitable parts of the zone'.

3.3. LAND USE

The Project Area traverses a Regional Study Area which is generally undeveloped, with few areas of permanent settlement. Settlements or townships occur at a limited number of locations along the Project Area. These are:

- Roxby Downs – 4.5 km to the east.

- Woomera – 6.5 km to the west.
- Pimba – 9.5 km to the west.

Land uses within the Regional Study Area are primarily low density sheep grazing and resource development in a number of localised areas.

The Project Area roughly follows the alignment of the Stuart Highway and the Port Augusta to Alice Springs railway line, the route of The Ghan tourist train. North of Woomera the alignment generally follows the Olympic Dam Highway.

A number of existing powerlines run roughly parallel to the Stuart Highway and the railway line throughout much of the length of the Regional Study Area, effectively creating a transport and energy infrastructure corridor character. The proximity of existing powerlines to the Stuart Highway and the railway line varies from approximately 500 m to 10 km. The existing powerlines cross the Olympic Dam Highway and remain in close proximity and roughly parallel to it for over 20 km (refer to Plate 4).

Plate 4 – Existing power infrastructure adjacent to the Olympic Dam Highway

3.4. LANDSCAPE CHARACTER TYPES AND SCENIC QUALITY

Based on the assessment of landscape character types and scenic quality, the local and sub-regional setting of the broader Project area can be divided into the landscape units and levels of scenic quality, as shown in ***Figure 2*** and ***Figure 3***. Refer also to ***Plates 5 – 10***.

The assessment of landscape character types and scenic quality has been undertaken at a desktop level, applying the attributes as described in ***Section 1.1.2*** and ***Section 1.1.3***.

Table 3 – Landscape Units and Scenic Quality

LANDSCAPE UNIT AREA	PROJECT CHAINAGE (KM)	SCENIC QUALITY	CHARACTERISTICS/USE
Unit 1 – Low Dunes	**132 kV Section** CH75 – 127km	Low - Moderate	▪ diverse vegetation of varying height and density ▪ broad plain with slight to locally moderate topographic variation ▪ direction of dunes generally aligned
Unit 2 – Open Plain	**132 kV Section** CH45 – 75km CH10 – 40km CH0 – 5 **275 kV Section** CH100 – 108	Low	▪ very low homogenous vegetation ▪ broad plain with minimal topographic variation
Unit 3 – Undulating Open Plain	**132 kV Section** CH40 – 45km	Low	▪ very low homogenous vegetation ▪ broad plain with slight topographic variation
Unit 4 – Salt Lakes	**132 kV Section** CH5 – 10km **275 kV Section** CH80 – 82km	Moderate to High	▪ Backdropped by isolated rounded hills ▪ salt lakes occasionally water filled ▪ minimal vegetation surrounding lake beds.
Unit 5 – Folded Hills	**275 kV Section** CH50 – 55km Offset from Project Area – **275 kV Section** CH 20 – 45km	Low to Moderate	▪ moderate degree of topographic variation. ▪ generally homogenous vegetation of a similar height but varying density

Unit 6 – Abrupt Hills	**275 kV Section** Offset from Project Area – CH 0km	Moderate	▪ moderate to high degree of topographic variation. ▪ exposed geology and rock formations ▪ strongly defined patterns resulting from combinations of eucalypt forest and treeless areas
Unit 7 – Shrubland Plain	**275 kV Section** CH60 – 80km CH0 - 55km	Low to Moderate	▪ minimal to slight topographic variation ▪ Generally homogenous vegetation of a similar height but varying density

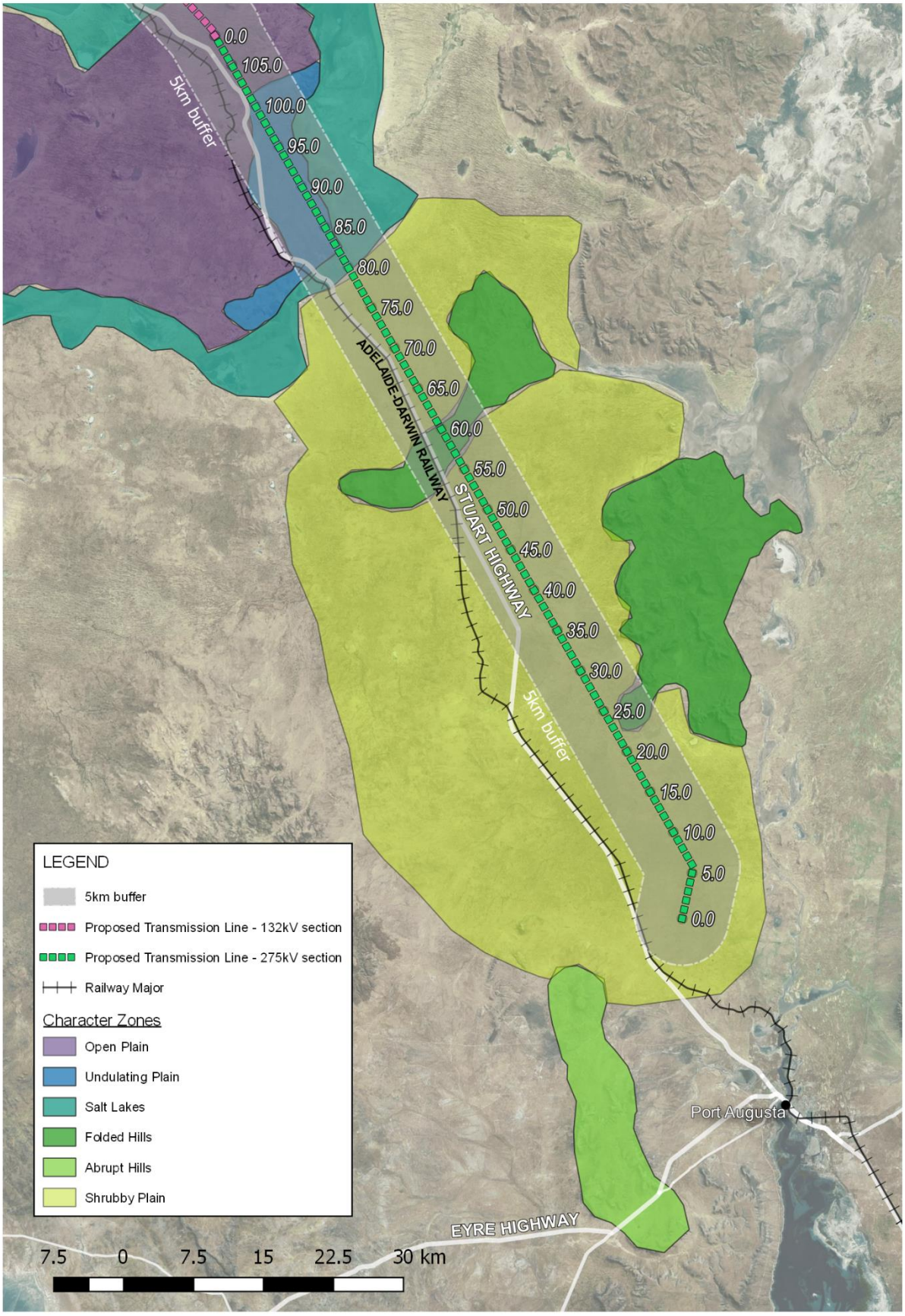

Figure 2 – Landscape character units – 275 kV Section

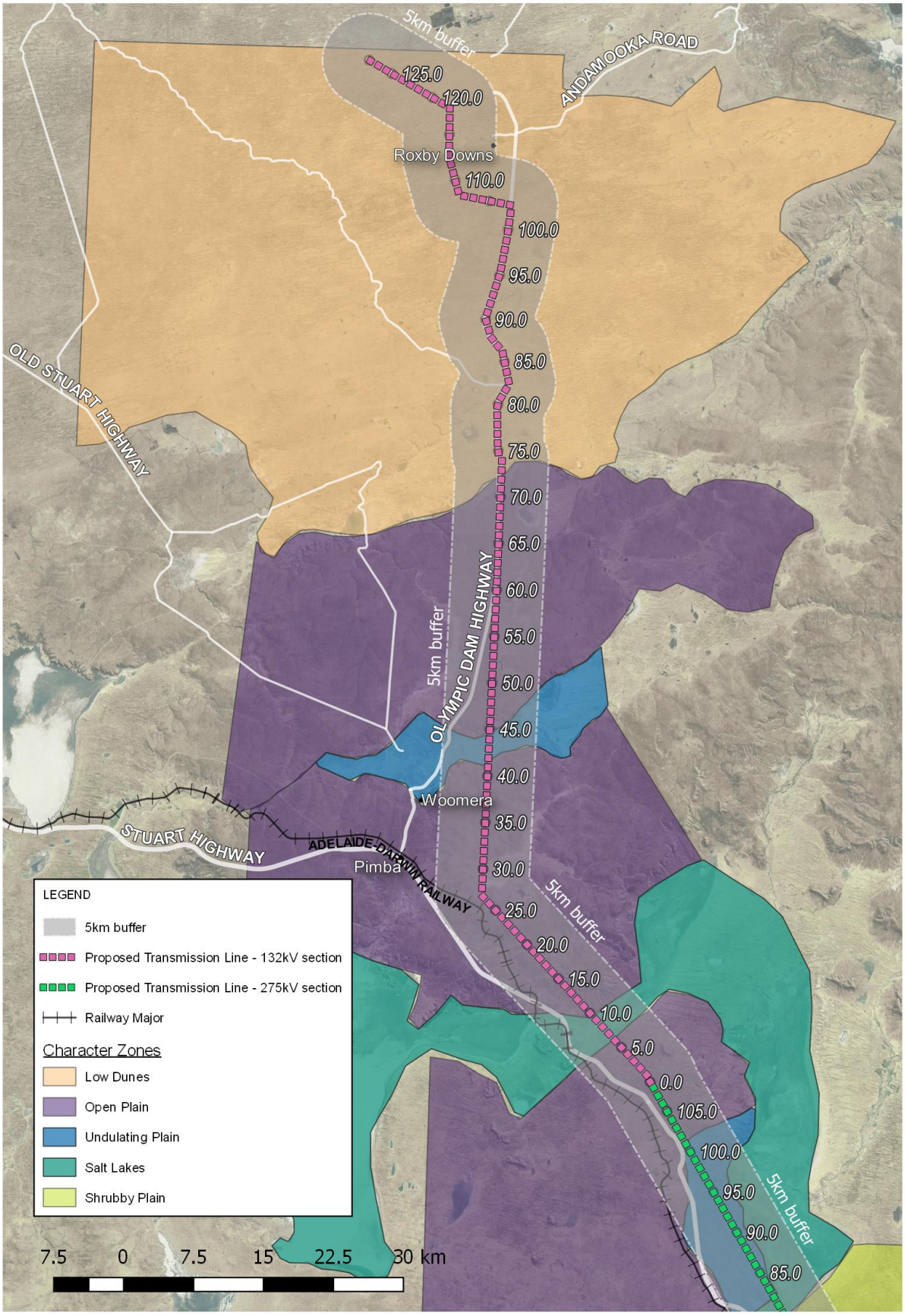

Figure 3 – Landscape character units – 132 kV Section

Plate 5 – Unit 1 – Low Dunes

Plate 6 – Unit 2 – Open Plain

Plate 7 – Unit 3 – Undulating Open Plain

Plate 8 – Unit 4 – Salt Lakes

Plate 9 – Unit 6 – Abrupt Hills

Plate 10 – Unit 7 – Shrubland Plain

3.4.1. Night time setting

Night time illumination in the region of the Project area, away from the townships of Olympic Dam, Woomera and the settlement of Pimba, is that of an intrinsically dark landscape[1].

[1] The Institute of Lighting Engineers (ILE) Guidance Notes for Reduction of Light Pollution

3.5. KEY VISTAS

The Project Area is generally not visible from publicly accessible viewpoints apart from where it approaches the Stuart Highway, the Olympic Dam Highway or the Port Augusta to Alice Springs railway line.

Key vistas of the landscape are afforded from the Stuart Highway, particularly road side rest areas or signed viewing points or lookouts. Key scenic viewpoints identified include:

- Island Lagoon lookout (refer to ***Plate 11***).
- Ranges View rest area (refer to ***Plate 12***).

Of these views, the view from Island Lagoon is to the west away from the Project Area and existing powerline infrastructure. Views from Ranges View rest area are to the east and the Project Area. Existing low voltage powerline infrastructure is visible in the immediate foreground.

Views will also be afforded from The Ghan, although these will be transitionary given the constant movement of the train.

Key features in views of the landscape are rocky outcrops, dune fields and salt lakes. The salt lakes being attractions both when dry and when occasionally water filled.

Although the focus of the viewpoints corresponds with landscapes with attributes of higher scenic quality, some viewers will appreciate areas of flat and expansive landscape for their intactness and remoteness, particularly viewers from urban areas who appreciate the concept of a “big sky”.

Plate 11 – View from Island Lagoon look out

Plate 12 – View from Ranges View rest area

3.6. ABSORPTIVE CAPABILITY

The definition of landscape absorptive capability is an assessment of how well a landscape setting is able to accommodate change.

The key factors considered in determining absorptive capability are topography and vegetation. In areas of flatter topography, overlooking is not possible and a low (eye height) and thin band of vegetation is able to screen views to a development from a given viewpoint. In areas of undulating or elevated topography, overlooking can occur and vegetation needs to be higher and denser to achieve effective screening. Intervening undulating topography also has the potential to block views in certain landscapes.

The landscape settings of the Project and its local, sub-regional and nearer regional surroundings (the primary areas subject to visual impact) have absorptive capabilities as described in ***Table 4***.

Table 4 – Landscape Absorptive Capability

Unit	Topography	Vegetation	Overall
Unit 1 – Low Dunes	moderate to high	moderate to high	moderate
Unit 2 – Open Plain	high	low	low
Unit 3 – Undulating Open Plain	high	low	low
Unit 4 – Salt Lakes	low to moderate	low	low
Unit 5 – Folded Hills	mod	low	low
Unit 6 – Abrupt Hills	low	low	low
Unit 7 – Shrubland Plain	high	low to moderate	low to moderate

4. VISUAL ASSESSMENT OF EFFECTS

4.1. VISIBILITY OF THE PROJECT

The area of highest visibility, and potentially higher impact, will typically be confined to within 1 km of the Project Area.

In the typically open landscape with low vegetation, views along, or close to parallel to, the Project Area, will be potentially less impacted than views perpendicular to it.

4.2. SENSITIVE VIEWPOINTS

Analysis was undertaken to identify a range of typical representative sensitive viewpoints in the visual setting of the Project.

The representative viewpoints (VP), located within the local, sub-regional and regional settings chosen for detailed assessment based on their higher levels of viewer sensitivity (***Figure 4*** and ***Figure 5***) are:

4.2.1. 275 kV Section

- Lookouts
  - Island Lagoon look out (VP6).
  - Ranges View rest area (VP3).
- Tourist Routes – Road and Rail
  - Stuart Highway (VP2, VP4 and VP5).
  - The Ghan and Stuart Highway (VP1)

4.2.2. 132 kV Section

- Townships
  - Roxby Downs – 4.5 km to the east (VP11).
  - Woomera – 6.5 km to the west (VP8).

Settlement

  - Pimba – 9.5 km to the east (VP7).
- Lookouts
  - Island Lagoon look-out - 4.6 km to the east (VP6).
- Local Access Roads
  - Olympic Dam Highway – 50 m to the west (VP9 and VP10).

High sensitivity National Parks, Flinders Ranges, Lake Gairdner and Lake Torrens, are located more than 10 km from the Project Area. As a result, the visual sensitivity of these areas is determined to be low.

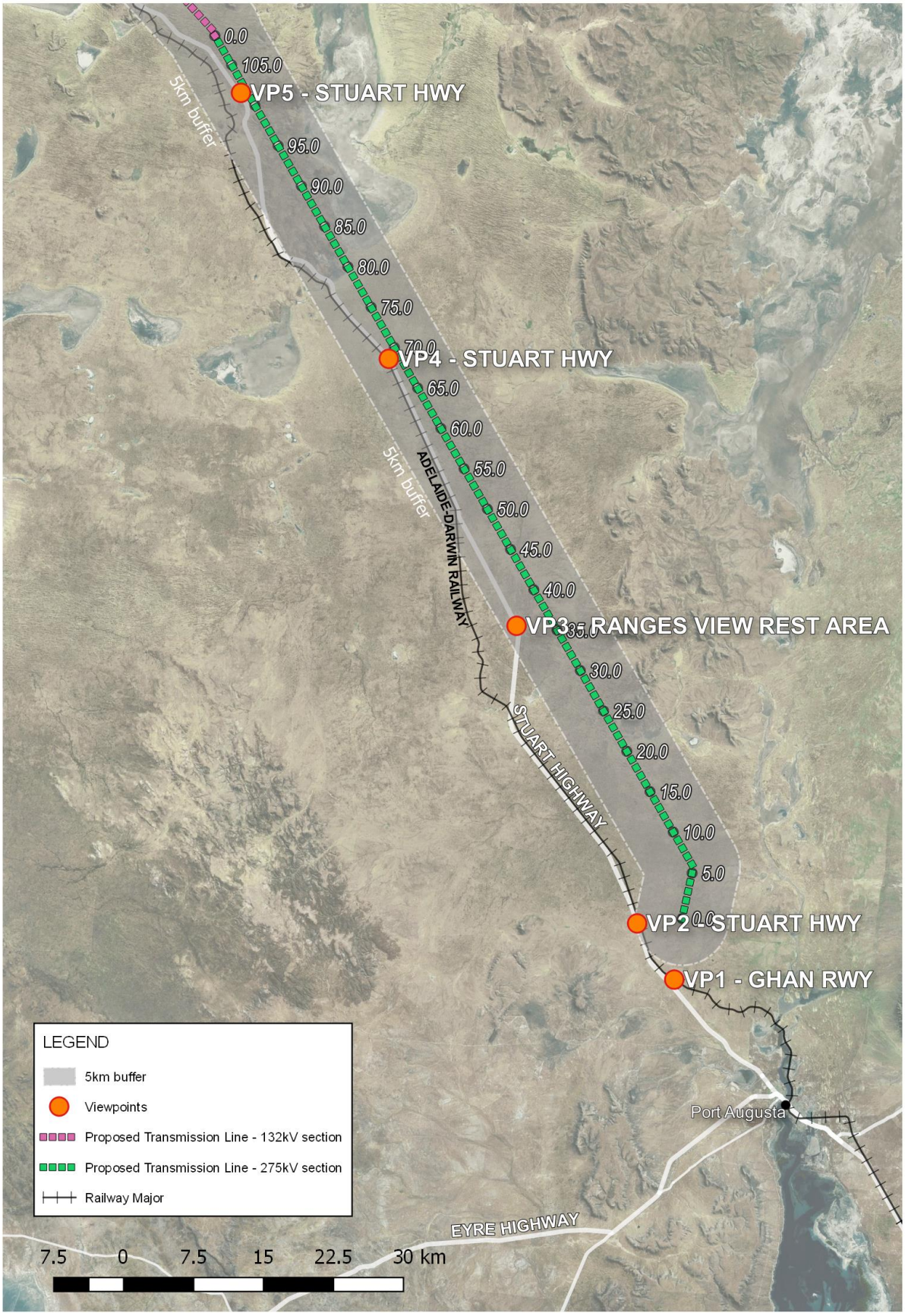

Figure 4 – Sensitive Viewpoints – 275 kV Section

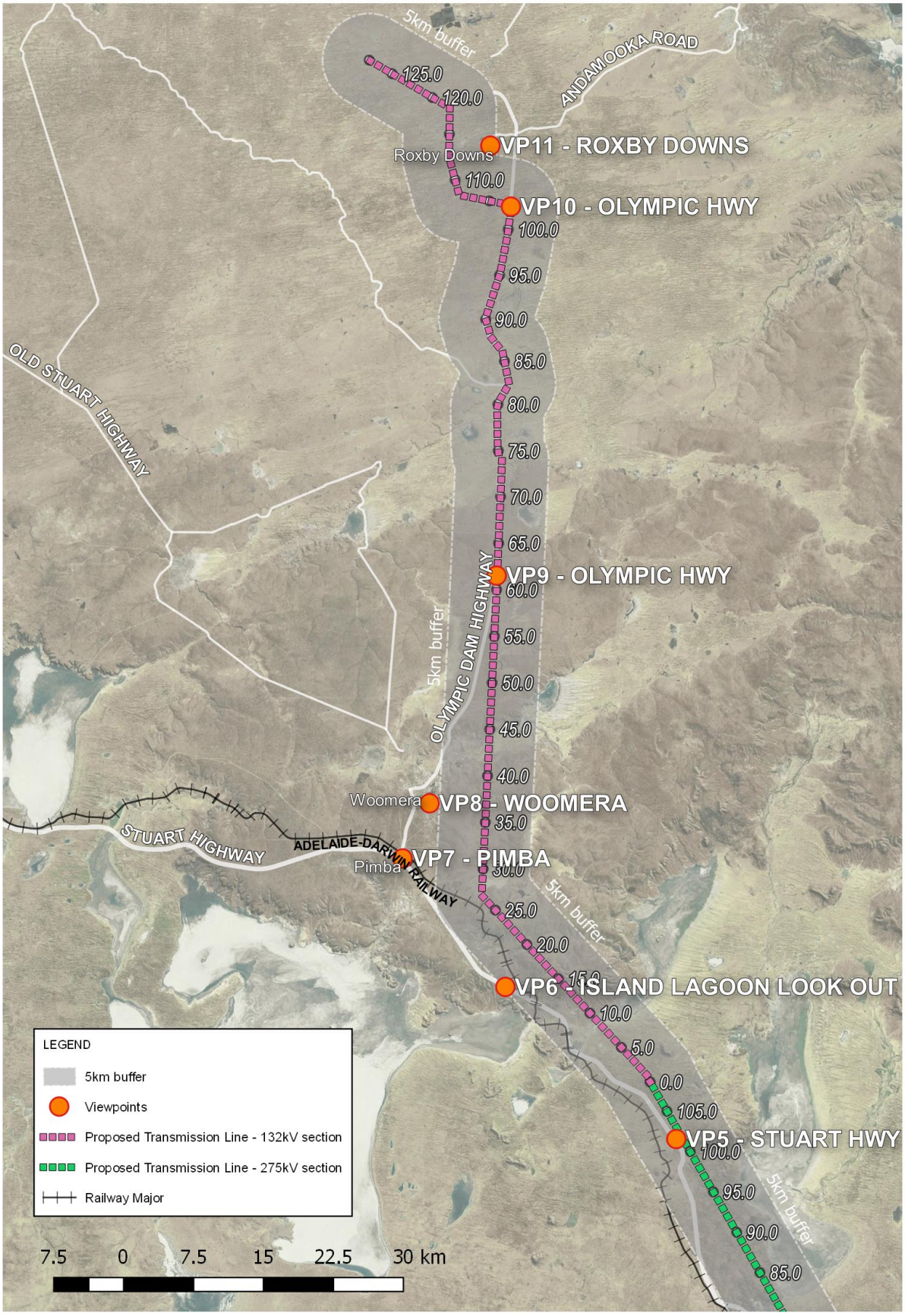

Figure 5 – Sensitive Viewpoints – 132 kV Section

4.3. VISUAL INTERACTIONS – 275 KV SECTION

The Project Area traverses a number of landscape types and in settings with varying levels of existing visual modification which influence the level of impact.

4.3.1. Viewpoint 1 – Ghan Railway and Stuart Highway

The viewpoint is from the carriageway of the Stuart Highway, approximately 900 m from the railway line. Solar Reserve's proposed transmission line to the Aurora solar thermal project site crosses both the Stuart Highway and the railway line in this location. The southern end of NA1 is located approximately 6.5 km to the north of the railway line.

Distance from the Project

The viewpoint is located 7.4 km from the Project.

Visual Sensitivity

Low, due to the distance of the Project from a tourism use associated with a major highway and railway line.

Visual Modification

Very low, due to the proposed power line being located adjacent to existing power infrastructure elements, which already result in a modification to the setting, and the effect of distance in reducing visibility.

Note: The proposed Solar Reserve Aurora project will also be located in this area.

Potential Visual Effect

The low level of visual sensitivity combined with a very low visual modification level will result in a very low visual effect for this section of the proposed power line route.

Plate 13 - View from Stuart Highway towards the Ghan Railway line and Project, with existing pipeline in foreground.

4.3.2. Viewpoint 2 – Stuart Highway

The viewpoint is from the carriageway of the Stuart Highway.

Distance from the Project

The viewpoint is located 4.8 km from the Project.

Visual Sensitivity

Low, due to the distance of the Project from a tourism use associated with a major highway.

Visual Modification

Very low, due to the proposed power line being located adjacent to existing power infrastructure elements, which already result in a modification to the setting, as well the effect of distance in reducing visibility. Additionally, infrastructure immediately adjacent to the road way results in an existing modified visual setting.

Potential Visual Effect

The low level of visual sensitivity combined with a very low visual modification level will result in a very low visual effect for this section of the proposed power line route.

Plate 14 View from Stuart Highway towards the Project with an existing pipeline on the eastern side of the road.

4.3.3. Viewpoint 3 – Ranges View Rest Area

This viewpoint is a wayside rest area off the Stuart Highway. It affords distant views across a flat plain to the Flinders Ranges. Its user group would include tourists.

Distance from the Project

The viewpoint is located 3.5 km from the Project.

Visual Sensitivity

Although tourists are considered a high sensitivity user group, the sensitivity level is low due to the distance of the viewpoint from the Project.

Visual Modification

Low, due to the proposed power line being located adjacent to existing vertical infrastructure elements, some significantly larger than that proposed, which already significantly modify the setting. Additionally, powerlines are located across the foreground of the field of view.

Potential Visual Effect

The low level of visual sensitivity combined with a low visual modification level will result in a low visual effect for this section of the Project.

Plate 15 - View from the Stuart Highway, adjacent to the rest area, towards the Project.

4.3.4. Viewpoint 4 – Stuart Highway

The viewpoint is from the carriageways on the Stuart Highway.

Distance from the Project

The viewpoint is located 1 km from the Project.

Visual Sensitivity

Moderate, due to the tourism use associated with a major highway.

Visual Modification

Very low, due to the proposed power line being located adjacent to existing power infrastructure elements, which already result in a modification to the setting, and the screening provided by scattered vegetation up to 4 metres in height.

Potential Visual Effect

The moderate level of visual sensitivity combined with a very low visual modification level will result in a very low visual effect for this section of the proposed power line route.

Plate 16 - View from the Stuart Highway towards the Project. Views to existing power poles and the Project are screened by vegetation.

4.3.5. Viewpoint 5 – Stuart Highway

The viewpoint is from the carriageway of the Stuart Highway.

Distance from the Project

The viewpoint is located 0.6 km from the Project.

Visual Sensitivity

Moderate, due to the tourism use associated with a major highway.

Visual Modification

Low to moderate, due to the proposed power line being located adjacent to existing power infrastructure elements, which already result in a modification to the setting.

Potential Visual Effect

The moderate level of visual sensitivity combined with a low to moderate visual modification level will result in a low to moderate visual effect for this section of the proposed power line route.

Plate 17 - View from the Stuart Highway towards Project. Existing power poles can be seen on the horizon.

4.4. VISUAL INTERACTIONS – 132 KV SECTION

4.4.1. Viewpoint 6 – Island Lagoon Look Out

The viewpoint is from the carriageway of the Stuart Highway adjacent to the look-out area.

Distance from the Project

The viewpoint is located 4.6 km from the Project.

Visual Sensitivity

Although tourists are considered a high sensitivity user group, the sensitivity level is low due to the distance of the viewpoint from the Project.

Visual Modification

Very low, due to the proposed power line being located adjacent to existing power infrastructure elements, which already result in a modification to the setting, as well the effect of distance in reducing visibility.

The scenic view over Island Lagoon is not impacted as it is in the opposite direction to the Project.

Potential Visual Effect

The low level of visual sensitivity combined with a very low visual modification level will result in a very low visual effect for this section of the proposed power line route.

Plate 18 - View from the Stuart Highway towards the Project.

4.4.2. Viewpoint 7 – Pimba Settlement

The viewpoint is from the carriageway of the Olympic Dam Highway on the eastern edge of Pimba.

Distance from the Project

The viewpoint is located 8.5 km from the Project.

Visual Sensitivity

Low, due to the distance from the Project.

Visual Modification

Very low, due to the effect of distance in reducing visibility.

Potential Visual Effect

The low level of visual sensitivity combined with a very low visual modification level will result in a very low visual effect for this section of the proposed power line route.

Plate 19 - View from Pimba Settlement towards the Project.

4.4.3. Viewpoint 8 – Woomera Township

The viewpoint is from Coorilla Avenue on the eastern outskirts of Woomera.

Distance from the Project

The viewpoint is located 6 km from the Project.

Visual Sensitivity

Low, due to the distance from the Project.

Visual Modification

Very low, due to the screening effects of rising topography and the effect of distance in reducing visibility.

Potential Visual Effect

The low level of visual sensitivity combined with a very low visual modification level will result in a very low visual effect for this section of the proposed power line route.

Plate 20 - View from Woomera township towards the Project.

4.4.4. Viewpoint 9 – Olympic Dam Highway

The viewpoint is from the carriageway of the Olympic Dam Highway.

Distance from the Project

The viewpoint is located 100 m from the Project.

Visual Sensitivity

Low, due to the road being primarily for local access and not tourism.

Visual Modification

Existing power lines are located on the west side of the road, resulting in an existing modification to the visual setting, particularly views to the west.

Views to the east are currently uninterrupted by powerlines or other infrastructure.

The visual modification level will be moderate to high, due to the proposed power line resulting in the enclosure of the view from the road.

Potential Visual Effect

The low level of visual sensitivity combined with a moderate to high visual modification level will result in a low to moderate visual effect for this section of the proposed power line route.

Plate 21 - View from the Olympic Dam Highway towards the Project.

4.4.5. Viewpoint 10 – Olympic Dam Highway

The viewpoint is from the carriageway of the Olympic Dam Highway.

Distance from the Project

The viewpoint is located 70 m from the Project.

Visual Sensitivity

Low, due to the road being primarily for local access and not tourism.

Visual Modification

Moderate, due to the proposed power line being partially screened from view by scattered taller vegetation and undulations in the topography in the foreground of the view.

Potential Visual Effect

The low level of visual sensitivity combined with a moderate visual modification level will result in a low visual effect for this section of the proposed power line route.

Plate 22 - View from the Olympic Dam Highway towards the Project.

4.4.6. Viewpoint 11 – Roxby Downs Township

The viewpoint is from the carriageway of the Olympic Dam Highway and the western edge of the township.

Distance from the Project

The viewpoint is located 4.5 km from the Project.

Visual Sensitivity

Low, due to distance from the Project.

Visual Modification

Very low due to the screening provided by taller vegetation and the reduction of visibility with distance.

Potential Visual Effect

The low level of visual sensitivity combined with a very low visual modification level will result in a very low visual effect for this section of the proposed power line route.

Plate 23 - View from Roxby Downs township towards the Project.

4.5. NIGHT TIME LIGHTING EFFECTS

It is expected that other than in close proximity to the Olympic Dam airport, where aviation warning lights may be required, the project will not be illuminated. As a result, there will be no night time lighting effects.

5. CONCLUSION

5.1. LANDSCAPE CHARACTER EFFECTS

The landscape settings of the Project throughout its local, sub-regional and nearer regional surroundings, (the primary areas subject to visual effect) have absorptive capabilities that are typically high for topography, due to limited opportunities for overlooking, and low for vegetation, due to the typically expansive landscapes with low growing vegetation.

The proposed power line route is generally located in a setting that has already been subject to modification by power infrastructure development. The colocation of additional infrastructure of a similar visual character will result in incremental change to the character of the landscape setting, rather than a significant change in character.

In these situations, the development may be noticeable, but does not markedly contrast with the existing landscape. This effect will decrease as the distance from the line to various viewing locations increases.

Consolidation of alike elements reduces effects on the landscape. Given the relatively slender form of the components of the project, consolidation of alignments will result in a minimal cumulative impact on the landscape of the setting.

5.2. VISUAL EFFECTS

Much of the route is located away from areas of higher viewer sensitivity but where it is located adjacent to a higher sensitivity viewpoint, the presence of existing infrastructure and modification to the visual and landscape setting often reduces the overall level of effect.

Where the Project is located on the opposite, eastern side of the Olympic Highway from existing powerline infrastructure to the west of the road, the modification level is greater than it would be if it were collocated.

Overall, the visual effect is reduced due to the distance of the Project from sensitive viewpoints.

6. REFERENCES

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Appendix F. Traffic Assessment

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Appendix F1. Traffic Baseline Assessment

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OZ Minerals Limited

Carriewerloo Substation to Prominent Hill Electricity Transmission Line Project

Traffic Baseline Assessment

July 2018

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1. Introduction

This assessment details traffic baseline conditions relevant to the OZ Minerals Limited Carriewerloo Substation to Prominent Hill Electricity Transmission Line Project.

An assessment of the baseline traffic conditions surrounding the Project Area is required as part of the Development Application submission. This report will assess the current traffic data available for the project area inclusive of crash statistics, traffic volumes, access arrangements and land use immediately surrounding the project area.

1.1 Purpose of this report

The purpose of this report is to identify the existing conditions and arrangements at the Project Area and provide a baseline assessment. This report will not assess future conditions and is intended to be a standalone document which assesses the existing traffic conditions and road uses.

1.2 Assumptions

The following qualifications, assumptions and exclusions apply to all works specified within this document;

- Scope of works is limited to the specified area identified by OZ Minerals Limited as the Carriewerloo Substation to Prominent Hill Electricity Transmission Line Project.
- Information and data provided to GHD by either OZ Minerals Limited or government websites, has not been independently verified or checked beyond the agreed scope of work and is assumed to be an accurate representation of existing conditions and deemed suitable for the purpose of this assessment. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.3 Limitations

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2. Project Area

The Project Area has been identified in **Figure 2** below and mostly runs adjacent to the Stuart Highway up until Pimba where the line then follows the Olympic Dam Highway before turning off and continuing along Olympic Way. All of these roads are owned and maintained by the Department of Planning, Transport and Infrastructure (DPTI).

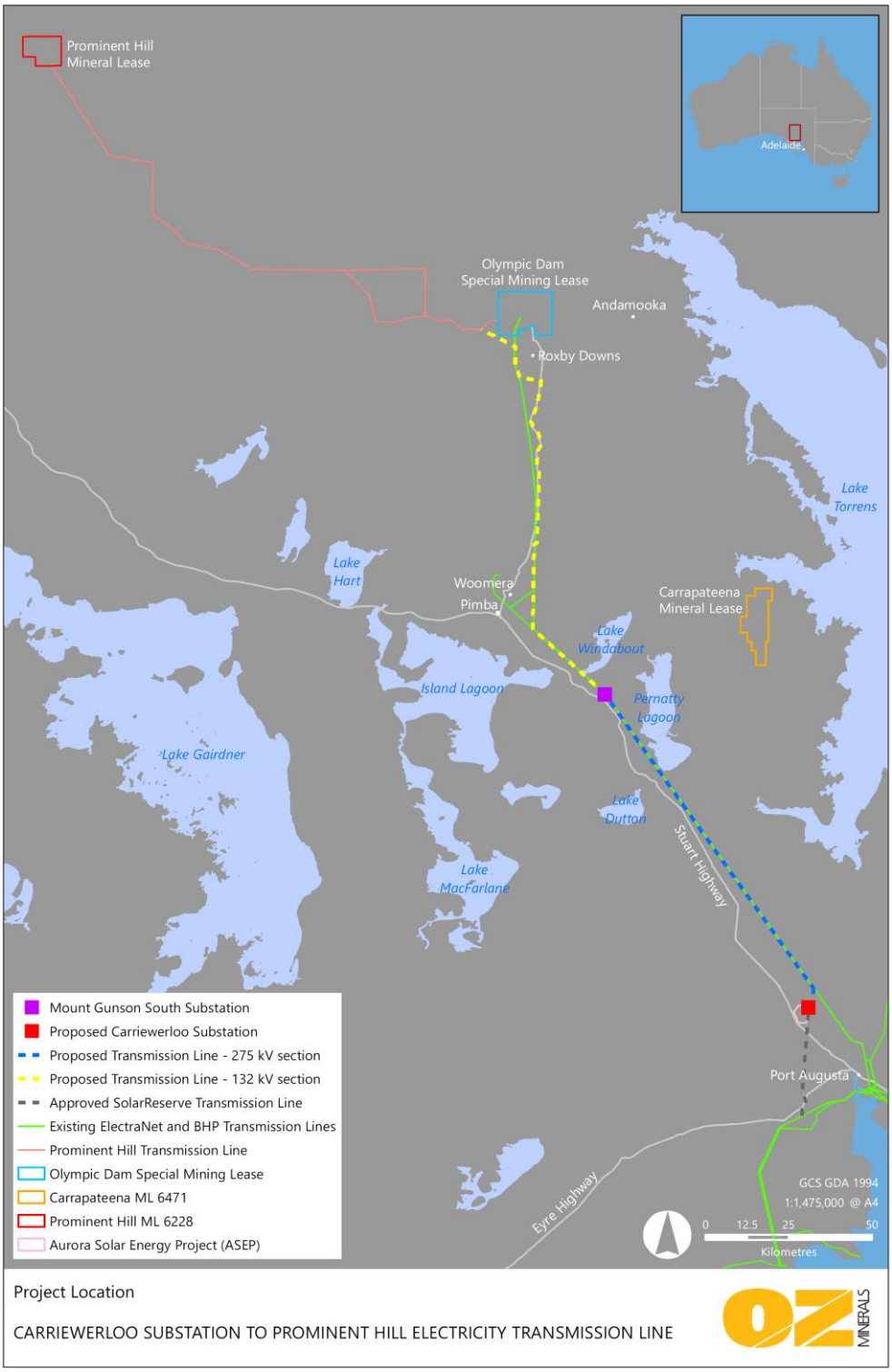

Figure 1 Carriewerloo Substation to Prominent Hill Electricity Transmission Line

This report encompasses traffic baseline conditions within the Regional Study Area which includes roads in and adjacent to the Project Area and linked transport routes. The main source of materials is expected to come from Port Adelaide and therefore a basic assessment of these routes will be included.

Table 1 is a summary of roads to be included within this assessment.

Table 1 Roads forming potential freight route

Roads included within Assessment			
Olympic Dam Highway	Olympic Way	Stuart Highway	Eyre Highway
Victoria Parade	Augusta Highway	Port Wakefield Highway	Port Wakefield Road
Salisbury Highway	Port River Expressway		

3. Traffic Data

3.1 Restricted Access Vehicles

Currently the route surrounding the project area is approved for vehicles up to Performance Based Standard (PBS) Level 4A and continues on past Olympic Dam. **Figure 2** is an extract from the RAVnet website and details the routes approved for up to Level 4A vehicles.

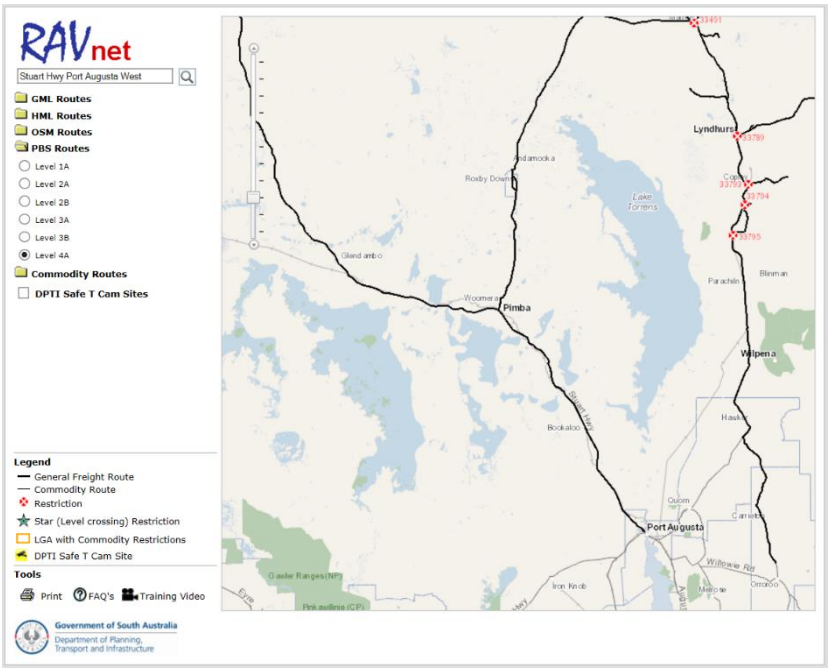

Figure 2 RAVnet Extract obtained March 2018 (Project Area)

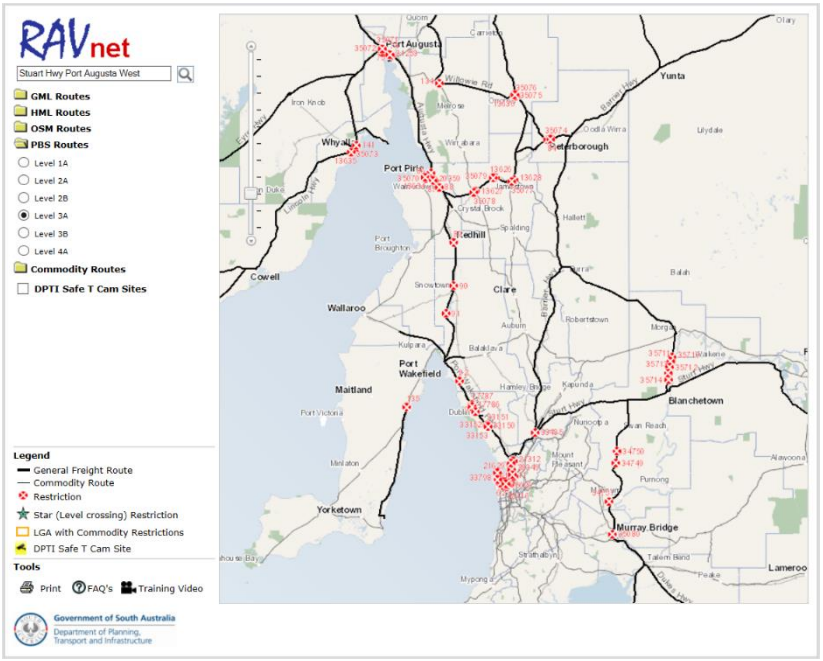

Figure 3 RAVnet Extract April 2018 (Port Augusta - Port Adelaide)

The route from Port Augusta to Port Adelaide is currently approved for vehicles up to PBS Level 3A however, Level 3B are approved from Port Augusta up to Two Wells. Level 4A vehicles are currently only approved north of Port Augusta.

3.2 Traffic Volumes

Traffic Volumes have been identified for the following roads adjacent to the Project Area and have been sourced from the Location SA Map Viewer website. Annual Average Daily Traffic (AADT) volumes are presented in **Table 2** with Commercial Vehicles (CV) identified as a percentage of the AADT.

Table 2 Traffic Volumes

Location	AADT	CV (%)	Year of Count
Olympic Way Between Olympic Dam Highway and 3.78 RRD	430	11.5%	2011
Olympic Dam Highway Between Woomera and Olympic Way	430	24.5%	2014
Olympic Dam Highway Between Pimba and Woomera	700	18.5%	2004
Stuart Highway Between Port Augusta and Pimba	850	28%	2016
Eyre Highway Between Victoria Parade and Stuart Highway	17500	7%	2018
Victoria Parade Entire Length	11800 – 14600	8.5% – 10%	2018
Augusta Highway Entire Length	3500 – 11800	10% – 23%	2015 – 2018
Port Wakefield Highway Entire Length	9600 – 16100	15.5 % – 18.5%	2014 – 2017
Port Wakefield Road Between Port Wakefield Highway and Salisbury Highway	55500 – 66100	13% – 13.5%	2014 – 2017
Salisbury Highway Between Port Wakefield Road and Port River Expressway	67300	11.5%	2015
Port River Expressway Entire Length	22500 – 42200	13.5% – 14%	2015

3.3 Crash Data

Crash Data has been obtained from the Location SA Map Viewer website for roads within the Regional Study Area.

3.3.1 Stuart Highway between Port Augusta and Pimba

Table 3 summarises the crashes from the last available 5 year period (2012 – 2016) for Stuart Highway between Port Augusta and Pimba. Majority of crashes resulted in property damage only (PDO) however there were a number of causality crashes which included 7 serious injuries and 1 fatality. The most common crash type was reported as "Hit Animal" with 24 crashes in total. During a site inspection conducted between 20th-22nd March 2018 it was observed that a number of properties surrounding the Stuart Highway were rural farming properties that did not have fencing to separate their properties and livestock from the highway.

The remaining crash types are types of crashes that are typically related to fatigue from long journeys. It was also noted that 48% of crashes that have occurred within the 5 year period were at night and low lighting may have been a contributing factor.

Table 3 Stuart Highway Crashes

	PDO		Injury		Serious Injury		Fatality		Total	
Hit Animal	23	19			1				**24**	**19**
Roll Over	7	2	5	2	2	1	1		**15**	**5**
Hit Fixed Object	7	3	2						**9**	**3**
Rear End	4								**4**	
Sideswipe					1	1			**1**	**1**
Left Road	2		2		1				**5**	
Head On	1	1			1				**2**	**1**
Right Turn					1				**1**	
Hit Object on Road			1						**1**	
Right Angle	1	1							**1**	**1**
Total	**45**	**26**	**10**	**2**	**7**	**2**	**1**		**63**	**30**

*RED = number of crashes occurring at night

**BLACK = total number of crashes (day and night)

3.3.2 Olympic Dam Highway between Pimba and Olympic Way

Table 4 summarises the crashes from the last available 5 year period (2012 – 2016) for Olympic Dam Highway between Pimba and Olympic Way. There is no clear trend in data that indicates a particular hazard however, there were still a large number of crashes occurring during night time conditions.

Table 4 Olympic Dam Highway Crashes

	PDO		Injury		Serious Injury		Fatality		Total	
Hit Animal	1		1	1					**2**	**1**
Roll Over	2	1	1	1	1				**4**	**2**
Hit Fixed Object	2	1	1						**3**	**1**
Head On			1						**1**	
Hit Object on Road	1								**1**	
Total	**6**	**2**	**4**	**2**	**1**				**11**	**4**

*RED = number of crashes occurring at night

**BLACK = total number of crashes (day and night)

3.3.3 Olympic Way between Olympic Dam Highway and Borefield Road

Table 5 summarises the crashes from the last available 5 year period (2012 – 2016) for Olympic Way between Olympic Dam Highway and Borefield Road. Majority of the crashes resulted in property damage only and no serious injuries or fatalities were reported. It is noted that 55% of these crashes occurred during night time conditions which indicates that low level lighting may be a contributing factor.

Table 5 Olympic Way

	PDO		Injury		Serious Injury		Fatality		**Total**	
Hit Animal	1		1						**1**	**1**
Roll Over	1	1							**1**	**1**
Hit Fixed Object	2	2	2	2					**4**	**4**
Left Road	1								**1**	
Rear End	1								**1**	
Total	**6**	**3**	**3**	**2**					**9**	**5**

*RED = number of crashes occurring at night

**BLACK = total number of crashes (day and night)

3.4 Traffic Environment

The Project Area travels along Stuart Highway through rural towns Pimba, Woomera and Roxby Downs. The majority of the road alignment within the Regional Study Area consists of straight roads with a few curved sections. The posted speed limit is 110 km/h which drops down to 80 km/h and then 60 km/h on the approach of towns. This area has a high percentage of heavy vehicles utilising the route and as such a number of overtaking lanes are present throughout.

4. Land Use

The majority of the land surrounding the project area is generalised for use of livestock and is mostly unfenced from the nearby road network. There are also relatively large sections of land marked for reserves running adjacent to Stuart Highway. A strip of vacant land adjacent to the Stuart Highway is located approximately half way between Port Augusta and Pimba on the western side of the road.

A portion of the Project Area travels through part of the Olympic Dam mining land and is not accessible to the general public. It is also expected that a large number of the heavy vehicles travelling through this section are generated by the works from the mine.

A water pipe runs adjacent the project area south of Woomera and is raised off of the ground. There are a number of existing access points that traverse over the pipe and have been built up to prevent damage occurring.

5. Site Observations

A site inspection was undertaken between the 20th of March and the 22nd of March 2018 to assess the baseline traffic conditions surrounding the project area. During the investigation it was observed that traffic volumes on the roads adjacent the project area are relatively low and have a high proportion of heavy vehicles.

High volumes of road kill were also identified during the site investigation and may be due to the lack of fencing surrounding farming properties in the area. It was noted that there are a number of signs along the road to inform drivers that livestock may cross the road at times as it is an unfenced area. The livestock on the road is considered to be a hazard to drivers as animals as large as cows were identified and the area is relatively remote which may cause potential issues if drivers are involved in an incident involving hitting an animal.

It was found that driving from Port Augusta to Olympic Dam was difficult in terms of fatigue management as the roads are mostly straight and the scenery is relatively similar throughout. Further assessment via the LocationSA website identified that there are no designated rest locations between Pimba and Olympic Dam however this section is only approximately a one hour drive. The LocationSA website identifies 4 rest locations on the northbound land and 4 on the southbound between Port Augusta and Pimba.

Fatigue management is to be dealt with in accordance with company polices that apply to the individual driver. Self-assessment of driver fatigue needs to be managed by the individual.

6. Summary

Traffic volumes on the roads surrounding the project area are relatively low with a high percentage of heavy vehicles. Due to the low volume of vehicles, long sight distances (due to the relatively straight nature of the road) and a number of overtaking lanes provided, safe overtaking opportunities are frequent. Currently it was observed that the roads adjacent the project area were operating effectively with no major issues identified.

Site investigations and analysis of the available crash data indicated that there is currently an issue with unfenced livestock properties adjacent to the roads with a total of 33% of crash types recorded as Hit Animal. Low lighting conditions have also been identified as an issue with 47% of crashes occurring at night.

The following roads assessed within the Regional Study Area appeared to be functioning reasonably well in their current condition during day time operation;

- Olympic Dam Highway
- Olympic Way
- Stuart Highway

The Traffic Assessment of Effects Report will investigate any changes to the Project Area from the construction and operation of the transmission line, including the use of laydown areas during construction.

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Appendix F2. Traffic Assessment of Effects

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OZ Minerals Limited

Carriewerloo Substation to Prominent Hill

Traffic Assessment of Effects

July 2018

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Figure index

1. Introduction

This report details the assessment of effects on the Regional Study Area in comparison to the baseline conditions relevant to the OZ Minerals Limited Carriewerloo Substation to Prominent Hill Electricity Transmission Line Project.

An assessment of effects of the proposed development on traffic conditions surrounding the Project Area, inclusive of the construction phase, is required as part of the Development Application submission. This report will assess the effects that the project will have on the current traffic environment of roads within the Regional Study Area.

1.1 Purpose of this report

The purpose of this report is to assess the effects of the increased traffic generated by the proposed development on the surrounding road network in comparison to the traffic baseline assessment. This report is intended to be read in conjunction with the Traffic Baseline Assessment Report.

1.2 Assumptions

The following qualifications, assumptions and exclusions apply to all works specified within this document:

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The opinions, conclusions and any advice in this report are based on assumptions made by GHD described in this report (refer section 1.2 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

2. Traffic Baseline Assessment

A Traffic Baseline Assessment Report (TBAR) was previously completed to assess to current traffic conditions on the surrounding road network adjacent to the proposed site. For further details on baseline conditions please refer to the TBAR.

The Regional Study area as shown below in **Figure 1**, is a conceptual layout only as identified by OZ Minerals Limited.

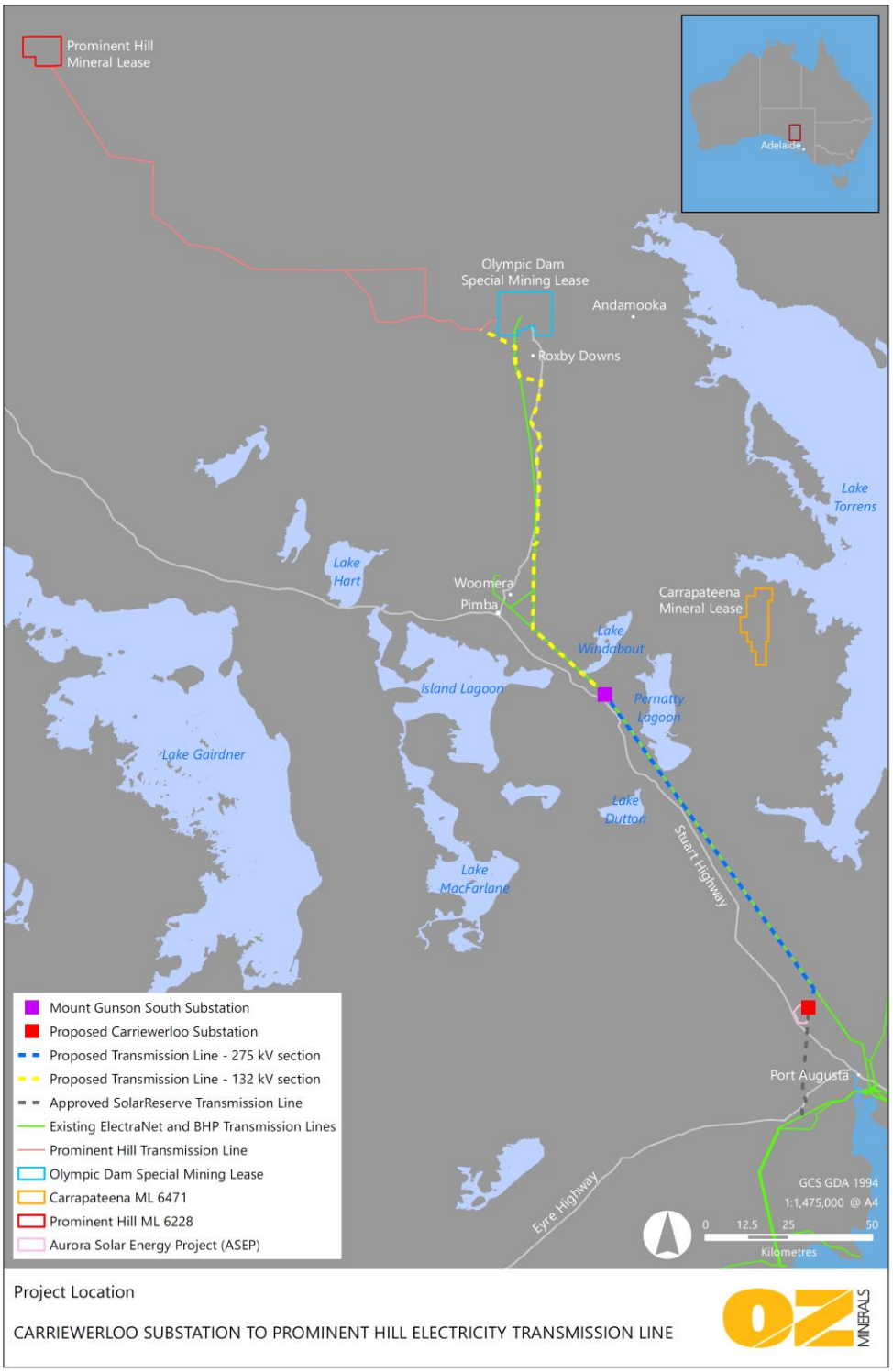


Figure 1 Carriewerloo Substation to Prominent Hill Electricity Transmission Line

3. Assessment of Effects (Construction Phase)

The construction phase of the project is expected to run for approximately 12-18 months. This includes the construction of the 132 kV line, and the 275 kV line which will be undertaken concurrently. This has been assessed to determine the potential effect on the Regional Study Area during this phase.

3.1 Traffic Generation and Distribution

The estimated traffic generation from the expected construction phase of this project (to and from the site) typically is based on an estimated maximum workforce at any one time.

As the workforce accommodation will be located within the laydown areas, it is expected that the workforce will include approximately 200 workers which is expected to generate movements into and out of surrounding towns as well as potential trips back to Adelaide during longer break periods.

Heavy vehicle movements are also expected to be increased with transport of materials and machinery between the laydown areas and the Regional Study Area. The estimated number of movements for both heavy vehicles and light vehicles has been provided by ElectraNet, and is shown in **Table 1** – Estimated Traffic Movements for Heavy & Light Vehicles below.

This information indicates that there will be approximately 300 vehicles per day (vpd) throughout the construction period of 12-18 months, based on worst case scenario for both sections concurrently over a 12 month period for the 132 kV and 275 kV sections. Vehicle types to transport the construction materials and equipment to the site will generally be 19.0 m Semi-Trailers and to a lesser extend 26.9 m B-Doubles.

Other vehicles also include Concrete Trucks (although batching plants will be used), Cranes, Bulldozers, Graders, Loaders, Compactors, Excavators and other various trucks including water trucks. Light Commercial vehicles (4WD, light truck) will also be used primarily for staff on per site.

3.2 Existing Traffic Volumes

Current classification of the Stuart Highway is as a primary arterial road and is the primary interstate transport route between South Australia and Northern Territory. The road is under the care, control and management of the Department of Planning, Transport and Infrastructure (DPTI), and typically designed to carry a single lane of traffic in either direction, divided by a painted centreline.

The roads within the Regional Study Area only (Stuart Highway, Olympic Dam Highway and Olympic Way) are operating with an Annual Average Daily Traffic (AADT) of approximately 2,410 vehicles per day (vpd). These sealed roads form part of the National Highway, are currently classified as high capacity roads, meaning the ability of the road to accommodate traffic volumes, the maximum hourly rate at which vehicles can reasonably be expected to cross a point on a roadway during a given time period under prevailing traffic roadway and control condition.

The Stuart Highway is capable of carrying up to an estimated 15,000 vpd, with approximately 2,410 vpd occurring along the roads within the Regional Study Area. The estimated additional traffic generated during the construction phase of approximately 300 vpd, will increase traffic volumes to 2,710 vpd, which will have a minimal impact on the existing road network and function.

Item	Vehicle type	Total number of loads[1]	Comments
Proposed Transmission Line - 275 kV section			
Towers	Semi-Trailer	230	1 load per tower
Conductors	Semi-Trailer	20	
Insulators and hardware	Semi-Trailer	12	
Concrete	Concrete Truck	930	4 deliveries per tower
Construction equipment	Cranes, Bulldozers, Graders, Loaders, Compactors, and Excavators	10-20	Generally remain on alignment
Light Commercial Vehicles	4WD Vehicles, Light Trucks	15-20 per day	
Other e.g. water, borrow material, camp supplies	Trucks (various)	Several per day	
Proposed Transmission Line - 132 kV section			
Towers	Semi-Trailer	185 (550 poles, 3 poles per semi-trailer)	Typically would require 30-40 semi-trailer loads over several days for each shipment from Port Adelaide to site depots
Conductors	Semi-Trailer	25	
Insulators and hardware	Semi-Trailer	20	
Concrete	Concrete Truck	1000	Estimate 2 trucks per pole
Construction equipment	Cranes, Bulldozers, Graders, Loaders, Compactors, and Excavators	10-20	Generally remain on alignment
Light Commercial Vehicles	4WD Vehicles, Light Trucks	15-20 per day	
Other e.g. water, borrow material, camp supplies	Trucks (various)	Several per day	

Table 1 – Estimated Traffic Movements for Heavy & Light Vehicles

[1] *Total number of loads is the cumulative total for the entire construction period unless otherwise indicated.*

3.3 Existing Access Arrangements

All road routes from Adelaide are principally either National Highways or State Roads and are subject to statutory permit conditions, which could affect the transportation requirements related to over dimensional and over mass vehicles.

However, OZ Minerals Limited has clearly indicated that they are not expected to be specific oversize loads (over dimensional or over mass) therefore, no over dimensional or over mass vehicles are expected to be deployed for the transportation of materials to the Regional Study Area. Appropriate permits would be obtained if over dimensional or over mass vehicles are required.

The transmission line will include a dedicated access track along most of its length, and existing tracks off the highway will be used to access the transmission line and its access tracks. Use of most of the individual access tracks are not likely to be prolonged or involve consistently high volumes of heavy vehicles.

There are expected to be two (2) to four (4) larger laydown areas along the alignment that will be used for temporary construction camps and construction yards, where access/egress will be more prolonged and involve higher volumes of vehicles.

As defined access/egress point locations have not yet been identified, a high-level assessment has been conducted on general areas.

It is assumed that all access/egress points will not form a 4-way intersection, nor be located on or within close proximity to bends or crests in the road. The location of the access/egress point is to provide sufficient sight distance for all vehicle movements with vegetation trimming/removal undertaken if and as required.

However, some short-term and recurrent delays to traffic may result due to implementation of traffic management at access/egress points of the main highway if and when required.

Temporary speed signage and truck warning signage may need to be installed on the approach to the potential laydown areas access/egress. DPTI will be consulted regarding specific access/egress points when details are available to make a determination as to whether a reduction in the posted speed limit (110 km/h) would be required leading up to the sites access/egress, i.e. reduced down to 60 km /h or 80 km/h.

3.3.1 Left and Right Turns

Requirements for turning treatments would typically be addressed during the detailed design phase, however a rural left turn treatment such as Basic Left Turn treatments (BAL), and Basic Right Turn treatments (BAR) may be required at the potential laydown area access/egress points due to the number of movements that could be expected as described in Section 3.1. DPTI will be consulted regarding potential requirements for turning treatments during detailed design.

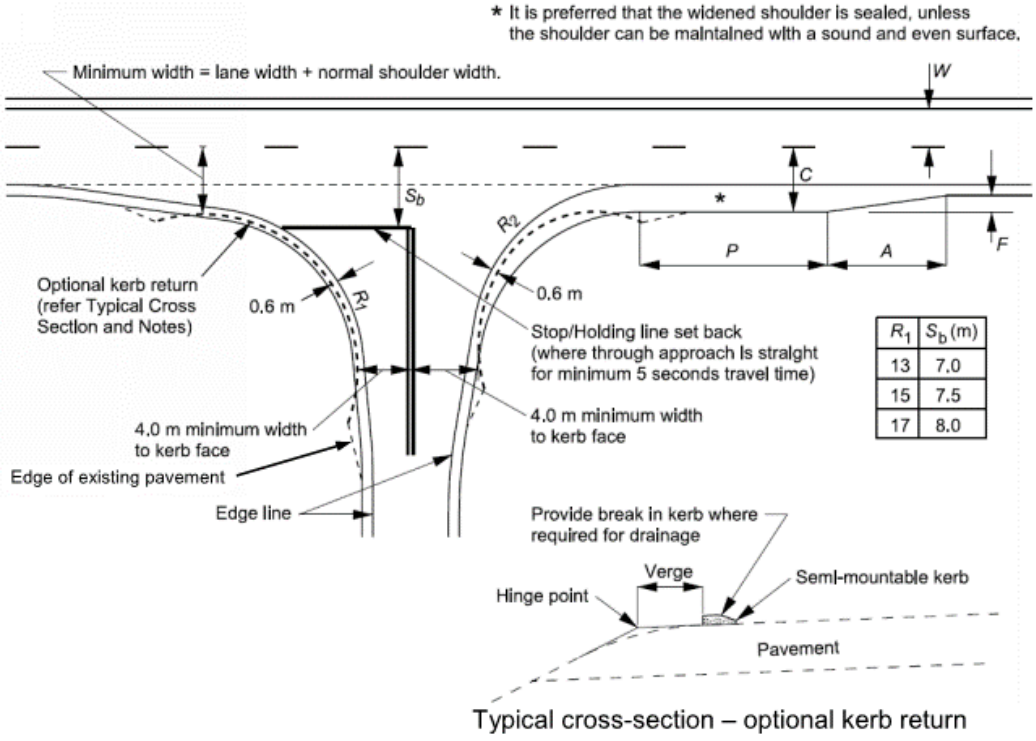
Where required, BAR and BAL treatments need to be designed as per *Austroads Guide to Road Design Part 4: Intersections and Crossings – General, and Part 4A: Unsignalised and Signalised Intersections*, as described below.

3.3.2 Basic Left Turn treatment (BAL)

The minimum treatment required for use in a rural situation (high-speed environment) for left turn treatments is show below in **Figure 1**, which provides tapers leading into and out of the left turn treatment in order to cater for the swept path of a large design vehicle.

New or reconstructed intersections must be designed to this requirement even if intersection legs have to be re-aligned. An exception is intersections that cater mainly for smaller vehicles (i.e. cars, vans, and service vehicles) and only occasionally have to cater for heavy vehicles.

In these circumstances it may be considered appropriate to design a simple radius without tapers that is able to cater for the smaller design vehicles. This requires the minimum length of widened parallel shoulder with a design speed approach of a major road at 110 km/h requiring a minimum of 35.0 m shoulder.



R_1	S_b (m)
13	7.0
15	7.5
17	8.0

Notes:

- *R_1 and R_2 are determined by the swept path of the design vehicle.*
- *The dimensions of the treatment are defined thus:*

  W = *Nominal through lane width (m) (including widening for curves).*

  C = *On straights – 6.0 m minimum.*
  On curves – 6.0 m plus curve widening (based on widening for the design turning vehicle plus widening for the design through vehicle).

  $A = \frac{0.5VF}{3.6}$

  V = *Design speed of major road approach (km/h).*

  F = *Formation/carriageway widening (m).*

  P = *Minimum length of parallel widened shoulder (Table 8.1).*

  S_b = *Setback distance between the centre of the major road and the give way or stop line in the minor road.*

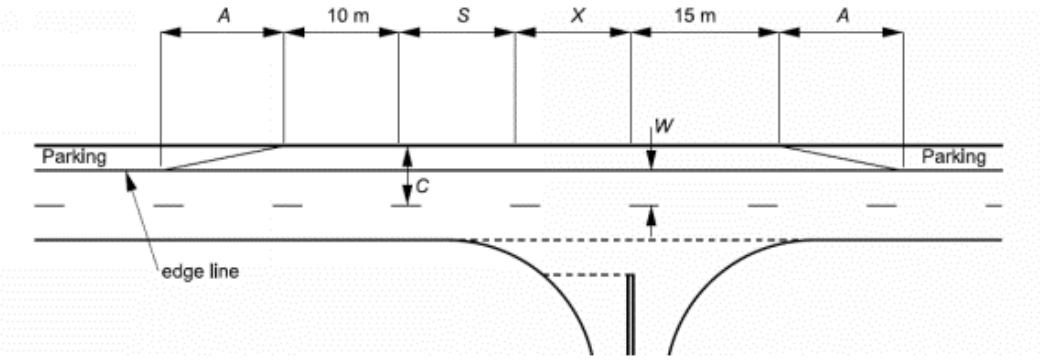
Source: Department of Main Roads (2006)[35].

Figure 2 Minimum requirement for Rural Basic Left-Turn treatment (BAL)

3.3.3 Basic Right Turn Treatment (BAR)

The BAR turn treatment show below in **Figure 1** is applicable at intersections of two-lanes roads and minor roads where traffic volumes do not warrant a higher order of treatment. The BAR should provide sufficient pavement width for the design vehicle to pass a vehicle waiting to turn right, in this case for the Stuart Highway it would be a 53.5 m road train.

The absolute minimum pavement width on a horizontal straight should be 6.0 m between the centreline and the edge of the pavement or kerb line while 6.5 m is the preferred minimum as it is adequate for heavy vehicles (excluding road trains) to pass right turning vehicles.



Notes: This diagram does not show any specific bicycle facilities. Where required bicycle facilities should be provided in accordance with this Part.

The dimensions of the treatment are defined thus:

W = *Nominal through lane width (m) (including widening for curves). Width to be continuous through the intersection.*

C = *On straights* – *6.0 m minimum*
– *6.5 m minimum for 19 m semi-trailers and B-doubles*
– *7.0 m minimum for Type 1 and Type 2 road trains*

On curves – *widths as above + curve widening (based on widening for the design turning vehicle plus* – *widening for the design through vehicle).*

$A = \frac{0.5V(C-W)}{3.6}$

Increase length A on tighter curves (e.g. where side friction demand is greater than the maximum desirable). Where the design through vehicle is larger than or equal to a 19 m semi-trailer, the minimum speed used to calculate A is 80 km/h.

V = *Design speed of major road approach (km/h).*

S = *Storage length to cater for one design turning vehicle (m) (minimum length 12.5 m).*

X = *Distance based on design vehicle turning path, refer to Design Vehicles and Turning Path Templates (Austroads 2013f).*

Source: Department of Main Roads (2006)[30].

Figure 3 Minimum requirement for Rural Basic Right-Turn treatment (BAR)

A turning radius in accordance with *Design Vehicles and Turning Path Templates (Austroads 2013)* should be used and the design turning vehicles swept path should be used to determine the length of the approach and departure widening for the site geometrics (i.e. angle of intersection, width of carriageway).

No lane line or right turn arrows should be marked on the pavement for a BAR turn treatment.

3.4 Restricted Access Vehicle Network

Performance Based Standards (PBS) set minimum heavy vehicle *'performance'* standards to ensure trucks are stable on the road and can turn and stop safely. PBS vehicles are generally referred to as SMART trucks, because they work smarter.

The Standards are a national program that focuses on how the vehicle behaves on the road, rather than how big and heavy it is. With this, the Standards have been approved through the *Council of Australian Governments* and the *Australian Transport Commission*.

Under the PBS scheme, the road network has been classified into four (4) national networks levels, i.e. Levels 1 to 4 as shown below in **Table 1** – Estimated Traffic Movements for Heavy & Light Vehicles.

Vehicle Performance Level	Network Access by Vehicle Length (m)	
	Access Class "A" Existing Networks	Access Class "B" Classified PBS Networks
Level 1 *(Similar to General access)*	L≤20 m (General access*)	
Level 2 *(Similar to B-Double routes)*	L≤26 m	L≤30 m
Level 3 *(Similar to Double, Type 1, road train routes)*	L≤36.5 m	L≤42 m
Level 4 *(Similar to Triple, Type 2, road train routes)*	L≤53.5 m	L≤60 m

**General Access is subject to a 50.5 tonne gross mass limit, posted local restrictions and restrictions or limitations specified by the road authority.*

Table 2 PBS Route network classifications

The route from Port Adelaide to Port Augusta has been gazetted for Level 3A vehicles under the Performance Based Standards (PBS) Scheme, through the National Heavy Vehicle Regulator (NHVR) classification system. However, Level 3B are approved for Port Augusta up to Two Wells.

Level 4A vehicles are currently only approved north of Port Augusta on the Stuart Highway. As the Regional Study Area is located north of Port Augusta, the Stuart Highway is approved for Level 4A vehicles.

These network levels include a Class "A" and Class "B" category for the vehicle lengths which cover General Mass Limits (GML), Concessional Mass Limits (CML) and Higher Mass Limits (HML). Stuart Highway PBS Classification is for Level 2A, which is approximately equivalent to a GML B-Double Route.

DPTI RAVnet provides up to date information on PBS route network classification of DPTI owned roads in SA. A RAVnet route assessment is only required for B-Double and Road Train access when a route is to be gazetted as part of the approved route network.

It is expected that vehicles associated with the proposed development operations will be less than this. As such, it is not expected that the route would require a heavy vehicle route assessment to be undertaken for operations.

3.5 Traffic Environment

No changes to the general traffic environment are expected to occur from the proposed development. The majority of the road alignment is relatively straight and surrounded by farming land and will not change as part of this development.

3.6 Road Safety

The proposed development will have negligible increase of traffic volumes on the roads surrounding the project area and will be subject to the same road safety conditions as existing traffic. However, a Road Safety Audit is planned be undertaken as part of the construction phase of the operation.

4. Assessment of Effects (Operations and Maintenance)

4.1 Predicted Change to Surrounding Network

It is expected that access to the transmission line will be via a number of existing access points along the Stuart Highway. There will be a dedicated access track running adjacent to the transmission line which will be used for maintenance purposes. As such, no change is predicted to the surrounding road network during operational stages of the development.

4.2 Traffic Volumes

It is expected that there would be minimal operational requirements for the transmission line and minimal traffic would be generated from this.

Maintenance activities on the line would predominantly be undertaken by 4WD vehicles and typically occur twice a year with a more detailed inspection occurring once every four (4) years. Larger scale maintenance programs, i.e. replacement of insulators, would be infrequent, estimated to be every 25 years.

Access tracks adjacent the line will remain in place for these inspections to occur. As such, only traffic movements associated with the maintenance will be turning off and onto the highway to access the provided track.

Therefore, the effect on traffic volumes after construction is completed are considered to be negligible.

4.3 Restricted Access Vehicle Network

This route north of Port Augusta is already approved for up to Level 4A vehicles and it is expected that vehicles associated with the proposed development operations will be less than this. As such, it is not expected that the route would require a heavy vehicle route assessment to be undertaken for operations.

Refer to Section 3.5 for further information.

4.4 Traffic Environment

No changes to the general traffic environment are expected to occur from the proposed development. The majority of the road alignment is relatively straight and surrounded by farming land and will not change as part of this development.

4.5 Road Safety

The proposed development will have negligible increase of traffic volumes on the roads surrounding the project area and will be subject to the same road safety conditions as existing traffic.

5. Summary

Traffic generated by the operation and maintenance of the transmission line is minimal and considered negligible in regards to the effect on the surrounding road network.

During construction a considerable number of vehicle movements will be generated for a period of 12-18 months. It is expected that the Project may generate approximately 300 vpd for the 275 kV and 132 kV sections.

The roads within the Regional Study Area (Stuart Highway, Olympic Dam Highway and Olympic Way) are operating with an Annual Average Daily Traffic (AADT) of approximately 2,410 vpd. The Stuart Highway is capable of carrying up to an estimated 15,000 vpd, with the estimated additional traffic generated during the construction phase of 300 vpd, equating to a total of 2,710 vpd, this will have a minimal impact on the existing road network and/or function.

Access/egress points created for potential laydown areas may result in possible conflict due to standing vehicles waiting to turn into the site. With this, turning treatments are expected to be required as described in Section 3.3, left and right turn treatments, i.e. BAL and BAR. These treatments are expected to be required at the potential laydown area access/egress points to enable safe vehicle movements to mitigate this risk.

There may be a requirement for temporary speed signage and truck warning signage to be installed on the approach to the potential laydown areas. DPTI will be consulted regarding specific access/egress points when details are available to make a determination as to whether a reduction in the posted speed limit would be required leading up to the sites access/egress, i.e. 80 km/h, reduced down from 110 km/h.

A Road Safety Audit (RSA) is typically undertaken for projects similar to this where the existing conditions of the road will possibly be altered, which will have an effect on the road network for all users. This is planned to be undertaken for construction activities; this is one of the most important aspects of managing the road system ensuring that the Safe System approach is adopted to road operation and planning.

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Appendix G. Socio-economic Assessment

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Appendix G1. Socio-economic Baseline Assessment

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FINAL

Socio-economic Baseline Assessment Carriewerloo Substation to Prominent Hill Electricity Transmission Line Project

A report to

OZ Minerals Limited

Prepared by

econsearch

17 May 2018

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ABBREVIATIONS

AADT	Annual average daily traffic
ABICSA	Aboriginal Business Industry Chamber of South Australia
ABS	Australian Bureau of Statistics
APOMA	Andamooka Progress and Opal Miners Association Inc.
APY	Anangu Pitjantjatjara Yankunytjatjara
ASR	Age-standardised rate
CD	Collection district
DPC	Department of the Premier and Cabinet
DPLG	Department of Planning and Local Government
DPTI	Department of Planning, Transport and Infrastructure
DSD	Department of State Development
GAB	Great Artesian Basin
GRP	Gross regional product
GSP	Gross state product
GVP	Gross value of production
IDR	Infant death rate
LGA	Local Government Area
NEM	National Electricity Market
NNTT	National Native Title Tribunal
OCA	Outback Communities Authority
PHIDU	Public Health Information Development Unit
RDAFN	Regional Development Australia Far North
RESA	Resources and Engineering Skills Alliance
RFDS	Royal Flying Doctor Service
SA	South Australia
SCAP	State Commission Assessment Panel
SEIFA	Socio-Economic Index for Areas
SES	State Emergency Service
SSC	State suburb code
TRA	Tourism Research Australia
WPA	Woomera Prohibited Area

1. INTRODUCTION

1.1 This Report

OZ Minerals proposes to develop an electricity transmission line approximately 237 km in length, from the proposed Carriewerloo Substation (north-west of Port Augusta) to a location west of Olympic Dam, where it will connect to OZ Mineral's' existing transmission line to Prominent Hill. The transmission line consists of a 275 kV line from Carriewerloo Substation to the Mount Gunson South Substation and a 132 kV line from the Mt Gunson South Substation to Olympic Dam.

This document forms a part of the Development Application submission, under the sponsorship of the Department of the Premier and Cabinet (DPC), for lodgement with the State Commission Assessment Panel (SCAP) under Section 49 of the Development Act 1993.

The objective of this report is to describe the contemporary socio-economic environment in which the Project is set. It will be used as the basis on which to assess potential socio-economic impacts associated with the Project.

1.2 Project Description

A description of the proposed activities for the Transmission Line Project is found in the Project Description Chapter of the Development Application, to which this report is appended.

1.3 Study Area

The Study Area is a 5 km buffer on the proposed alignment (i.e. 10 km corridor). A broader Regional Study Area includes key population centres, local towns, and local council areas.

The transmission line corridor, for the purposes of the Development Application, is defined as a 500 m corridor and is referred to as the Project Area.

1.4 Study Scope

The objective of the socio-economic baseline characterisation is to provide information on specific aspects of the existing socio-economic conditions in the Study Area and region, suitable for the conduct of an impact assessment. The study includes:

- existing land use and infrastructure
- existing demography, culture and social conditions
- existing economic base of the region.

Preparation of this report involved the following tasks:

- Review of government databases and publically available information to describe the social and economic profile of the study area and region
- Development of a summary of demographic profiles of relevant communities within the Study Area and region
- Identification and description of relevant historical and current socio-economic influences on the Study Area and region
- Characterisation of existing land uses
- Consideration of the existing local and State planning schemes.

1.5 Information Sources

This report has been prepared using the Socio-economic Baseline Report for the Carrapateena Project (DMC 2016) as a template.

A full list of information sources is provided in References Section. Key documents referred to in this report include:

- Australian Bureau of Statistics (ABS 2002, 2007, 2010, 2012, 2017a,b,c,d, 2018a,b)
- Public Health Information Development Unit (PHIDU, 2018)
- Department of the Premier and Cabinet (DPC 2011, 2017, 2018a,b,c,d,e)
- South Australian Electricity Report and updated generation information. Australian Energy Market Operator (AEMO 2017, 2018)
- Far North Regional Plan. A volume of the South Australian Planning Strategy (DPLG 2010)
- Regional Development Australia Far North Regional Plan 2013-2016 (RDAFN 2013)
- Regional Mining and Infrastructure Planning Project – Far North (Deloitte 2013a)
- The Integrated Transport and Land Use Plan 2015. Department of Planning, Transport and Infrastructure (DPTI 2015b)
- South Australian Future Mining Workforce Report 2014-2030. Resources and Engineering Skills Alliance (RESA 2013b).
- 2011 Resources and Energy Infrastructure Demand Study, report to Resources and Energy Sector Infrastructure Council (Parsons Brinckerhoff 2011)
- Flinders Ranges, Outback communities and Roxby Downs Growth and Investment Strategies, reports to Regional Development Australia Far North (SC Lennon & Associates 2016a,b,c).

1.6 Stakeholder Identification

OZ Minerals has periodically reviewed and revised the stakeholders to the Project. This ongoing process of stakeholder review aims to identify stakeholders with an interest in the Project, and

those potentially impacted by the Project. It remains a 'live' list. Stakeholders to the proposed Project include:

- Kokatha peoples / Kokatha Aboriginal Corporation[1]
- Barngarla Aboriginal Corporation
- Pastoral stations located within the Project Area:
    - Mount Arden Pastoral Lease
    - Carriewerloo Pastoral Lease
    - Kootaberra Pastoral Lease
    - Oakden Hills Pastoral Lease
    - Pernatty Pastoral Lease
    - Arcoona Pastoral Lease
    - Purple Downs Pastoral Lease
    - Andamooka Pastoral Lease
    - Roxby Downs Pastoral Lease
- Local communities including:
    - Andamooka community
    - Port Augusta community
    - Port Pirie community
    - Roxby Downs community
    - Woomera community.
- Local councils and representative of unincorporated areas, represented by:
    - Port Augusta City Council
    - Port Pirie Regional Council
    - Whyalla City Council
    - Municipal Council of Roxby Downs
    - Andamooka Progress and Miners Association
    - Woomera Board
    - Outback Communities Authority (OCA)
    - Upper Spencer Gulf Common Purpose Group.

[1] Other interested Native Title parties relevant to placement of off-lease infrastructure have been identified and will be included in applicable off-lease approval documentation.

- Government of Australia, represented by:
    - Department of the Environment and Energy
    - Department of Defence
    - Department of Industry, Innovation and Science
    - Department of Infrastructure, Regional Development and Cities.
- Government of South Australia, represented by:
    - Department of State Development
    - Department of Environment and Water
    - Environment Protection Authority South Australia
    - Department of The Premier and Cabinet
    - Department for Planning, Transport and Infrastructure
    - Minerals and Energy Advisory Council
    - SafeWork SA.
- Regional Development Australia – Far North
- Regional Development Australia – Whyalla and Eyre
- Regional Development Australia – Yorke and Mid North
- South Australian Arid Lands Natural Resources Management Board
- Royal Flying Doctor Service
- Local community organisations, such as Roxby Downs Community Club
- Conservation Council of South Australia
- Providers of services such as water, power and telecommunications
- Emergency services such as police, ambulance, fire service and SES
- Non-government organisations with environmental interests
- Media
- Industry and business community
- South Australian Chamber of Mines and Energy
- Global Maintenance Upper Spencer Gulf
- Other community representatives
- Other community members (e.g. tourists, volunteers)
- OZ Minerals
- Investors, financiers and insurers.

This list is not exhaustive and additional stakeholders may be identified as the proposed Project progresses.

2. DEMOGRAPHIC SUMMARY

Table 2-1 provides a summary of key demographic indicators of the Regional Study Area. Population statistics are described in Section 3 for relevant regions. The table is extracted from the full suite of demographic indicators provided in Appendix 2.

Information to describe the demographic characteristics of the Regional Study Area has been sourced from the 2016 census of population and housing and pervious releases (ABS 2017a). However, information presented for the residential areas of Woomera, Andamooka and Pima are limited, due to limited population in these locations. Information defining these regions in details can be found in Appendix 1.

Census information for Pimba is provided based on a census collection district (CD) containing the residential area. Given the remoteness of this area, it is likely that most, if not all, of the population within the CD would be in the town of Pimba. Note that the use of CDs ceased following the 2006 census. A custom region has been constructed to resemble the same geography for the following census years[2].

Table 2-1 shows:

- A notable gender imbalance across Woomera and Pimba, with 35.7 and 37.3 per cent of the respective populations being female. Community populations are generally dominated by males across the entire Regional Study Area, with exception to Whyalla and Port Pirie. Across South Australia and Australia, females hold the gender balance
- The median age in Andamooka, at 53 years old, is significantly older than the rest of the Regional Study Area (ranging from 30 at Roxby Downs to 48 at Woomera), or South Australia (40) and Australia (38)
- A high proportion of one-parent families living in Pimba (66.7 per cent) – about four times that of the State and Australian proportions. Note, Pimba's small population (and number of families) likely results in a high degree of variability in reported proportions. The next highest proportion of one-parent dwellings was in Whyalla (21.1 per cent)
- Couple families with children are most prolific in Roxby Downs (56.7 per cent); whereas couple families without children are notable for Woomera (87.5 per cent)
- Median weekly individual incomes range from $1,547 at Roxby Downs to $475 in Andamooka. The same disparity exists with regards to median weekly family incomes, ranging from $2,456 at Roxby Downs to $708 in Andamooka
- The proportion of family household is highest in Roxby Downs (67.7 per cent), while lone households are greatest in Woomera (61.1 per cent)

[2] See Appendix 1 for detailed regional definitions.

- About half the population in Pimba has access to the internet, compared with 93.4 per cent at Roxby Downs
- Unemployment is highest in Whyalla (12.4 per cent), Port Pirie (10.7 per cent) and Coober Pedy (9.9 per cent) and lowest in Roxby Downs (3.5 per cent).

Table 2-1 Demographic indicators summary, 2016

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	South Australia	Australia
Person characteristics										
Population (no.)	13,808	3,884	1,762	146	316	63	21,828	17,364	1,676,653	23,401,892
Male %	51.0%	57.1%	54.6%	64.3%	54.4%	62.7%	50.0%	49.0%	49.3%	49.3%
Female %	49.0%	42.9%	45.4%	35.7%	45.6%	37.3%	50.0%	51.0%	50.7%	50.7%
Age										
Median age	39	30	46	48	53	39	40	44	40	38
Family characteristics										
Couple families with children %	36.6%	56.7%	33.0%	12.5%	37.5%	0.0%	37.3%	36.7%	42.1%	45.5%
Couple families without children %	40.7%	33.9%	46.4%	87.5%	41.7%	33.3%	40.4%	42.3%	40.0%	37.2%
One parent families %	20.7%	9.4%	17.1%	0.0%	20.8%	66.7%	21.1%	19.7%	16.3%	15.6%
Other families %	2.0%	0.0%	3.4%	0.0%	0.0%	0.0%	1.2%	1.3%	1.7%	1.7%
Income										
Median weekly individual income ($)	604	1,547	497	1,179	475	1,342[a]	497	481	600	662
Median weekly household income ($)	1,094	2,456	882	1,562	708	890[a]	987	905	1,204	1,432
Dwellings characteristics										
Families										
Family households %	58.7%	67.7%	37.9%	38.9%	44.5%	40.0%	59.0%	60.8%	64.9%	66.7%
Lone person households %	28.1%	19.7%	35.6%	61.1%	52.7%	20.0%	31.9%	31.4%	26.6%	22.8%
Group households %	2.5%	3.0%	1.7%	0.0%	2.7%	16.0%	2.4%	1.7%	3.4%	4.0%
Other households	10.7%	9.6%	24.8%	0.0%	0.0%	24.0%	6.7%	6.0%	5.2%	6.5%
Internet access										
Internet connection total %	71.9%	93.4%	64.4%	76.0%	64.8%	52.9%	73.8%	71.2%	82.6%	85.5%
Internet not accessed from dwelling %	28.1%	6.6%	35.6%	24.0%	35.2%	47.1%	26.2%	28.8%	17.4%	14.5%
Employment (population aged 15 years and over)										
Unemployed %	9.7%	3.5%	9.9%	0.0%	9.4%	0.0%	12.4%	10.7%	7.5%	6.9%

[a] Median figures correspond to the ABS SA1 region of 411411, this includes Pimba and residual balance areas.

Source: ABS 2017a and EconSearch analysis

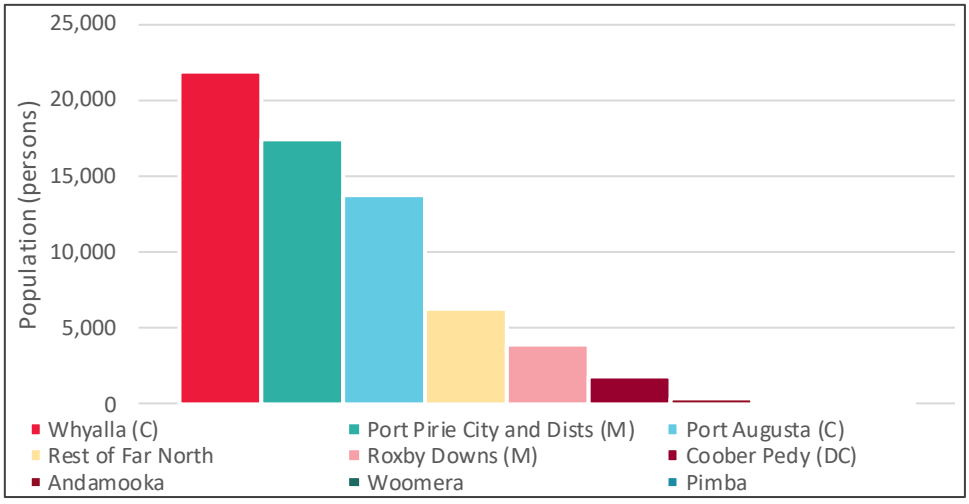
3. REGIONAL SOCIAL AND ECONOMIC PROFILE

3.1 Far North

The broader Far North region of South Australia comprises almost 800,000 km^2 and accounts for approximately 80 per cent of the State's land mass (RDAFN 2013). It is the largest and least populated area of South Australia, but forms a link between the remote 'outback' of central Australia, specifically Coober Pedy in South Australia and Alice Springs in Northern Territory with the mining centre of Roxby Downs in South Australia. It has a long history of exploration, pastoralism, tourism, government services and mining and links transport between Australia's eastern and western States and the Northern Territory. The region has a long and diverse history of mining operations, such as the Tarcoola goldfield, copper mining throughout the Flinders Ranges, opal mining at Coober Pedy and Andamooka and the Olympic Dam copper-uranium mine.

As a region, the Far North has a population of about 26,200 people; and major towns include Port Augusta (13,800 residents), Roxby Downs (3,900 residents) and Coober Pedy (1,800 residents) (ABS 2017a). Figure 3-1 shows how the population is disaggregated across residential areas of the Far North and significant towns outside of the broader region (specifically Whyalla and Port Pirie).

Figure 3-1 Far North Population Distribution, 2016



Source: ABS 2017a

3.1.1 Indigenous population

The Far North region with the local government areas (LGA) of Whyalla and Port Pirie are home to around one-fifth of South Australia's Indigenous community (about 7,100 people). Port Augusta and the rest of Far North (which includes the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands) are where the biggest indigenous communities reside (ABS 2017a).

The Indigenous people of the Far North consist of multiple groups. These include Anangu, Antakarinja, Kokatha, Arabana, Nukunu and Barngarla.

Table 3-1 Indigenous population, 2016

	Population (no.)	Indigenous origin (no.)	Indigenous origin %
Far North Region			
Port Augusta (C)	13,808	2,523	18.3%
Roxby Downs (M)	3,884	116	3.0%
Coober Pedy (DC)	1,762	302	17.1%
Woomera	146	0	0.0%
Andamooka	316	13	4.1%
Pimba	63	8	12.7%
Rest of Far North	6,224	2,491	40.0%
Total Far North	26,203	5,453	20.8%
Other significant residential areas			
Whyalla	21,828	1,032	4.7%
Port Pirie City and Dists (M)	17,364	631	3.6%
South Australia	1,676,653	34,184	2.0%
Australia	23,401,892	649,171	2.8%

Source: ABS 2017a, EconSearch analysis

The Far North region has a higher population of persons identifying as indigenous (20.8 per cent) relative to the State and national proportions (2.0 per cent and 2.8 per cent respectively) (ABS 2017a). Aboriginal populations are largely represented in Port Augusta in the Study Area.

3.1.2 Future population

Table 3-2 provides population projections for the Regional Study Area and South Australia. These estimates are based on figures from the 2016 census of population and housing, which were updated using growth rates extracted from Department of Planning, Transport and Infrastructure (DPTI) population projections (DPTI 2016).

Table 3-2 15-year population projections

	Census	Projections					
	2016	2021		2026		2031	
	(no.)	(no.)	% from 2016	(no.)	% from 2016	(no.)	% from 2016
Far North region							
Port Augusta (C)	13,808	14,025	1.6%	14,238	3.1%	14,447	4.6%
Roxby Downs (M)	3,884	4,114	5.9%	4,405	13.4%	4,668	20.2%
Coober Pedy (DC)	1,762	1,644	-6.7%	1,516	-14.0%	1,393	-21.0%
Woomera[a]	146	146	0.3%	147	0.8%	147	0.6%
Andamooka[a]	316	317	0.3%	319	0.8%	318	0.6%
Pimba[a]	63	63	0.3%	64	0.8%	63	0.6%
Rest of Far North	6,223	6,097	-2.0%	6,143	-1.3%	6,187	-0.6%
Total Far North	26,202	26,406	0.8%	26,832	2.4%	27,223	3.9%
Other significant residential areas							
Whyalla (C)	21,828	22,285	2.1%	22,543	3.3%	22,655	3.8%
Dists (M)	17,364	17,721	2.1%	17,851	2.8%	18,006	3.7%
South Australia	23,401,891	24,445,147	4.5%	25,467,665	8.8%	26,424,001	12.9%

[a] Regional growth rates relate to the Unincorporated Far North region.

Source: ABS 2017a, DPTI 2016 and EconSearch analysis

Table 3-2 shows that by 2031, the Far North is expected to grow at a much slower rate than the whole of state (3.9 and 12.9 per cent respectively). Within the Far North, this growth is expected occur mostly in Roxby Downs and Port Augusta (increase of about 780 and 640 people respectively), partly offset by a decrease in population in Coober Pedy (about 370 people).

3.1.3 Contribution to economy

The Far North's economic drive has historically been dominated by agriculture from cropping in the southern region, to pastoralism in the mid and northern regions. Although pastoralism is still a large economic driver, the discovery of resources through exploration and mining has made mining (of mineral resources) by far the most dominant economic factor. The rise in tourism, with two of the State's major icons located in the Far North—the Flinders Ranges and the Outback—has seen it become an important emerging economic contributor. Another fast emerging economic driver comes from the growth of the Defence sector (at Woomera and Cultana, refer Section 6.5) in the region (DLPG 2010).

Table 3-3 shows the contribution of regions to the State's GRP. Regional South Australia, including the Far North, contributed about $25.6 billion (25.5 per cent) to Gross State Product (GSP) in 2015/16 (EconSearch 2017). Health and social assistance and ownership of dwellings were the largest contributors to the South Australian economy, however in the Far North, mining is by far the greatest contributor. The contribution of mining is discussed further in Section 6.6. Electricity, gas, water and waste and construction were also among the largest contributors to the region. The Far North's regional share of Gross Regional Product (GRP) for 2015-16 was 5.5 per cent, second to, but well behind, Adelaide Metro (74.5 per cent), but it has the largest nine-year average annual growth rate (9.2 per cent).

Table 3-3 Gross Regional Product ($m), 2015–16

Sector	Far North	Adelaide Metro[a]	Adelaide Hills	Barossa, Light and Lower North	Eyre and Western	Fleurieu and Kangaroo Island	Limestone Coast	Murray and Mallee	Yorke and Mid-North	South Australia
Agriculture, Forestry and Fishing	98	320	215	398	684	373	949	1,227	802	5,065
Mining	3,116	1,790	176	17	570	124	8	15	42	5,858
Manufacturing	76	5,075	199	513	219	81	277	217	193	6,849
Electricity, Gas, Water and Waste	474	2,103	161	16	67	16	27	116	140	3,120
Construction	381	5,465	172	142	239	84	127	137	180	6,926
Wholesale Trade	43	2,468	53	75	134	32	74	75	87	3,042
Retail Trade	81	3,850	157	137	165	101	106	178	177	4,951
Accommodation and Food Service	101	1,843	66	70	98	68	54	53	73	2,426
Transport, Postal and Warehouse	157	4,222	69	116	215	92	126	190	152	5,338
Information Media and Telecommunications	22	1,855	15	12	15	20	21	15	26	2,001
Finance and Insurance	41	6,601	80	104	155	63	79	100	142	7,365
Renting, Hiring and Real Estate	39	1,842	56	44	57	41	33	41	43	2,196
Ownership of Dwellings	97	6,955	307	291	188	177	217	248	247	8,726
Professional, Scientific and Technical Services	70	4,710	69	63	68	30	30	40	52	5,131
Administrative and Support	77	1,408	22	39	41	18	17	35	26	1,683
Public administration and Safety	143	5,444	166	62	114	55	96	120	124	6,323
Education and Training	102	4,031	142	157	164	62	130	125	150	5,063
Health and Social Assistance	169	7,784	161	183	264	137	215	234	277	9,424
Arts and Recreational	16	750	19	18	13	13	6	18	5	857
Other Services	81	1,815	46	48	64	29	30	48	52	2,213
Net Taxes in Final Demand	129	4,386	204	195	153	137	172	189	207	5,773
Gross Regional Product (GRP)	5,511	74,715	2,556	2,701	3,686	1,751	2,793	3,420	3,196	100,330
Regional Share of GRP (2015–16)	5.5%	74.5%	2.5%	2.7%	3.7%	1.7%	2.8%	3.4%	3.2%	100.0%
Nine Year Average Annual Growth Rate	9.2%	4.3%	3.7%	2.5%	5.4%	4.9%	0.5%	3.8%	4.2%	4.8%

[a] Adelaide metro is compromised of the South Australian Government regions of Eastern, Northern, Southern and Western Adelaide.

Source: EconSearch analysis

3.1.4 Agriculture

Agriculture remains a steady contributor to the South Australian economy. In 2015-16, the agriculture, forestry and fishing industry contributed of about 5.0 per cent to GSP.

Two-hundred and twelve pastoral properties exist across the Unincorporated Areas of the Far North and approximately 50 primary production leases exist across council regions. approximately 411,000 km^2 of land (over half of the Far North region) is used for sheep, beef cattle and grain farming (RDAFN 2013). The contribution to GRP of the agriculture industry in the Far North (combined with a small amount of hunting) was $98m (1.8 per cent of GRP) in 2015-16. The contribution of pastoral activity is discussed further in Section 6.3.

3.1.5 Tourism

The contribution of tourism to the Far North is discussed in Section 6.4. In the Far North, the sectors of accommodation and food service, arts and recreation, and renting, hiring and real estate (of which a portion would be the result of tourism to the area), contributed $156m to GRP in 2015-16, or 2.8 per cent of GRP.

In the Finders Ranges and Outback tourism region, visitors spent almost $414m in the region in 2015-16 (TRA 2017).

3.1.6 Mining

Overview

More recently the region has been characterised by the strong presence of mining and the resultant fly-in-fly-out population. Mining in the area includes the BHP Billiton's Olympic Dam mine, OZ Minerals' Prominent Hill mine, and SIMEC Mining (formally Arrium, refer Section 6.6) (Deloitte 2013a). Mining in the Far North exhibits considerable diversity with exploration and development projects targeting iron, copper, uranium, gold and silver; which is discussed further in Section 6.6. Areas around existing or historical mining areas, such as Olympic Dam, Tarcoola and Coober Pedy, have undergone considerable exploration in the past decade, and have resulted in the identification of some significant deposits. In addition, the emerging provinces of the Musgrave Ranges and the Woomera Prohibited Area (WPA), which has been recently opened up to additional exploration, have added to the geographic spread and diversity of exploration targets in this region. Mining is the most significant sector in the Far North, with 27 per cent of employment attributable to mining. The significance of mining is even greater in Roxby Downs, where it contributes to 51 per cent of the region's employment (ABS 2017a).

Mining and Population

A study by the ABS into the impact of the 'mining boom' on population in mining regions has found that growth in mining in Australia has had minimal impact on many of Australia's cities, towns and regions (ABS 2016). Mining jobs comprise only a small proportion of the total workforce in most places. Even at the peak of the boom in 2012, only 2.4 per cent of the

Australian workforce was employed in the mining industry. The populations of all the mining regions studied by the ABS declined in 2014-15, corresponding with a slowdown of the resources boom and a reduction of people employed in the mining industry in Australia. Updated population data show a continuation of this trend, with further reductions in all of these regions for 2015-16 (ABS 2017b).

Mining and Labour Costs

In November 2016, workers employed in the mining industry in Australia had the highest full-time adult average weekly ordinary time earnings of $2,572 (compared with the lowest, the accommodation and food services industry, at $1,108 (ABS 2018a). On a state-by-state comparison, South Australia had the second lowest full-time adult average weekly ordinary time earnings of $1,446 (compared with ACT $1,747 and WA of $1,703).

These rates of pay are set against the median weekly individual incomes of townships in the Regional Study Area of $604 at Port Augusta, $1,547 at Roxby Downs, $497 at Coober Pedy, $1,179 at Woomera, $475 at Andamooka, $1,342 at Pimba, $497 at Whyalla and $481 at Port Pirie.

3.1.7 Electricity, gas, water and waste

South Australia's domestic electricity supply comes from a range of renewable and non-renewable sources, the three main electricity generators being gas-fired generation, wind energy and rooftop photovoltaics systems. Following the closure of the coal-fired Playford and Northern power stations in Port Augusta, South Australia no longer produces electricity from coal. The renewable energy sector is expected to grow in importance in the Far North region as new generation is developed. The Generation Information Page on the AEMO website (AEMO 2018) lists seven wind, solar and stored hydro projects under development in the Regional Study Area, as of March 2018, with a combined capacity of around 1.3 gigawatts. The South Australian Government has entered into a generation project agreement with the planned Aurora Solar Energy Project, a 150MW solar thermal plant near Port Augusta, operated by Solar Reserve (AEMO 2017, SolarReserve 2018). In the Far North Region, Port Augusta, Woomera, Roxby Downs and some towns along the transmission line to Leigh Creek are connected to the national electricity grid. Most Outback communities however, rely on diesel generators to provide power. Some towns have been exploring the use of small-scale hybrid plants based on renewable energy and gas or diesel (SC Lennon & Associates 2016a).

In 2015-16, the electricity, gas, water and waste industry contributed of about 3.1 per cent to GSP. In the Far North, the contribution to GRP of the electricity, gas and waste industry was $474m (8.6 per cent) in 2015-16 (Table 3-3). This shows the industry to be much more significant in the Far North than the whole of State (ranked second and thirteenth respectively).

3.1.8 Construction

Construction is a significant component of both the Far North and South Australian economies. In 2015-16, the construction industry contributed of about 6.9 per cent to GSP. The significance of the construction industry was similar in the Far North with a contribution to GRP of $381m

(6.9 per cent of GRP) in 2015-16. The construction Industry's contribution to GRP was ranked third and fourth in the Far North and South Australia economies respectively.

3.2 Pastoral Settlement

The Project Area intersects nine pastoral leases. Listed from south to north, they are:

1. Mount Arden Pastoral Lease
2. Carriewerloo Pastoral Lease
3. Kootaberra Pastoral Lease
4. Oakden Hills Pastoral Lease
5. Pernatty Pastoral Lease
6. Arcoona Pastoral Lease
7. Purple Downs Pastoral Lease
8. Andamooka Pastoral Lease
9. Roxby Downs Pastoral Lease.

There are 212 pastoral leases in the Regional Study Area (Far North), covering approximately 411,000 km^2 of land. Section 6.3 shows that around two-thirds of this land is used primarily for cattle and around one-third primarily for sheep.

The properties operate on pastoral leases managed by the Department for Environment and Water under the advice of the Pastoral Board. Under the *Pastoral Land Management and Conservation Act 1989 (SA)*, pastoral leases provide pastoralists with access to Crown land for the purposes of raising livestock and developing related infrastructure. They are required to manage pastoral land sustainably with the aim of preventing further degradation and, where possible, to improve the condition of the land. Rangelands pastoral properties encompass 40 per cent of land in South Australia and are considered to be both economically valuable and culturally and ecologically significant due to the rare and endangered native species that occupy the lands. Pastoral properties are monitored for compliance with lease conditions every two to five years. Monitoring results are used to decide whether lease extensions are granted (SA Arid Lands 2018a). In 2016-17, pastoral rents in South Australia amounted to $1,480,362 (Pastoral Board 2017).

There are 24 Public Access Routes on pastoral leases in South Australia, totalling around 650 kilometres. These are not part of the formal road network, they are unimproved and unsurfaced routes to provide access to four-wheel drive vehicles in dry conditions for the purpose of tourism (SA Arid Lands 2018b). The pastoral properties generally generate their own power, source water from local dams and bores and maintain an extensive network of private roads.

Each of the nine pastoral leases in the Project Area is intersected by Exploration Licenses which authorises the licensee to explore for all minerals and/or opal other than extractive minerals (i.e. building construction materials), subject to conditions. Table 3-4 summarises the

Exploration Licences that intersect with each pastoral lease at the time of publishing. Pernatty and Arcoona have the most active Exploration Licences (20 each), followed by Oakden Hills (12), Andamooka (10), and Roxby Downs (9). The commodities sought include base metals, clay, cobalt, copper, gold, iron, lead, rare earths, silver, uranium and zinc.

Table 3-4 Exploration Licenses (count, licensees and commodities sought)

Pastoral lease	Count	Licensees	Commodities sought
Mount Arden	4	FMG Resources Pty Ltd	Uranium; Iron; Gold; Rare Earths; Copper
Carriewerloo	5	FMG Resources Pty Ltd, Menninnie Metals Pty Ltd	Uranium; Iron; Gold; Rare Earths; Copper
Kootaberra	4	Gawler Resources Pty Ltd, FMG Resources Pty Ltd, Munta Salt Pty Ltd, OZ Minerals Carrapateena Pty Ltd, OZM Carrapateena Pty Ltd	Uranium; Gold; Copper; Clay
Oakden Hills	12	Terrace Mining Pty Ltd, Gawler Resources Pty Ltd, Daktyloi Metals Pty Ltd, Munta Salt Pty Ltd, OZ Minerals Carrapateena Pty Ltd, OZM Carrapateena Pty Ltd, Yandan Gold Mines Pty Ltd, Yandan Gold Mines Pty Ltd, FMG Resources Pty Ltd	Uranium; Silver; Cobalt; Gold; Copper; Clay; Zinc; Iron; Lead
Pernatty	20	Terrace Mining Pty Ltd, OZ Minerals Carrapateena Pty Ltd, OZM Carrapateena Pty Ltd, OZ Exploration Pty Ltd, Gawler Resources Pty Ltd, Red Metal Limited, Daktyloi Metals Pty Ltd, Olympic Domain Pty Ltd, Kelaray Pty Ltd, Havilah Resources Limited, Tasman Resources Ltd, Yandan Gold Mines Pty Ltd, FMG Resources Pty Ltd, Gawler Resources Pty Ltd.	Gold; Copper; Silver; Cobalt; Uranium; Zinc; Lead; Iron
Arcoona	20	Olympic Domain Pty Ltd, Red Tiger Resources Limited, Terrace Mining Pty Ltd, OZ Exploration Pty Ltd, FMG Resources Pty Ltd, Riversgold (Australia) Pty Ltd, BHP Billiton Olympic Dam Corporation Pty Ltd, OZ Minerals Carrapateena Pty Ltd, OZM Carrapateena Pty Ltd, THZ Pty Ltd, Tasman Resources Ltd	Silver; Cobalt; Gold; Copper; Uranium; Iron; Rare Earths; Iron Ore
Purple Downs	8	FMG Resources Pty Ltd, Olympic Domain Pty Ltd, BHP Billiton Olympic Dam Corporation Pty Ltd, OZ Exploration Pty Ltd	Uranium; Iron; Gold; Rare Earths; Copper; Silver; Iron Ore
Andamooka	10	OZ Minerals Carrapateena Pty Ltd, OZ Exploration Pty Ltd, BHP Billiton Olympic Dam Corporation Pty Ltd, Tasman Resources Ltd, FMG Resources Pty Ltd, Olympic Domain Pty Ltd	Uranium; Iron; Gold; Rare Earths; Copper; Silver; Iron Ore
Roxby Downs	9	FMG Resources Pty Ltd, BHP Billiton Olympic Dam Corporation Pty Ltd, Tasman Resources Ltd, OZ Exploration Pty Ltd	Uranium; Iron; Gold; Rare Earths; Copper; Silver; Base Metals

Source: DPC 2018a

3.2.1 Mount Arden Pastoral Lease

The Mount Arden pastoral lease is around 340 km^2 in size and is centred about 30 km North of Port Augusta. The southern termination of the study area is centred on the boundary between Mount Arden and Carriewerloo pastoral leases. The lease was last transferred in 2011-12

(Pastoral Board 2012). There are currently four Exploration Licences intersecting the lease seeking uranium, iron, gold, rare earths and copper (Table 3-4).

3.2.2 Carriewerloo Pastoral Lease

The Carriewerloo pastoral lease is around 870 km^2 in size and is centred around 50 kilometres north-west of Port Augusta. The southern termination of the study area is centred on it's boundary between Mount Arden and Carriewerloo pastoral leases. The lease hasn't been transferred in the last ten years. In 2007, there were around 25,000 sheep producing wool and 14,000 mated ewes on the lease (Dawkins 2007). There are currently five Exploration Licences intersecting the lease seeking uranium, iron gold, rare earths and copper (Table 3-4).

3.2.3 Kootaberra Pastoral Lease

The Kootaberra pastoral lease is around 1,200 km^2 in size and is centred around 70 kilometres north of Port Augusta. The Study Area runs through the centre of the pastoral lease for around 45 kilometres. The lease hasn't been transferred in the last ten years. There are currently four Exploration Licences intersecting the pastoral lease seeking uranium, gold, copper and clay (Table 3-4).

3.2.4 Oakden Hills Pastoral Lease

The Oakden Hills pastoral lease is around 1,700 km^2 in area and is centred around 140 kilometres north-west of Port Augusta and around 60 kilometres south of Woomera. The property was founded in the 1879 and is owner-managed. The study area passes through the lease for around 63 kilometres. The lease hasn't been transferred in the last ten years. There are currently twelve Exploration Licences intersecting the lease seeking uranium, silver, cobalt, gold, copper, clay, zinc, lead and iron (Table 3-4).

3.2.5 Pernatty Pastoral Lease

The Pernatty Pastoral lease is around 2,230 km^2 and is centred around 150 kilometres north of Port Augusta and 70 kilometres east of Woomera. Pernatty Station was established in 1868 and was stocked with sheep in 1871. It has a maximum SA Pastoral Board rating of 23,000 sheep or 4,600 cattle equivalent, with the average carrying ability of 11,647 sheep and 288 cattle annually. It is where the OZ Minerals Carapateena operation is located. The Study Area intersects the south-west corner of the lease by around 9 kilometres. The lease hasn't been transferred in the last ten years. There are currently twenty Exploration Licences intersecting the pastoral lease seeking gold, copper, silver, cobalt, uranium, zinc, lead and iron (Table 3-4).

3.2.6 Arcoona Pastoral Lease

The Arcoona pastoral lease is around 3,430 km^2 in size and is centred around 200 kilometres north-west of Port Augusta and surrounds Woomera. The Study Area passes through the centre of the lease for around 67 kilometres. In 2008, the lease was acquired by the Handbury family and supported around 20,000 sheep (Partridge 2009). The lease hasn't been transferred since.

There are currently twenty Exploration Licences intersecting the pastoral lease seeking silver, cobalt, gold, copper, uranium, iron and rare earths (Table 3-4).

3.2.7 Purple Downs, Andamooka and Roxby Downs Pastoral Leases

In 2014, the leases for the Purple Downs, Andamooka and Roxby Downs pastoral leases were granted to the Kokatha people, who hold native title over the area. The leases were previously held by BHP. The Kokatha Pastoral Company has been established to manage the leases totalling around 5,000 km^2 in size. Plans for the pastoral land include repairs, improvements and restocking with sheep and cattle as the lease has been 'let run-down' (Brown 2016).

The Purple Downs pastoral lease is centred around 45 kilometres north of Woomera and 40 kilometres south of Roxby Downs. The study area passes through the centre of the lease for around 31 kilometres. The Andamooka pastoral lease is centred around the Andamooka township and extends for around 55 kilometres from Roxby Downs to Lake Torrens. The Study Area intersects the western boundary of the lease for around 28 kilometres. The Roxby Downs pastoral lease surrounds Roxby Downs and Olympic Damn on their north, west and south sides. The Study Area terminates in this pastoral lease after running along its western boundary for around 40 kilometres.

There are currently eight Exploration Licences intersecting Purple Downs, ten intersecting Andamooka and nine intersecting Roxby Downs pastoral lease seeking uranium, iron, gold, rare earths, copper, silver and base metals (Table 3-4).

3.3 Residential Areas

3.3.1 Far North residential areas

3.3.1.1 Port Augusta

Overview

Port Augusta is the largest community in the Far North region and an important regional centre and potential source of workers and services. Established as a natural harbour in 1852, it became one of South Australia's largest regional cities and a major service centre for the region. In 1878, Port Augusta was the proposed southern terminus for the north south transcontinental railway line headed to Darwin (The Ghan). From 1913–1917 the 2,000 km east west transcontinental railway between Port Augusta and Kalgoorlie (the Indian Pacific) was constructed. Port Augusta is an important stop on both the Indian Pacific and The Ghan railway services.

Stirling North is situated approximately 7 km east of Port Augusta, at the centre of a number of transport corridor junctions including the major rail junction to the Port Augusta power station, the east-west rail link, and the junction of the Augusta Highway and the Flinders Ranges Way. In the 2016 census Stirling North SSC (state suburb code) had a population of 2,673.

The Davenport Community Council Incorporated holds an Aboriginal Lands Trust lease for use and management of a portion of land in Port Augusta, with the key aim being to develop the community through better housing, employment opportunities and to look after the surrounding environment. The lease expires in 2080, and includes a central location for community living, with a population ranging from around 80 to 150 (Aboriginal Lands Trust 2016).

Until recently, Port Augusta provided a large proportion of South Australia's base load electricity, using coal supplied from the Leigh Creek coal mine. Both the power station and mine closed in the first half of 2016 (see also Section 7.1.3). Currently there is an emphasis on renewable energy, which is discussed further in Section 7.1.3.

Port Augusta is also an important starting point for ecotourism ventures into the Flinders Ranges. In the three years to December 2016, the Flinders Ranges attracted an annual average of 665,000 overnight and 626,000 day trips visitors each year (SATC 2017). The Pichi Richi Railway is a major attraction, connecting Port Augusta to the town of Quorn, through Pichi Richi Pass. Other tourist attractions are the Wadlata Outback Centre and the Australian Arid Lands Botanic Gardens (Port Augusta City Council 2018a).

Horticulture is an expanding industry in Port Augusta, particularly with the development of Sundrop Farms commercial greenhouse complex. In 2010 Sundrop Farms' first commercial greenhouse facility in South Australia became operational in Port Augusta. Work to extend the facilities to 20 hectares commenced in 2014, which was completed in 2016. The facilities use solar tower technology to produce energy for plant growing systems and to heat and cool the greenhouses as required (Sundrop 2016).

Notwithstanding existing strengths and recent developments in Port Augusta, the 2016 Census of Population and Housing (ABS 2017a) suggests some degree of economic decline. In particular, the labour force size has decreased over the last decade (down 190 people) coupled with an increase in the unemployment rate (up 2.7 percentage points).

Average weekly rent and monthly mortgage repayments were $180 per week and $1,213 per month respectively. While both these amounts were cheaper than the State average of $260 per week and $1,491 per month, the low average income of Port Augusta residents meant that 9.8 per cent of renters and 4.8 per cent of home owners were considered to be under housing stress as a result of spending more than 30 per cent of their household income on rent or repayments (ABS 2017a).

Port Augusta had a high proportion of people identifying as Aboriginal (18.3 per cent).

According to RDAFN (2017), Port Augusta has two main options for economic growth:

1. Organically grow as a regional services centre for the Far North
2. Continue to establish itself as a base for working with the region's natural resources.

In 2016, there was optimism in Port Augusta about the Defence expansion at Cultana, renewable energy, and the Carrapateena Project (Strategic Economic Solutions 2016). But it was noted that

Port Augusta lacked core skills, capabilities and industry links that were hindering local economic benefit.

The Port Augusta Airport completed construction of a new terminal during 2014 which provided seating for 68 people, and access to new amenities within the existing building. The facility also provides office space and baggage handling. The upgrade included improvements to the carpark and plane parking areas (Port Augusta City Council 2018b).

Social Services and Infrastructure

Port Augusta has a range of community and sporting infrastructure and services including aged care, child care, special needs care, parks, ovals, art centres and other health and sporting services. The city's aged care services include the Nerrilda nursing home (46 bed nursing home), Ramsey village (62 bed nursing home) and Wami Kata (a commonwealth funded Aboriginal and Torres Strait Islander Flexible Aged Care Provider with 32 beds) (Aged Care Guide 2018). There is also a range of health programs associated with aged care such as a Men's Shed, Let's Keep Active program, Active Aging program, Walking Group and Men's Social Afternoon. Port Augusta has two child care centres in the town plus outside of school hours care at three schools (DET 2018). There is also a special needs centre and a number of substance misuse services (Port Augusta City Council 2018c).

Port Augusta's wide range of sporting and recreation infrastructure includes a swimming pool, 16 parks, a golf club, a number of ovals, basketball and tennis courts, soccer fields, along with a wide range of sporting clubs and associations.

Port Augusta also has a public transport service, the City Link bus, which provides public transport around the city. The Port Augusta Airport is owned and operated by the Port Augusta City Council and serviced by Regional Express Airlines which provides regular passenger transport between Port Augusta, Coober Pedy and Adelaide. Annual passenger numbers are approximately 16,000 per year (Port Augusta City Council 2018d).

Health, education, child care facilities, police and emergency services are described in Section 7.2.

Demographic Trends

Table 3-5 shows a comparative analysis of demographic trends in Port Augusta over the three censuses from 2006, 2011 and 2016. The table shows:

- The population of Port Augusta has slightly decreased over the past decade (down 67 people)
- Median weekly individual and household incomes have increased by around 45 and 37 per cent respectively. However, median weekly rent and monthly mortgage repayments have increased at a faster rate (57 and 72 per cent respectively)
- The unemployment rate has increased (2.7 percentage points) over the decade.

Table 3-5 Demographic Trends – Port Augusta, 2006 - 2016

	2006	2011	2016	10-Yr Change
Person characteristics				
Population (total number)	13,875	13,986	13,808	-67
Male %	50.6%	50.8%	51.0%	0.3%
Female %	49.4%	49.2%	49.0%	-0.3%
Indigenous origin %	16.6%	16.9%	18.3%	1.7%
Age				
0–14 years %	21.3%	20.3%	18.9%	-2.4%
65 years and over %	12.0%	14.0%	16.5%	4.5%
Median age	39	38	39	-
Main language spoken at home				
English only %	87.3%	84.7%	83.2%	-4.2%
Income				
Median weekly individual income ($)	417	541	604	187
Median weekly household income ($)	798	992	1,094	296
Home ownership				
Median weekly rent ($)	115	150	180	65
Rent payments more than 30% household income (%)	n.a.	8.7%	9.8%	
Median monthly mortgage repayment ($)	706	1,213	1,213	507
Mortgage repayments more than 30% household income (%)	n.a.	4.8%	3.7%	
Employment status				
In the labour force (total number)	6,062	6,097	5,872	-190
Employed full-time %	56.6%	59.6%	55.0%	-1.6%
Employed part-time %	29.2%	28.1%	29.1%	0.0%
Unemployed %	7.0%	5.8%	9.7%	2.7%
Education				
Secondary (%)	12.3%	11.5%	9.4%	-2.9%
Technical or further education (%)	8.3%	5.8%	0.0%	-8.3%
University or tertiary (%)	5.7%	2.1%	0.0%	-5.7%

Source: ABS 2017a

3.3.1.2 Roxby Downs

Overview

Roxby Downs was established in 1987 as a joint venture between Western Mining Corporation (now BHP Billiton Ltd) and the Government of South Australia, to service the nearby Olympic Dam mine. The town was the first of its kind in South Australia. The town is subject to a specific Indenture Act (the *Roxby Downs (Indenture Ratification) Act 1982 (SA)*) and is administered by the Municipal Council of Roxby Downs (Roxby Council 2018a). As a result of its recent construction and corporate financial investment, Roxby Downs has modern, well maintained infrastructure. At the time of the 2011 census, the-then level of mining activity and proposed expansions resulted in very low unemployment (1.8 per cent compared with the State average of 5.7 per cent) and very high incomes (individual weekly income of $1,463 compared to the

State average of $534). Although unemployment increased in 2016, the difference relative to the State average became greater (3.5 and 7.5 per cent respectively). Similarly, incomes rose by a greater amount in Roxby Downs relative to the State average ($1,547 and $600 respectively).

Estimates of personal income for small areas released by the ABS (2017c) identified Roxby Downs as a "notable exception" to the trend of capital city regions being likely to have greater proportions of high income recipients (defined as individuals earning at the highest quartile). A total of 54.7 per cent of income recipients in Roxby Downs where identified as high income earners in 2012-13[3], compared with 21.2 per cent for the whole of South Australia. The portion of high income earners remained relatively the same in 2014-15[4] (54.8 and 21.6 per cent in Roxby Downs and South Australia respectively) (ABS 2017c).

The regional advantage of Roxby Downs, based on ABS Socio-Economic Index for Areas (SEIFA), was ranked tenth among South Australian LGAs for 2016. This was just above Mount Barker and below Holdfast Bay. However, the rank of Roxby Downs was also above the metropolitan LGAs of Tea Tree Gully (thirteenth), Campbelltown (thirteenth) and West Torrens (fourteenth) (ABS 2018b). Notwithstanding Roxby Downs' relative advantage within the state, its SEIFA ranking has decreased since 2011 (ranked second).

Despite high incomes, housing affordability was a significant issue being driven by a high demand for suitable housing associated with the expansion of BHP Billiton's Olympic Dam operation. ABS Census data from 2016 show that the average weekly rent and monthly mortgage repayments were $198 and $2,000 respectively. While weekly rent was $62 per week cheaper than the State average of $260 per week, mortgage repayments were $509 more expensive per month than the State average of $1,491 per month. Because of the very high average incomes of some Roxby Downs residents, only 3.2 per cent of renters and 3.1 per cent of home owners were considered to be under housing stress as a result of spending more than 30 per cent of their household income on rent or repayments (ABS 2017a).

Social Services and Infrastructure

Roxby Downs has a wide range of modern well equipped buildings, business facilities and services that are actively administrated by a community network. The town established a community board in 2005 which is a non-for profit association that consists of a number of forums and partnerships. The board's vision is to create a vibrant town in which its community is caring, diverse, safe and tolerant and that has a strong business and social presence that provides a healthy and secure lifestyle. The purpose of the board is to act as a peak body to oversee the implementation of the community plan, forums and partnerships, and to liaise with government authorities and private sector business.

[3] This was $75,000 per annum or higher in 2012-13.

[4] This was $78,206 per annum or higher in 2014-15.

Forums and partnerships in Roxby Downs (Roxby Council 2018b) include:

- Alcohol and substance abuse forum
- Arts and culture forum
- Business forum
- Community garden
- Education and workplace training forum
- Environment forum
- Family forum
- Health forum
- Multicultural forum
- Roadsafe forum
- Sport and recreation forum
- Volunteering partnership
- Women's network forum
- Youth forum.

Roxby Downs is serviced by four churches covering several denominations, a range of health services, a community library and a range of sport and recreation facilities and services.

Roxby Council offers a range of support contact details and visiting specialists in the area of aged care support, disability and other health disciplines, which visit regularly. No aged care homes were identified in Roxby Downs but two home-care services are available (AnglicareSA and Calvary Community Care (Aged Care Guide 2018). Two child care services operate in Roxby Down in addition to out of school hours care provided by the area school (DET 2018).

Roxby Downs has two indoor sport stadiums, swimming pools, a youth centre, fitness gym, squash courts, tennis courts, sports ovals, a skate park, netball courts, soccer pitch and a cinema. These facilities cater to a range of sports and sporting associations including netball, basketball, volleyball, tennis, squash, swimming, soccer, football and cricket (Roxby Council 2018c).

Health, education, child care facilities, police and emergency services are described in Section 7.2.

Demographic Trends

Table 3-6 shows a comparative analysis of demographic trends in Roxby Downs over the three censuses from 2006, 2011 and 2016. The table shows:

- Population in Roxby Downs has decreased slightly (172 people) over the past decade despite significant growth in previous years (increase of 646 people over 2006 to 2011)
- Median weekly individual and household incomes have increased by around 39 and 22 per cent respectively. However, median weekly rent and monthly mortgage repayments have increased at a faster rate (43 and 54 per cent respectively)
- The unemployment rate has increased (1.2 percentage points) over the decade, despite a slight decrease in labour force (down 109 people).

Table 3-6 Demographic Trends – Roxby Downs, 2006 - 2016

	2006	2011	2016	10-Yr Change
Person characteristics				
Population (total number)	4,056	4,702	3,884	-172
Male %	56.1%	58.8%	57.1%	1.0%
Female %	43.9%	41.2%	42.9%	-1.0%
Indigenous origin %	1.6%	1.6%	3.0%	1.4%
Age				
0–14 years %	28.0%	22.9%	26.4%	-1.6%
65 years and over %	0.4%	0.4%	1.2%	0.7%
Median age	30	29	30	-
Main language spoken at home				
English only %	89.6%	82.8%	83.8%	-5.8%
Income				
Median weekly individual income ($)	1,116	1,463	1,547	431
Median weekly household income ($)	2,017	2,718	2,456	439
Home ownership				
Median weekly rent ($)	138	196	198	60
Rent payments more than 30% household income (%)	n.a.	5.1%	3.2%	
Median monthly mortgage repayment ($)	1,300	2,350	2,000	700
Mortgage repayments more than 30% household income (%)	n.a.	4.2%	3.1%	
Employment status				
In the labour force (total number)	2,391	2,824	2,282	-109
Employed full-time %	76.8%	78.4%	71.4%	-5.4%
Employed part-time %	15.7%	13.3%	18.7%	3.0%
Unemployed %	2.2%	1.8%	3.5%	1.2%
Education				
Secondary (%)	12.3%	11.5%	9.4%	-2.9%
Technical or further education (%)	8.3%	5.8%	0.0%	-8.3%
University or tertiary (%)	5.7%	2.1%	0.0%	-5.7%

Source: ABS 2017a

3.3.1.3 Coober Pedy

Overview

Coober Pedy is an opal mining town located in the Outback of South Australia approximately 850 kilometres north of Adelaide and 680 kilometres south of Alice Springs. Coober Pedy is recognised as the largest producer of opal in the world with an estimated 70 per cent of the world's precious opal being mined in the opal fields of the area.

The Coober Pedy Precious Stones Field, from which the opal is mined, covers an area of 4,954 km^2 of which it is estimated that approximately 10 per cent of the total area has been worked.

The town water supply comes from an underground source 24 kilometres north of town. The water is pumped through an underground pipeline to the water works where it is treated by reverse osmosis.

Completion of the Stuart Highway (in 1987) now allows a comfortable yet lengthy drive through Central Australia. Coober Pedy is serviced daily by coach services and 6 days a week with Regional Express Airlines. Tourism and mining are the driving economic forces in the town (District Council of Coober Pedy 2018a).

The majority of the population is dependent upon opal mining and tourism. Other employment is provided in areas including property managers, railway and highway workers and government agencies. Coober Pedy is quickly becoming the regional service centre of Outback South Australia and is now the focus for essential services such as medical, health, welfare, law and order, education and leisure (DPTI 2012).

Strategic issues that need to be addressed in particular include economic development, tourist appeal and the adequate supply of land for retail, commercial and industrial uses. Sustainable growth in Coober Pedy is achievable, there is however a fine line between offering generally recognised services to meet the needs of tourists and the community, whilst at the same time maintaining the outback mining character for which the town is known (DPTI 2012).

Social Services and Infrastructure

Coober Pedy has a range of social infrastructure including sport, health, aged care, parenting and wellbeing services. However, being a relatively small town compared to the large residential centres in the Regional Study Area, the number of options within each type of service is low. These is only one child care centre in Coober Pedy but the area school also offers after school care (DET 2018). In-home aged care and two aged care homes operate in Coober Pedy. Country Health Connect has 4 aged care beds and Umoona Aged Care has 15 beds for Aboriginal and Torrens Straight Islander people (Aged Care Guide 2018). The District Council of Coober Pedy offers free Men's and Women's groups, homework help, and weekly Baby Bounce and Playgroup sessions for mothers and toddlers (District Council of Coober Pedy 2018b).

The Umoona Tjutagku Health Service Aboriginal Corporation provides services to Aboriginal people in the town including a Breakfast Program, Well Baby Program and Drug and Alcohol Services, Counselling and other services (UTHS 2017).

Sports and recreation facilities in Coober Pedy include a town oval (with football, soccer and cricket competitions), a public swimming pool, BMX track, gym, golf course, adventure playground, motor speedway and shooting range.

Health, education, child care facilities, police and emergency services are described in Section 7.2.

Demographic Trends

Table 3-7 shows a comparative analysis of demographic trends in Coober Pedy over the three censuses from 2006, 2011 and 2016. The table shows:

- The population of Port Augusta has decreased over the past decade (149 people)
- Median weekly individual and household incomes have increased significantly, by around 61 and 59 per cent respectively. Median weekly rent also increased by a similar amount (67 per cent). Conversely monthly mortgage repayments grew at a much slower rate (17 per cent)
- The unemployment rate has remained relatively the same over the decade.

Table 3-7 Demographic Trends – Coober Pedy, 20016 - 2016

	2006	2011	2016	10-Yr Change
Person characteristics				
Population (total number)	1,911	1,694	1,762	-149
Male %	56.6%	56.2%	54.6%	-2.0%
Female %	43.4%	43.8%	45.4%	2.0%
Indigenous origin %	14.0%	16.2%	17.1%	3.1%
Age				
0–14 years %	17.1%	16.5%	16.0%	-1.1%
65 years and over %	13.8%	19.3%	22.6%	8.8%
Median age	46	45	46	-
Main language spoken at home				
English only %	58.1%	65.6%	60.3%	2.2%
Income				
Median weekly individual income ($)	309	428	497	188
Median weekly household income ($)	553	735	882	329
Home ownership				
Median weekly rent ($)	90	110	150	60
Rent payments more than 30% household income (%)	n.a.	3.6%	5.4%	
Median monthly mortgage repayment ($)	477	600	556	79
Mortgage repayments more than 30% household income (%)	n.a.	3.8%	1.9%	
Employment status				
In the labour force (total number)	761	754	707	-54
Employed full-time %	52.9%	57.0%	56.6%	3.6%
Employed part-time %	26.4%	27.1%	24.1%	-2.3%
Unemployed %	9.8%	8.8%	9.9%	0.1%
Education				
Secondary (%)	12.3%	11.5%	9.4%	-2.9%
Technical or further education (%)	8.3%	5.8%	0.0%	-8.3%
University or tertiary (%)	5.7%	2.1%	0.0%	-5.7%

Source: ABS 2017a

3.3.1.4 Andamooka

Overview

Historically, Andamooka has been an opal mining town that has seen boom and bust times since the 1930s. The town has experienced significant population shifts from two to 2,000 people, with a population of 316 recorded in 2016. The town is surrounded by white soil cones, created by mining. The local opals are of high quality and include matrix opals, which are unique to the area. Opals have attracted many fossickers from around the world, which has given Andamooka a multicultural society that is particularly isolated from other communities (APOMA 2018a).

During the five-year period of 2008-2012, Andamooka has experienced perhaps the most significant changes of any town in the region, as it is within the influence of Roxby Downs and has become a 'dormitory suburb' for workers at the Olympic Dam mine, approximately 26 km to the west. The announcement to downscale the design of the expansion project, in August 2012, appears to have changed the nature of Andamooka's role in augmenting the accommodation needs of BHP Billiton workers. Andamooka's population has decreased from 1,100 to just 450 in the few years since BHP Billiton's announcement (Donnellan 2015).

During the 2016 census unemployment increased in Andamooka to be significantly greater than the State average (9.4 and 7.5 per cent respectively) and individual incomes were low ($475 compared with the State average of $600).

ABS Census data indicated that the average weekly rent and monthly mortgage repayments were $115 per week and $929 per month respectively. While both these amounts were significantly cheaper than the State averages of $260 per week and $1,491 per month, the lower average income of Andamooka residents meant that 5.7 per cent of renters and no home owners were considered to be under housing stress as a result of spending more than 30 per cent of their household income on rent or repayments (ABS 2017a).

Social Services and Infrastructure

Andamooka was once one of the most isolated towns in South Australia, but with developments surrounding Olympic Dam Mine and nearby Roxby Downs township there is now an all-weather sealed road extending 120 km from the Stuart Hwy at the Pimba turn-off, past Roxby Downs and into Andamooka. Heavy rains can close outback tracks including the Borefield Road and the Oodnadatta and Strezlecki Tracks, but access into and out of Andamooka remains open, although this may rarely be temporarily closed during major rain events as water flows across the sealed road (APOMA 2018a).

Andamooka has a town management committee that represents the town in partnership with the Andamooka Progress and Opal Miners Association (APOMA) and the Outback Communities Authority (OCA). Because of the small population of the town, there are only a few community groups that exist, which include:

- a community church
- hospital auxiliary

- Country Women's Association
- Volunteer SES / CFS
- Volunteer Ambulance Service
- Andamooka Sports Shooters Association.

Community facilities include a playground complete with a basketball ring, skate park, BMX track, barbecues and a picnic area. The town has one motel which provides meals and accommodation, a restaurant, a café, fuel station and a grocer. Camp grounds with power and a shower block and toilets are also available.

Health, education, child care facilities, police and emergency services are described in Section 7.2.

Demographic Trends

Table 3-8 shows a comparative analysis of demographic trends in Andamooka over the three censuses from 2006, 2011 and 2016. The table shows:

- The population of Andamooka has decreased over the past decade (down 210 people)
- Median weekly individual and household incomes have increased, by around 28 and 19 per cent respectively. However monthly mortgage repayments grew at a significantly faster rate (132 per cent)
- The unemployment rate has increased (1.2 percentage points) the decade.

Table 3-8 Demographic Trends – Andamooka, 2006 - 2016

	2006	2011	2016	10-Yr Change
Person characteristics				
Population (total number)	526	592	316	-210
Male %	53.9%	55.2%	54.4%	0.6%
Female %	46.1%	44.8%	45.6%	-0.6%
Indigenous origin %	3.4%	3.5%	4.1%	0.7%
Age				
0–14 years %	14.4%	20.3%	12.0%	-2.4%
65 years and over %	19.2%	15.9%	28.2%	9.0%
Median age	48	41	53	5
Main language spoken at home				
English only %	79.7%	85.1%	77.6%	-2.0%
Income				
Median weekly individual income ($)	370	466	475	105
Median weekly household income ($)	597	878	708	111
Home ownership				
Median weekly rent ($)	115	180	115	0
Rent payments more than 30% household income (%)	n.a.	4.3%	5.7%	
Median monthly mortgage repayment ($)	400	1,083	929	529
Mortgage repayments more than 30% household income (%)	n.a.	2.5%	0.0%	
Employment status				
In the labour force (total number)	220	234	130	-90
Employed full-time %	57.7%	66.2%	50.7%	-7.0%
Employed part-time %	28.6%	20.5%	33.3%	4.7%
Unemployed %	8.2%	6.0%	9.4%	1.2%
Education				
Secondary (%)	12.3%	11.5%	9.4%	-2.9%
Technical or further education (%)	8.3%	5.8%	0.0%	-8.3%
University or tertiary (%)	5.7%	2.1%	0.0%	-5.7%

Source: ABS 2017a

3.3.1.5 Woomera

Overview

Woomera sits to the west of the Project Area. The village of Woomera was established in 1947 to serve the Woomera Rocket Range (later the Woomera Test Facility). Following World War II, the British and Australian governments proposed a large remote area for rocket research and development. This joint project between the United Kingdom and Australia gave rise to the Woomera Rocket Range and WPA, a military area covering 127,000 km^2 of northwest South Australia, extending to the coast of the northwest of Western Australia. 'Woomera', a western interpretation of the Pitjantjatjara word for the spear thrower/launcher, was chosen to name the site. The first missile was launched in 1949 and the site became a world leader in scientific and engineering activity. The site was used for joint Australia-United Kingdom weapons and

aerospace testing, including rocket and satellite launching and tracking. Activities at the site were shrouded in security and secrecy until the mid-1990s. These activities created employment for Defence personnel and civilians. Defence continued to support and invest into the Woomera community, which developed into a well-maintained and serviced township. At its peak, Woomera housed Australian, British and American personnel and their families. It was classified as a military base and was a closed town. The population fluctuated from 3,000 to 6,000 in the 1960s and had reduced to 146 people at the time of the 2016 census. The population can fluctuate significantly during times of trial activities (the most recent, testing of the UK MOD Taranis aircraft, was conducted in 2010). Defence continues to provide a secure standard of living for Woomera's remaining residents (DoD 2016).

In 1999 the Australian Government established the nearby Woomera Immigration Reception and Processing Centre, to house asylum seekers and refugees. The centre refocussed attention on Woomera as a centre for security and defence. Following ongoing public pressure, the centre was closed in 2003 (DIBP 2012).

While the housing is ageing, Woomera has some good infrastructure that could support a much larger population. Woomera had no unemployment (compared with the State average of 7.5 per cent), high incomes ($1,179 per week compared to $600 per week State average), and a majority of working age residents, many with young families (people aged 0-14 years in Woomera made up about 8.2 per cent of the population).

Although most launch pads at Woomera are now disused, the site continues to be used for rocket launching, aircraft and aerospace testing and by the Defence Science and Technology Organisation. The town was acknowledged by the American Institution of Aeronautics and Astronautics in 2007 as a world aerospace site of historical significance.

The Woomera Board and the OCA represent the town, however, Defence is the key stakeholder within the community. The population of Woomera remains controlled by Defence and most of the housing in Woomera is owned and managed by Defence, with only a small number of houses available for rent or purchase (BHP Billiton 2013). The RAAF Woomera Airfield exists approximately 5 km north of Woomera town. It is controlled by the RAAF and civilian aircraft are generally not permitted to use the airfield (DoD 2007).

Social Services and Infrastructure

Woomera has a range of community and recreation facilities including the aircraft and missile park, two museums, school, theatre, heritage centre, swimming pool, ten pin bowling alley, fitness centre and golf course. The town also has a weekly newsletter and a community radio station, its own football club, bowling club and Returned Services League. Although these facilities exist in Woomera, because of the dwindling population, most of the facilities are not open consistently or at all. For example, the museum is open occasionally (by appointment or for special events), the ten pin bowling alley is open as needed, there are no longer enough players to field a football team and the bowling club exists although there are no greens to play.

In additional Woomera hospital has closed since 2014 due to lack of funding, and is now serviced by a general health service, with a GP two days per week and a nurse six days per week (ABC 2014).

The school and post office operate on a regular basis. There are no aged care or disability services operating in Woomera (Aged Care Guide 2018).

Health, education, child care facilities, police and emergency services are described in Section 7.2.

Demographic Trends

Table 3-9 shows a comparative analysis of demographic trends in Woomera over the past three censuses (2006, 2011 and 2016). The table shows:

- The population of Woomera has decreased significantly over the past decade (down 149 people)
- Median weekly individual and household incomes have increased, by around 48 and 7 per cent respectively, while weekly rent also increased by 33 per cent
- The unemployment rate has decreased (to nil) over the decade.

Table 3-9 Demographic Trends – Woomera, 2006 - 2016

	2006	2011	2016	10-Yr Change
Person characteristics				
Population (total number)	295	216	146	-149
Male %	55.8%	55.1%	64.3%	8.5%
Female %	44.2%	44.9%	35.7%	-8.5%
Indigenous origin %	5.4%	5.1%	0.0%	-5.4%
Age				
0–14 years %	23.1%	20.4%	8.2%	-14.8%
65 years and over %	0.0%	4.2%	3.4%	3.4%
Median age	28	37	48	20
Main language spoken at home				
English only %	86.8%	86.7%	90.5%	3.7%
Income				
Median weekly individual income ($)	796	836	1,179	383
Median weekly household income ($)	1,462	1,302	1,562	100
Home ownership				
Median weekly rent ($)	90	150	120	30
Rent payments more than 30% household income (%)	n.a.	6.9%	0.0%	n.a.
Median monthly mortgage repayment ($)	0	0	0	0
Mortgage repayments more than 30% household income (%)	n.a.	0.0%	0.0%	n.a.
Employment status				
In the labour force (total number)	177	124	104	-73
Employed full-time %	80.9%	70.2%	89.5%	8.6%
Employed part-time %	10.4%	21.8%	10.5%	0.1%
Unemployed %	4.6%	2.4%	0.0%	-4.6%
Education				
Secondary (%)	12.3%	11.5%	9.4%	-2.9%
Technical or further education (%)	8.3%	5.8%	0.0%	-8.3%
University or tertiary (%)	5.7%	2.1%	0.0%	-5.7%

Source: ABS 2017a

3.3.1.6 Pimba

Pimba is a small settlement located at the junction of the Stuart Highway to Alice Springs and the road to Woomera and Roxby Downs. Pimba has a very small population of 63 in the 2016 census (limited and no data available from the 2006 and 2011 censuses respectively). It was established originally as a workers' camp during the construction of the transcontinental railway to Western Australia at the end of World War I and retained as a railway siding once the track became operational. Both the Ghan and the Indian Pacific trains pass through Pimba. The township was not formally surveyed until the early 1960s. Pimba has one, iconic, roadhouse which provides a rest, accommodation, food and fuel stop for passing motorists (Spud's 2018) and serves as starting point to access the remote northern region. There is significant light vehicle traffic movement through the settlement.

Social Services and Infrastructure

There were no community or sporting organisations, infrastructure, aged care or disability services identified in Pimba in 2016.

Demographic Trends

Table 3-10 shows a comparative analysis of demographic trends in Pimba over the past three censuses (2006, 2011 and 2016). The table shows:

- The population of Pimba has increased over the past decade (11 people)
- The unemployment rate has remained the same (at nil) over the decade.

Table 3-10 Demographic Trends – Pimba, 2006 - 2016

	2006	2011	2016	10-Yr Change
Person characteristics				
Population (total number)	52	115	63	11
Male %	74.0%	n.a	62.7%	-11.3%
Female %	26.0%	n.a	37.3%	11.3%
Indigenous origin %	7.7%	n.a	12.7%	5.0%
Age				
0–14 years %	10.7%	n.a	11.1%	0.4%
65 years and over %	21.4%	n.a	22.2%	0.8%
Median age	39	n.a	39	-
Main language spoken at home				
English only %	90.4%	n.a	63.5%	-26.9%
Income				
Median weekly individual income ($)	n.a.	n.a	1,342	n.a
Median weekly household income ($)	n.a.	n.a	890	n.a
Home ownership				
Median weekly rent ($)	n.a.	n.a	n.a.	n.a
Rent payments more than 30% household income (%)	n.a.	n.a	n.a.	n.a.
Median monthly mortgage repayment ($)	n.a.	n.a	n.a.	n.a
Mortgage repayments more than 30% household income (%)	n.a.	n.a	n.a.	n.a.
Employment status				
In the labour force (total number)	63	n.a	44	-19
Employed full-time %	82.9%	n.a	82.9%	0.0%
Employed part-time %	17.1%	n.a	17.1%	0.0%
Unemployed %	0.0%	n.a	0.0%	0.0%
Education				
Secondary (%)	12.3%	11.5%	9.4%	-2.9%
Technical or further education (%)	8.3%	5.8%	0.0%	-8.3%
University or tertiary (%)	5.7%	2.1%	0.0%	-5.7%

Source: ABS 2017a

3.3.2 Other significant residential areas

3.3.2.1 Whyalla

Overview

Whyalla is well south from the Project Area, but could potentially be important as a source of services, local suppliers, workers and housing. Historically, Whyalla was a steel producing town that experienced a significant economic downturn in the late 1980s and 1990s as many of the steel mills closed. Since then it has diversified into industries such as aquaculture, sustainable development and renewable energy technologies. Whyalla has been identified as "ideally situated" to become a mining services hub for South Australia, with transport, engineering, business and retail industries to meet the needs of local and remote mineral developments. It has also been acknowledged that insufficient infrastructure in the region has hampered mining development (SACES 2012).

Whyalla was home to the only non-Adelaide based university campus in South Australia (University of South Australia, Whyalla Campus) and the Spencer Institute of TAFE. Whyalla Aerodrome is the largest in the region and mid- to large-sized regional aircraft and small airline jets could land there.

ABS Census data indicates that the average weekly rent and monthly mortgage repayments were $176 per week and $1,235 per month respectively. While both these amounts were significantly cheaper than the state average of $260 per week and $1,491 per month, the low average income ($497 per week) of Whyalla residents meant that 4.4 per cent of renters and 11.8 per cent of home owners were considered to be under housing stress as a result of spending more than 30 per cent of their household income on rent or repayments (ABS 2017a).

Social Services and Infrastructure

Whyalla has a range of community and health services and infrastructure spread around the town. This includes a modern regional health facility which was redeveloped in 2013 to provide a comprehensive cancer hub, mental health and rehabilitation units, a new accident and emergency unit, new operating theatres and patient accommodation units. The city's aged care services include the Yeltana Nursing Home (48 beds), Annie Lockwood Court (51 beds) and Copperhouse Court (42 beds) (City of Whyalla 2018a).

Whyalla has a number of social services and facilities including churches, a maritime museum, a cinema, a local craft village, parks, gardens and wetlands, a recently developed foreshore centre and a large health and leisure centre. The health and leisure centre has a range of pools (included a 25 m heated pool) for all ages, a gymnasium, squash courts, fitness centre and a sauna.

In May 2018, the council has resolved to commit $2.4m ($1.1m budgeted with the remainder to be sought from State government grants) to develop a new jetty at Whyalla foreshore (City of Whyalla 2018b).

There is also a public bus service that operates throughout the city, as well as a bus and airline services (Regional Express and Qantaslink) that operate to and from Adelaide.

The city has a range of sport and recreation facilities and associations that include but are not limited to; yacht, boat and fishing clubs and associations, basketball, netball, cricket, tennis, football, soccer, volleyball and cycling clubs and associations, a golf club, go kart club, bowling clubs (both grass and tenpin) and racing clubs.

Health, education, child care facilities, police and emergency services are described in Section 7.2.

Demographic Trends

Table 3-11 shows a comparative analysis of demographic trends in Whyalla over the three censuses from 2006, 2011 and 2016. The table shows:

- The population of Whyalla has increase slightly over the past decade (up 411 people), in addition to the proportion of Indigenous people which has increased notably (from 3.6 per cent in 2006 to 4.7 in 2016)
- Median weekly individual and household incomes have increased, by around 36 and 30 per cent respectively. However weekly rent and monthly mortgage repayments grew at a significantly faster rate (68 per cent for both)
- The unemployment rate has increased significantly (3.5 percentage points) over the decade.

Table 3-11 Demographic Trends – Whyalla, 2006 - 2016

	2006	2011	2016	10-Yr Change
Person characteristics				
Population (total number)	21,417	22,089	21,828	411
Male %	50.7%	50.6%	50.0%	-0.7%
Female %	49.3%	49.4%	50.0%	0.7%
Indigenous origin %	3.6%	4.2%	4.7%	1.1%
Age				
0–14 years %	21.7%	20.1%	19.2%	-2.5%
65 years and over %	13.6%	14.9%	17.1%	3.4%
Median age	40	38	40	-
Main language spoken at home				
English only %	90.0%	88.8%	86.9%	-3.1%
Income				
Median weekly individual income ($)	365	472	497	132
Median weekly household income ($)	762	943	987	225
Home ownership				
Median weekly rent ($)	105	150	176	71
Rent payments more than 30% household income (%)	n.a.	10.1%	4.4%	n.a.
Median monthly mortgage repayment ($)	737	1,289	1,235	498
Mortgage repayments more than 30% household income (%)	n.a.	6.0%	11.8%	n.a.
Employment status				
In the labour force (total number)	9,323	9,970	9,477	154
Employed full-time %	57.1%	57.6%	52.5%	-4.6%
Employed part-time %	27.5%	27.2%	29.5%	2.0%
Unemployed %	8.9%	8.2%	12.4%	3.5%
Education				
Secondary (%)	12.3%	11.5%	9.4%	-2.9%
Technical or further education (%)	8.3%	5.8%	0.0%	-8.3%
University or tertiary (%)	5.7%	2.1%	0.0%	-5.7%

Source: ABS 2017a

3.3.2.2 Port Pirie and City Districts (M)

Overview

Port Pirie was historically expanded to support mining at Broken Hill, particularly as lead and zinc ore from Broken Hill was smelted at Port Pirie; whilst copper mining in the region supported the growing economy and population (Deloitte 2013b). This history has seen the Port Pirie smelter in operation for 125 years (Eklund 2012). The smelter, operated by Nyrstar, is one of the world's largest primary lead smelting facilities which has an adjacent dedicated port facility for receipt of concentrates, and also services the mid-north region and uses road and rail for dispatch. As such, the town is heavily reliant on the smelter for providing direct and indirect employment (Port Pirie Regional Council 2016). The Nyrstar facility at Port Pirie began a $600 million redevelopment in 2015 (aided by funding support from the Government of South

Australia and the Australian Government's Export Finance and Insurance Corporation). The redevelopment opened in January 2018, securing more than 700 jobs (Moret 2018).

The Port Pirie township is situated close to the National Highway road transport corridor, and the primary interstate rail freight network. Despite proximity to infrastructure corridors, it has been noted that there may be considerable challenges moving product through the township to access the port (Deloitte 2013b).

ABS Census data indicate that the average weekly rent and monthly mortgage repayments were $170 and $1,001 respectively. These repayments are similar to those recorded for Whyalla and significantly cheaper than the state average of $260 per week and $1,491 per month. Despite this, a low median weekly personal income of $481 meant that 9.4 per cent of renters and 4.6 per cent of home owners were under housing stress as a result of spending 30 per cent or more of their household income on rent or repayments (ABS 2017a).

Social Services and Infrastructure

The Port Pirie area contributes a range of community, health, education and government administration services. The town is also a base for sporting and retail facilities due to its large catchment area (Port Pirie Regional Council 2016). It has an all-weather airstrip which is suitable for light aircraft, and is supported by an intrastate public transport service through Premier Stateliner busses. The town also has a town bus, taxi service and community bus (Port Pirie Regional Council 2018).

Port Pirie has a number of key venues offering sporting activities including three ovals, a number of parks including an equestrian racecourse, a sporting complex, YMCA, swimming pool and a foreshore area. The council also has a vision to develop a Port Pirie Regional Sports Precinct, centred on the redevelopment of the Port Pirie swimming pool, Memorial Oval and Pire West Oval. The city's aged care services include the Helping Hand Lealholme facility, St Joseph's House, and Senate Road Hostel.

Health, education, child care facilities, police and emergency services are described in Section 7.2.

Demographic Trends

Table 3-12 shows a comparative analysis of demographic trends in Port Pire over the three censuses from 2006, 2011 and 2016. The table shows:

- The population of Port Pirie has slightly increased over the past decade (down 225 people)
- Median weekly individual and household incomes have both increased by around 43 per cent respectively. However, median weekly rent and monthly mortgage repayments have increased at a faster rate (55 and 54 per cent respectively)
- The unemployment rate has increase slightly (0.7 percentage points) over the decade.

Table 3-12 Demographic Trends – Port Pirie

	2006	2011	2016	10-Yr Change
Person characteristics				
Population (total number)	17,139	17,332	17,364	225
Male %	48.8%	49.2%	49.0%	0.2%
Female %	51.2%	50.8%	51.0%	-0.2%
Indigenous origin %	2.3%	2.9%	3.6%	1.3%
Age				
0–14 years %	21.2%	20.0%	17.9%	-3.3%
65 years and over %	17.8%	18.9%	21.4%	3.6%
Median age	44	41	44	-
Main language spoken at home				
English only %	92.6%	92.6%	89.6%	-2.9%
Income				
Median weekly individual income ($)	336	403	481	145
Median weekly household income ($)	634	777	905	271
Home ownership				
Median weekly rent ($)	110	150	170	60
Rent payments more than 30% household income (%)	n.a.	9.5%	9.4%	n.a.
Median monthly mortgage repayment ($)	650	1,018	1,001	351
Mortgage repayments more than 30% household income (%)	n.a.	5.2%	4.6%	n.a.
Employment status				
In the labour force (total number)	6,856	7,155	7,292	436
Employed full-time %	53.5%	53.6%	50.4%	-3.1%
Employed part-time %	29.8%	32.7%	33.5%	3.7%
Unemployed %	10.0%	7.4%	10.7%	0.7%
Education				
Secondary (%)	12.3%	11.5%	9.4%	-2.9%
Technical or further education (%)	8.3%	5.8%	0.0%	-8.3%
University or tertiary (%)	5.7%	2.1%	0.0%	-5.7%

Source: ABS 2017a

4. CULTURAL HERITAGE AND COMMUNITY

4.1 Aboriginal Cultural Heritage

The region has a long history of occupation by Aboriginal people and many Aboriginal people maintain a strong connection with the land and water in the Regional Study Area. Since the start of European exploration in the 1840s, the histories of Aboriginal and non-Indigenous people have converged. Aboriginal histories became intimately linked with European exploration and the emergence of the pastoral industry. Explorers relied heavily on the navigational and diplomatic skills of Aboriginal guides, and many pastoralists encouraged Aboriginal people to live on their properties to provide labour.

4.2 Indigenous Population

Table 4-1 shows the relative size of the Aboriginal population in identified residential centres across the Regional Study Area. In each centre, other than Woomera, the relative size of the Indigenous population is higher than the state and national averages. The relative size is particularly high in Port Augusta, Coober Pedy and Pimba.

Table 4-1 Indigenous population as a proportion of total population, 2016

Region	Indigenous origin as a proportion of total population (%)
Port Augusta (C)	18.3%
Coober Pedy (DC)	17.1%
Pimba	12.7%
Whyalla	4.7%
Andamooka	4.1%
Port Pirie City and Dists (M)	3.6%
Roxby Downs (M)	3.0%
Woomera[a]	0.0%
South Australia	2.0%
Australia	2.8%

[a] The low population of Woomera means the indigenous origin proportion is variable. The proportion was 1.5 per cent in 2001, 5.4 per cent in 2006 and 4.6 per cent in 2011 (ABS 2002, 2007, 2012).

Source: Appendix 2

4.3 Native Title

The Project Area intersects two determined native title areas (Figure 4-1). Most of the area lies within determined Kokatha People (Part A) (Federal Court Reference SAD90/2009) native title area. The native title claim over the area was determined by the Federal Court on 1st September 2014. The southern 32 kilometre portion of the Project Area is within the determined Barngarla

Native Title Claim (Federal Court Reference SAD6011/1998) area. The native title claim was determined by the Federal Court on 23rd June 2016.

The population centres in the Regional Study Area cover an additional three native title claim areas and one determined native title area (Figure 4-1) that are not intersected by the Project Area.

- There are three overlapping claims to Port Augusta:

    1. Barngarla Native Title Claim (registered) (Federal Court Reference SAD6011/1998)
    2. Nukunu Native Title Claim (registered) (Federal Court Reference SAD6012/1998)
    3. Kokatha No. 3 (not registered) (Federal Court Reference SAD83/2016)

    The first claim listed is to modify a previously determined area to include Port Augusta. The southern portion of the study area is in the already-determined part of the claim and would not be affected by the outcome of this claim. The second claim listed is a registered claim and the third has not been registered.

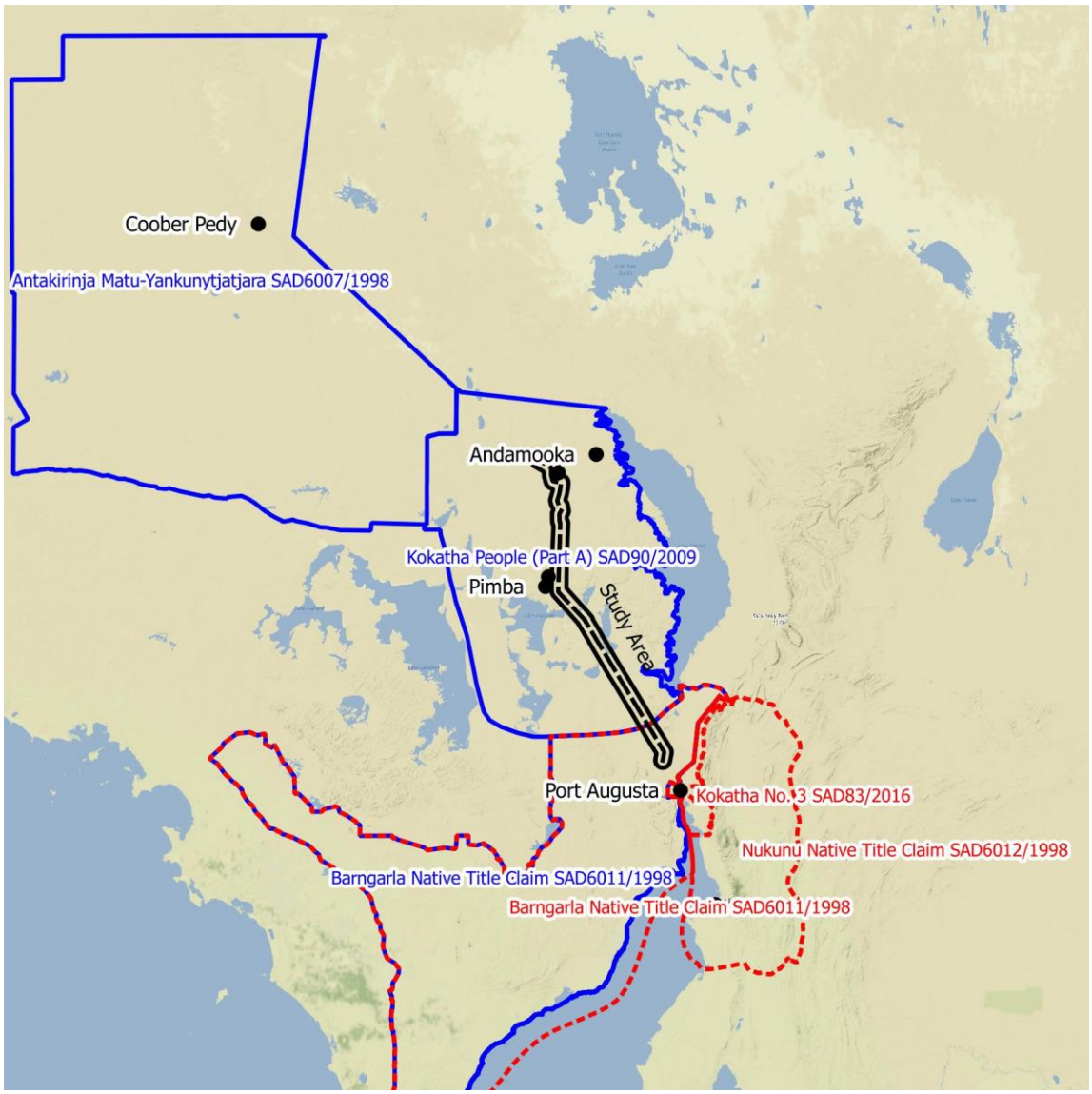
- Whyalla is within the determined Barngarla Native Title Claim (Federal Court Reference SAD6011/1998) area, which covers the southern portion of the Study Area.

- Port Pirie is within the registered Nukunu Native Title Claim (Federal Court Reference SAD6012/1998) area.

- Roxby Downs, Andamooka, Woomera and Pimba are all within the determined Kokatha People (Part A) (Federal Court Reference SAD90/2009) native title area, which covers the northern portion of the project area.

- Coober Pedy is within the determined Antakirinja Matu-Yankunytjatjara (Federal Court Reference SAD90/2009) native title area. Native title over this area was determined by the Federal Court on 11th May 2011.

Figure 4-1 Native title determination and claim areas in the Regional Study Area



Source: NNTT 2018a, NNTT 2018b

4.4 Aboriginal Business

During 2015, the Aboriginal Business Industry Chamber of South Australia (ABICSA) was established to provide a commercially focused business mechanism to support Aboriginal businesses, link sectors to create opportunity, lobby for opportunities and changes with government and sectors, and to provide a source of information for Aboriginal businesses. Member businesses will be able to link with other member businesses through this initiative when fully established. At the time of writing, the membership section of the ABICSA website noted that, when developed, the section would be "an access point for member resources and a place to connect with other Aboriginal businesses" (ABICSA 2015).

Aboriginal Business Connect is a register of South Australian businesses with at least 50 per cent Aboriginal ownership. The register is maintained by the South Australian Government with support by Supply Nation and connects the Aboriginal business sector to opportunities for

procurement, contracting, sub-contracting and establishing joint ventures with established businesses (DSD 2018).

Table 4-2 describes the businesses on Aboriginal Business Connect that are focused on the Regional Study Area. That is, they are either located within the Regional Study Area or outside of it but with a service area that intersects the Regional Study Area without covering the whole of the state. Services provided by these businesses include: cultural awareness, civil construction, construction services, mining services, wholesale, labour hire, cleaning, catering, arts and health.

Table 4-3 lists all other businesses on Aboriginal Business Connect with a service area that encompasses the Regional Study Area. These businesses are not focused on the Regional Study Area any more than other regions of South Australia. Most of these businesses are located in suburbs of Adelaide and have service areas that include all of South Australia and other states in Australia (many are national).

Table 4-2 Aboriginal owned businesses located in or directly servicing the Regional Study Area

Business details	Description of activities
Trading name: Iga Warta **Location relative to project:** Regional Study Area **Location:** Copley, SA **Service area:** National	Iga Warta offers cultural awareness programs that highlight the relevance of Adnyamathanha culture in our everyday lives, as well as the issues facing Aboriginal people in today's society.
Trading name: Anangu Building Services **Location relative to project:** Regional Study Area **Location:** Quorn, SA **Service area:** Regional Study Area	The business is based in Fregon and undertakes residential and light commercial building projects and also repairs and maintenance within the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands.
Trading name: Super Ink **Location relative to project:** Regional Study Area **Location:** Stirling North, SA **Service area:** Regional Study Area	Retail seller of ink cartridges and toners to suit most printers.
Trading name: Kokatha Martin Joint Venture Pty Ltd **Location relative to project:** Regional Study Area **Location:** Woomera, SA **Service area:** Regional Study Area	Kokatha Martin Joint Venture (KMJV) is a partnership formed between Kokatha Aboriginal Corporation (Kokatha) and PA & CI Martin Pty Ltd (Martin) to deliver quality civil and building construction services to clients in the Mid North and Far North region of South Australia.
Trading name: Walga Mining and Services **Location relative to project:** Regional Study Area **Location:** Whyalla Norrie, SA **Service area:** South Australia and other areas	Walga Mining and Services offer a complete crushing, fire protection, civil works that will task manage projects, and support government and private contracts.
Trading name: Kokatha Mining Services **Location relative to project:** Regional Study Area **Location:** Port Augusta, SA **Service area:** South Australia	Through our Joint Ventures arrangements, Kokatha are able to facilitate and/or provide employment and labour hire services, cleaning and catering services, general building construction, building construction and support, maintenance and repair services, demolition services, asbestos removal services, plumbing and electrical services.

Trading name: Barlarri Aboriginal Corporation **Location relative to project:** Other **Location:** Murray Bridge, SA **Service area:** Regional Study Area	We will promote language, culture and heritage through caring for Land, Sea, Waters, Lakes and Islands, as Barngarla women of Eyre Peninsula in the State of South Australia and progress in showcasing and promoting creative arts and to carry out all we inspire to do as Barngarla women and community.
Trading name: Health and Immunisation Management Services **Location relative to project:** Other **Location:** Thebarton, SA **Service area:** Regional Study Area	Nurse owned and operated Healthcare company that works with Councils, Indigenous clients and private industry.

Source: DSD 2018

Table 4-3 Other aboriginal owned South Australian businesses with a service area encompassing the Regional Study Area

Trading name	Location	Service area
SA Prestige Mobile Detailing	Craigburn Farm, SA	South Australia
Scotdesco Inc.	Bookabie, SA	South Australia
Gerard Pastoral	Gerard Via Berri, SA	South Australia
Kornar Winmil Yunti	Goodwood, SA	South Australia
Karijini Development	Hilton Plaza, SA	South Australia
Narungga Construction and Developments PTY Limited	Moonta, SA	South Australia
Ngopamuldi Aboriginal Corporation	Murray Bridge, SA	South Australia
The Trustee for A.M.Y. Nominees Charitable Trust	Norwood, SA	South Australia
A.M.Y. Environmental Services Pty. Ltd.	Norwood, SA	South Australia
BARRETT SERVICES	Ottoway, SA	South Australia
Zancott Recruitment Pty Ltd	Payneham, SA	South Australia
Kangaroo Island Ocean Safari	Penneshaw, SA	South Australia
Cut Once	West Lakes, SA	South Australia
HGH Developments Pty Ltd	Woodchester, SA	South Australia
Tandanya	Adelaide, SA	South Australia and other areas
Peter Kittle Holden	Adelaide, SA	South Australia and other areas
First People Digital	Adelaide, SA	South Australia and other areas
Firstaipro	Adelaide, SA	South Australia and other areas
RJS Building	Ceduna, SA	South Australia and other areas
David Liddiard Recruitment and Labour Hire	Glenelg North, SA	South Australia and other areas
Birubi	Glenelg North, SA	South Australia and other areas
MIB Distribution Pty Ltd	Goodwood, SA	South Australia and other areas
MIB Enterprises	Goodwood, SA	South Australia and other areas
Yaanma Services Pty Ltd	Hilton, SA	South Australia and other areas
Carey Training	Hilton, SA	South Australia and other areas
Zippy Indigenous Facility Services Pty Ltd	Joslin, SA	South Australia and other areas
LC Aerial	Mount Gambier, SA	South Australia and other areas
Garridja	Norwood, SA	South Australia and other areas
Munda Pest Management	Renmark, SA	South Australia and other areas
Hertz Trucks	Richmond, SA	South Australia and other areas
Vimba Warta Civil and Mining Pty Ltd	Wayville, SA	South Australia and other areas
Westcol Drilling	Welland, SA	South Australia and other areas

Gerard Pastoral	Winkie via Berri, SA	South Australia and other areas
Envirologix	Adelaide, SA	National
Zenith FG	Adelaide, SA	National
Ngare Employment Solutions Pty Ltd	Adelaide, SA	National
PwC's Indigenous Consulting	Adelaide, SA	National
Something Wild	Adelaide, SA	National
TQCSI Yaran	Adelaide, SA	National
Zancott Knight FM	Adelaide, SA	National
Nakkarra Enterprises	Burton, SA	National
Intract Australia	Dry Creek, SA	National
Australian Institute for Loss and Grief	Ethelton , SA	National
Ochre Dawn Creative Industries	Glandore, SA	National
DLG	Glenelg North, SA	National
Dreamtime Creative	Glenelg North, SA	National
Supply Pac Pty Ltd	Glenelg South, SA	National
CorporateConnect.AB Pty Ltd	Glenelg North, SA	National
Bookabee Australia	Grange, SA	National
Galyahna	Grange, SA	National
Ninti Pty Ltd	Hackney, SA	National
Australian Indigenous Advisory Group Pty Ltd	Hilton, SA	National
Indigenous Participation Solutions Pty Ltd	Hilton, SA	National
JLB Yaran	Hilton, SA	National
Ngare Connections	Hilton, SA	National
Yaran Business Services	Hilton, SA	National
Print Nation	Hindmarsh, SA	National
Academy Indigenous Services	Kilburn, SA	National
CSA Amusements	Largs Bay, SA	National
Empowerment 4 Riders	Lower Hermitage, SA	National
Wakarla Glass Gorge Tours	Mallala, SA	National
We Create Print Deliver	Mawson Lakes, SA	National
Cedrent Vehicle Hire	Mile End, SA	National
Parakeelya Architecture and Construction	Myrtle Bank, SA	National
Pitjantjatjara Council Aboriginal Corporation	Netley, SA	National
IndigeBiz AU	North Plympton, SA	National
Ocean Jewels Dreaming	Osborne, SA	National
Peter Kittle Motor Company	Para Hills West, SA	National
Outback Energy Savers	Para Hills West, SA	National
Anangu Ngangkari Tjutaku Aboriginal Corporation	Seaton, SA	National
As above	Sellicks Beach, SA	National
DDR Indigenous Contractors	St Marys, SA	National
Linking Futures	Tonsley, SA	National
Edoardo Crismani	UNDERDALE, SA	National
Print Junction	Wingfield, SA	National
Coast n Cafe	Yallunda Flat, SA	National

Source: DSD 2018

4.5 Non-Indigenous Cultural Heritage

The Regional Study Area contains a rich and varied history of non-Indigenous land use. Most sites relate to development of the pastoral industry, as well as the historical themes of transport, mining, exploration and the Woomera Rocket Range.

Non-Indigenous cultural heritage aspects are reflected in local government planning schemes and regulations in some of the communities within the Regional Study Area (see Section 6.8).

Examples of the non-Indigenous cultural heritage of the Regional Study Area are found at:

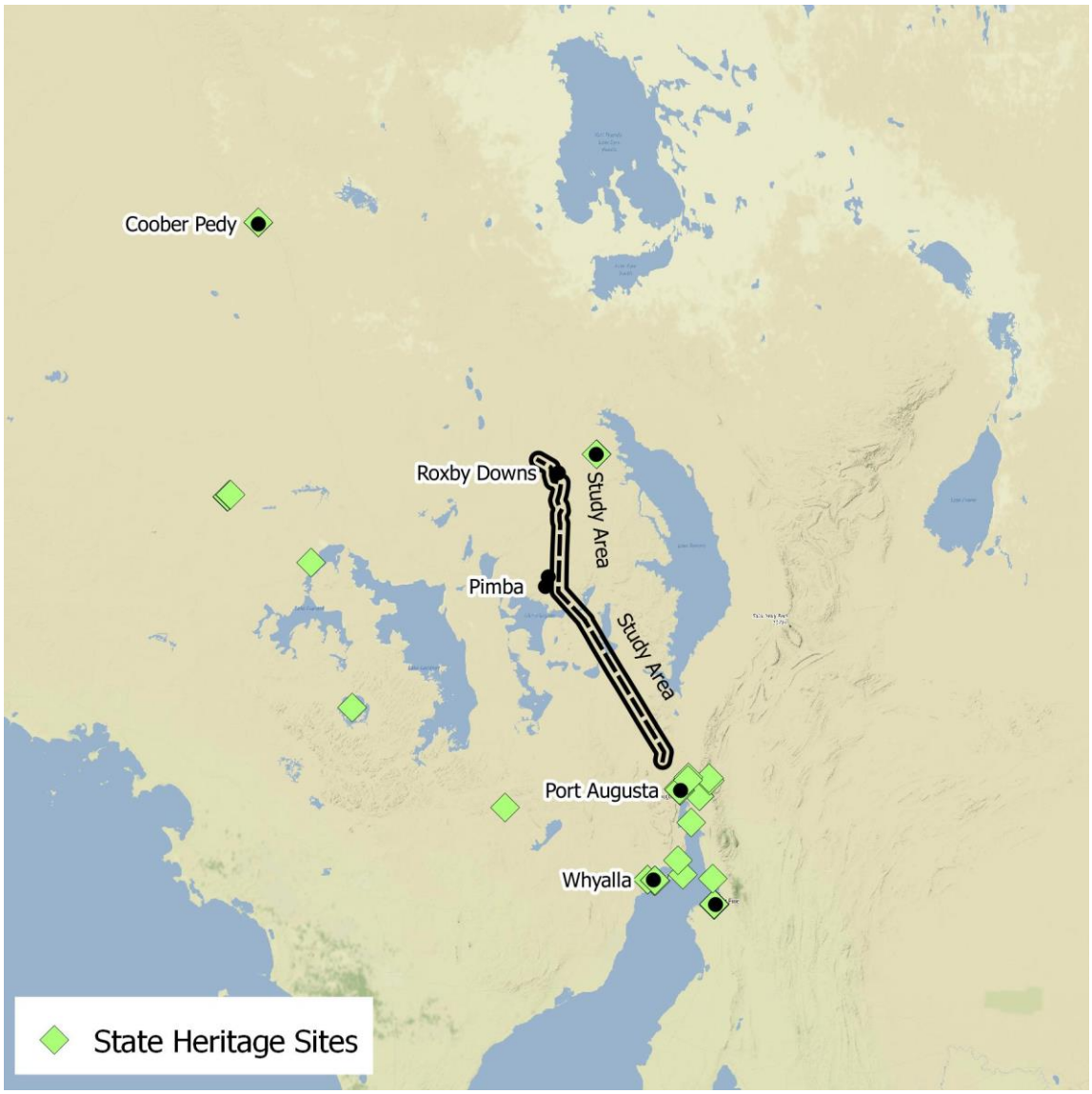
- Andamooka which continues to reflect its opal mining history complete with opal miners' cottages from the 1950s and '60s, and historical cemetery
- Woomera which played an important role in space exploration and rocket testing in the 1960s
- Port Augusta where the Pichi Richi Railway, built in the 1870s as narrow gauge railway and the last remaining portion of the original 'Old Ghan' railway line, reflects the area's transport history
- Whyalla where the maritime museum displays the HMAS Whyalla, built in the Whyalla shipyards in 1941, reflects the maritime history of the Upper Spencer Gulf.

Figure 4-2 shows that the location of the State Heritage Sites under the *South Australian Heritage Act 1978 (SA)* in the Regional Study Area are all outside of the Study Area and are mostly grouped near its southern end. Table 4-4 briefly describes each site using data from the South Australian Heritage Register (DPTI 2017). The sites selected are:

- within the Far North SAGR, south of the line between Andamooka and Coober Pedy and west of Lake Torrens and the Flinders Rangers, or
- between Port Pirie and Port Augusta or Whyalla and Port Augusta (inclusive).

A total of 50 sites were selected based on these criteria. A number of Local Heritage places are also present within the Regional Study Area, particularly in Port Pirie.

Figure 4-2 Map of state heritage sites in the Regional Study Area



Source: DPTI 2017

Table 4-4 List of state heritage sites within the Regional Study Area

Heritage Number	Suburb	Description	Details
21950	ANDAMOOKA	House	Dick Clark's Residence including semi-dugout living room, two detached sleep-outs and workroom, together with dry-stone walling and connecting paths
13	ANDAMOOKA	Museum	Andamooka Historic Precinct (Historical Museum Reserve), including Frank Albertoni's house, Bob Cutzow's Dugout, Tom Brady's Dugout, Mrs Perry's Kitchen and Andy Absalom's House
16290	COOBER PEDY	Religious Building	Coober Pedy Catholic Church and Presbytery
16291	COOBER PEDY	House	Three-roomed dugout, including the ground within two metres of the dugout space
29	IRON KNOB	Rock (bare or awash)	Coralbignie (Houlderoo) Rocks (designated place of geological significance)

26042	KINGOONYA		Glenloth Gold Battery Site (designated place of archaeological significance)
16498	POINT LOWLY VIA WHYALLA	Lighthouse Beacon	Point Lowly Lighthouse Complex (including Lighthouse, Reserve Land of 2.14 Hectares, Power House, Two Keepers' Cottages, Oil Store, and Signal Flag Mast)
16261	PORT AUGUSTA	Business House - Offices	Seaview House (former Bank of South Australia Port Augusta Branch)
16262	PORT AUGUSTA	Hall	Port Augusta Institute
16265	PORT AUGUSTA	Council Offices	Port Augusta Town Hall
16266	PORT AUGUSTA	Law Courts	Port Augusta Courthouse
16267	PORT AUGUSTA	Business House - Offices	Port Augusta Cultural Centre (Former Port Augusta Waterworks workshop, storeroom, stables and courtyard)
16268	PORT AUGUSTA	Historic Sites (unclassified)	Gladstone Square Bandstand
16269	PORT AUGUSTA	Historic Sites (unclassified)	Beatton Memorial Drinking Fountain, Gladstone Square
16271	PORT AUGUSTA	Business: Commercial/Retail	Curdnatta Art Gallery (former first Port Augusta Railway Station)
16263	PORT AUGUSTA	Religious Building	St Augustine's Anglican Church
16264	PORT AUGUSTA	Business House - Offices	Former Port Augusta School of the Air
16272	PORT AUGUSTA	Railway Platform	Second Port Augusta Railway Station
16273	PORT AUGUSTA	Wharf	Port Augusta Wharf
16274	PORT AUGUSTA	Geological Monuments	Red Cliff Point (designated place of geological significance), Winninowie Conservation Park
24	PORT AUGUSTA	Geological Monuments	Lake Acraman Impact Structure
16270	PORT AUGUSTA WEST	Tank on Tower	Port Augusta West Water Tower
16488	PORT GERMEIN	Pier - Jetty	Port Germein Jetty Site, including Jetty and Two Railway Sheds
13535	PORT PIRIE	Primary School	Good Samaritan Catholic Convent School
13536	PORT PIRIE	Historic Sites (unclassified)	Second World War Memorial Gates
13537	PORT PIRIE	Business House - Offices	Former AMP [Australian Mutual Provident Society] Port Pirie Office Building
13524	PORT PIRIE	Business House - Offices	Barrier Chambers Offices
13525	PORT PIRIE	Business House - Offices	Former Adelaide Steamship Company Building
13526	PORT PIRIE	House	Dwelling (former Sampson's Butcher Shop)
13527	PORT PIRIE	Business House - Offices	Development Board Building (former Port Pirie Courthouse, later Customs House)
13528	PORT PIRIE	Business House - Offices	National Trust Museum (former Port Pirie Customs House)
13529	PORT PIRIE	Museum	National Trust Museum (former Port Pirie Railway Station)

13530	PORT PIRIE	Post Office	Port Pirie Post Office
13531	PORT PIRIE	Historic Sites (unclassified)	Shops, rear of Portside Tavern (former Jubilee Hotel, former Royal Exchange Hotel)
13532	PORT PIRIE	Hotel - Motel - Inn	Family Hotel
13533	PORT PIRIE	House	Dwelling ('Carn Brae')
13534	PORT PIRIE	Business House - Offices	Waterside Workers' Federation (former Amalgamated Workers' Association) Building
16275	STIRLING NORTH	Tank on Tower	Davenport Reservoir and Storage Tank
16350	STIRLING NORTH	Geological Monuments	Saltia Creek Elatina Formation (designated place of geological significance)
14	STIRLING NORTH	Homestead - Farmhouse (other than pastoral)	Former Ostrich Farm, Emeroo Station, including Original Homestead, Ruins of Hatching Shed, Exotic Plants and Ostrich Fences
26041	TARCOOLA		Tarcoola Goldfield, Government Battery and Township (designated place of archaeological significance)
16500	WHYALLA	Secondary School/College	Whyalla High School (former Whyalla Technical High School)
16499	WHYALLA	Monument - Column - Cairn - Cross - Shrine - Marker - Statue	World War Two Gun Emplacements, Hummock Hill
26028	WHYALLA	Hotel - Motel - Inn	Spencer Hotel
26027	WHYALLA	Hotel - Motel - Inn	Bay View Hotel
27685	WHYALLA	Geological and landform boundaries - general	Fitzgerald Bay Stranded Shingle Ridge (designated place of geological significance)
25672	WHYALLA	Law Courts	Whyalla Court House
16496	WHYALLA NORRIE	House	Dwelling - Gay Street Cottage (Relocated to the Mount Laura Homestead Museum Reserve in 1978)
16497	WHYALLA NORRIE	Police Station	Former Wooden Lock-up from Whyalla Policeman's Dwelling (Relocated to the Mount Laura Homestead Museum Reserve in 1978)
16358	WOOLSHED FLAT VIA PORT AUGUSTA	Bridge	Woolshed Flat Railway Bridge

Source: DPTI 2017

4.6 Community Groups and Events

A summary of identified community events within the Study Area is provided in Table 4-5. Many area annual events, such as Australia Day and Christmas related celebrations. Other community events are usually closely tied to local community identity and history or economic drivers. Across the Regional Study Area, common event themes are:

- sports (shooting, golf, racing, running, surf boat and fishing)
- art (visual, craft and music)
- local community focused (cultural awareness and agricultural shows).

Table 4-5 Identified community events in the Regional Study Area

Location	Event	Organiser	Timing
Roxby Downs	Roxby Downs Outback Cup	Roxby Downs Racing Club	August 2018
	Roxby Downs Golf Day and Giant Auction	Roxby Downs RFDS Support Group	September 2018
	2018 Australia Day Awards and BBQ	Roxby Council	January 2018
	Andamooka Sports Shooting Association OPAL CLASSIC	Andamooka Sports Shooting Association	May 2018
	2018 World Food and Music Festival		October 2018
Andamooka	Andamooka Opal Festival (Oktopalfest)	Andamooka Opal Hotel	October 2017
	Australia Day	Andamooka Progress and Opal Miners Association	January 2018
Port Augusta	Australia Day breakfast	Rotary Club of Port Augusta, Port Augusta City Council	January 2018
	Anzac Day service	Port Augusta RSL Club	April 2018
	JOBEX Port Augusta	Department of State Development	November 2018
	Pichi Richi Marathon	Pichi Richi Marathon Committee	June 2018
	City of Port Augusta Cup	Port Augusta Racing Club	July 2018
	Wharfest (Port Augusta Show Day)	Apex Club of Port Augusta	August 2017
	Port Augusta Golf Classic	Port Augusta Golf Club	August 2018
	Port Augusta Kids Crabbing Day	Port Augusta	February 2018
	Outback Surf Boat Carnival	Port Augusta City Council, Australian Surf Rowers League of South Australia	November 2018
	Saltbush Motorcycle Club Annual Toy Run	Saltbush Motorcycle Club	November 2017
	Carols in the Park	Port Augusta Christian Ministers Association	December 2017
	Port Augusta Community Charities Magic Cave	Port Augusta Community Charities Committee	December 2017
	Port Augusta Rotary Christmas Pageant	Port Augusta Rotary Club	December 2017
	Community Christmas Party	Port Augusta City Council	December 2017
Port Pirie	Craft Anonymous (art exhibition)	Adelaide City Council, Port Pirie Regional Art Gallery	March 2018
	Port Pirie Australia Day Celebrations 2018	Port Pirie Regional Council	January 2018
	Port Pirie Pistol and Shooting Club Inc – ISSF Open	Port Pirie Pistol and Shooting Club	August 2018
	NAIDOC week	NAIDOC Committee	July 2017
	Port Pirie Country Music Festival	Northern Country Music Association	October 2018
Whyalla	uneARTh Festival	Whyalla Council	April 2018
	Whyalla Maritime Museum Open Day	Whyalla Maritime Museum	May 2018
	Whyalla Show	Whyalla Show Society	August 2018
	Clean Up Australia Day	Whyalla City Council	February 2018
	Fishy Fringe Festival	Port Augusta	March 2018
	Hidden Music Festival	Diversity Entertainment	March 2018

Source: Roxby Council 2018d, Andamooka Progress and Opal Miners Association 2018b, Port Augusta City Council 2018e, Port Pirie Regional Council 2018, Whyalla 2018

5. COMMUNITY HEALTH

The Social Health Atlas of Australia (PHIDU 2018) includes data on a range of population characteristics including demography, socio-economic status, health status and risk factors, and use of health and welfare services. These data are produced for Local Government Areas (LGAs), Greater Capital City Statistical Areas, State regions and nationally. These regions align with the identified residential centres in the Regional Study Area with the exception of Port Pirie (the LGA includes surrounding rural area and other towns such as Crystal Brooke) and Woomera, Andamooka and Pimba (Unincorporated SA includes these, and many other, towns).

Baseline health status and risk factors for identified residential centres within the Regional Study Area are presented in Table 5-1. The data show:

- The fertility rate between 2013 and 2015 for all residential centres in the Regional Study Area were higher than the South Australian average
- The incidence of low birth weight between 2012 and 2014 was higher than the state average in Port Augusta, Whyalla and Unincorporated SA, and lower than the state average in Port Pirie and Roxby Downs
- The data on the infant death rate in the Regional Study area are sparse so a conclusion cannot be made for residential centres. However, Port Augusta and Whyalla each had an infant death rate above the South Australian Average between 2010 and 2014
- Smoking during pregnancy between 2012 and 2014 was more common in each of the residential centres in the Regional Study Area (apart from Roxby Downs) than in the rest of South Australia
- Poor or fair self-assessed health in 2014-15 was more common in each of the residential centres in the Regional Study Area (apart from Roxby Downs) than in the rest of South Australia
- The incidence of chronic disease was similar in the Regional Study Area to the rest of South Australia in 2011-12. The notable exceptions being: incidence of diabetes was particularly low in Roxby Downs, and incidence of mental and behavioural problems was particularly high in Port Augusta and Port Pirie
- The main risk factors in 2014-15 varied between residential centres of the Regional Study Area. Compared to the South Australian average, the key risk factors were smoking and obesity in Port Augusta, Port Pirie and Whyalla, and alcohol consumption in Roxby Downs
- Incidence of profound disability in 2016 were above the South Australian Average in Port Pirie and Whyalla and below average in the rest of the Regional Study Area
- The median age at death between 2010 and 2014 was lower in each residential centre in the Regional Study Area than the South Australian average

- The rate of avoidable deaths between 2010 and 2014 was higher than the South Australian average in Port Augusta, Coober Pedy and Unincorporated SA, and lower or close to average elsewhere in the Regional Study Area.

Table 5-1 Health status and risk factors in the Regional Study Area

Data presented for LGA area	Port Augusta (C)	Port Pirie City and Dists (M)	Whyalla (C)	Roxby Downs (M)	Coober Pedy (DC)	Unincorporated SA[a]	South Australia	Australia
Fertility Rate								
Fertility Rate (2013 to 2015)	2.3	2.2	2.1	2.1	2.1	2.5	1.9	1.9
Mothers and Babies								
Low birth weight rate (%, 2012-2014)	7.4	5.8	8.2	4.0	-	8.2	6.6	6.1
Infant deaths (Average annual IDR per 1,000 births, 2010-2014)	11.2	-	4.0	-	0.0	-	3.1	3.6
Smoking during pregnancy (%, 2012-2014	21.9	27.2	26.5	9.2	25.0	14.3	12.9	12.3
Self-assessed Health								
Fair or poor health (ASR per 100 people, 2014-15))	20.1	20.5	21.9	13.4	-	-	15.9	14.8
Chronic Disease								
Diabetes (ASR per 100, 2011-12)	6.4	7.2	7.3	4.5	-	-	6.5	5.4
High blood cholesterol (ASR per 100, 2011-12)	33.7	34.3	32.9	35.5	-	-	34.7	32.8
Mental and behavioural problems (ASR per 100, 2011-12)	17.1	17.0	14.6	12.5	-	-	14.7	13.6
Circulatory system diseases (ASR per 100, 2011-12)	17.4	18.1	17.4	14.1	-	-	16.9	17.3
Respiratory system diseases (ASR per 100, 2011-12)	31.1	31.7	32.8	28.1	-	-	30.9	28.7
Musculoskeletal system diseases (ASR per 100, 2011-12)	29.4	31.3	27.0	25.2	-	-	28.1	27.7
Risk Factors								
Current smokers (ASR per 100, 18 years and over, 2014-15)	19.5	20.1	18.5	15.2	-	-	15.0	16.1
High-risk alcohol consumption (ASR per 100, 15 years and over, 2014-15)	17.2	18.6	15.1	22.1	-	-	16.1	16.7
Obesity (ASR per 100, 18 years and over, 2014-15)	37.4	38.3	37.6	29.0	-	-	29.8	27.9
Disability								
Profound disability (%, 2016)	6.0	8.8	7.1	0.9	5.6	2.0	6.3	5.4
Mortality								
Median age at death (years, 2010-2014)	76.5	80.0	77.0	50.0	71.0	66.5	82.0	81.0
Avoidable deaths from selected external causes (falls, fires, burns, suicide) (ASR per 100,000, 2010 to 2014)	28.1	8.7	17.1	0.0	54.4	-	14.5	13.2
Avoidable deaths from other external causes (transport accidents, drownings) (ASR per 100,000, 2010 to 2014)	18.5	15.3	14.5	-	68.4	30.7	16.1	16.1

[a] Areas of South Australia not in a local government area. These areas include Woomera, Pimba and Andamooka.

Source: PHIDU 2018

6. EXISTING LAND USE AND PLANNING

6.1 Land Use

Land use in the Far North is primarily for pastoral purposes, conservation, defence and Indigenous lands. The Far North also hosts more than 70 per cent of the State's mining and mineral processing (DPLG 2010).

The Government of South Australia's planning strategy comprises plans for seven regional areas within the State that have been developed to guide future land use and development. The Far North Plan was published in 2010 for the period 2010-2036 and includes Port Augusta, Flinders Ranges, Roxby Downs and the region's unincorporated areas (DPLG 2010).

For the Far North, the plan identifies four key issues for its future (DPLG 2010):

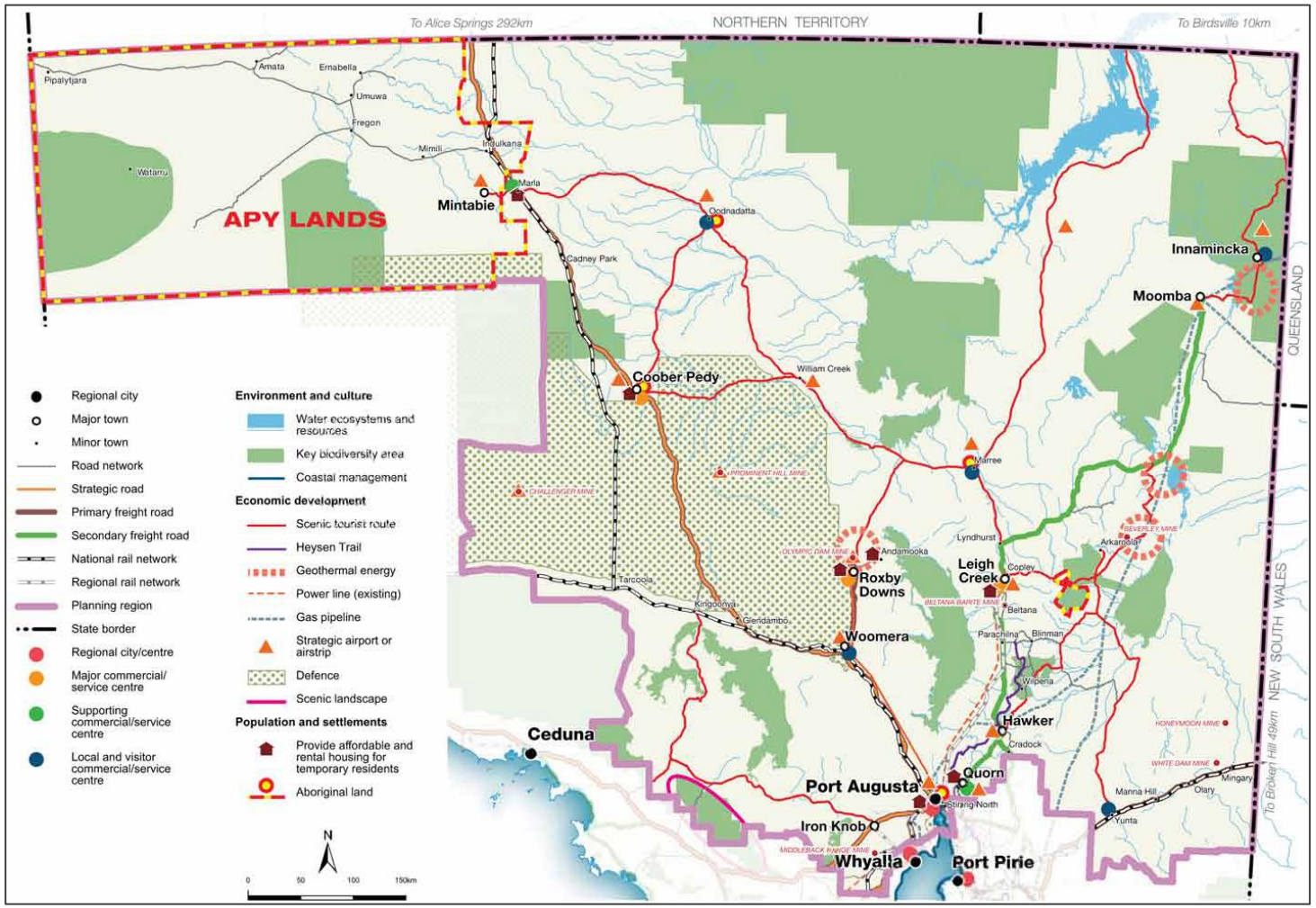
1. Environment and culture – valuing and managing its environmental, cultural and heritage assets, sites of significance to Aboriginal people, geological structures and the fragile nature of its arid environment
2. Economic development – managing the impact of an expanding mining industry while ensuring economic diversity and attracting and retaining skilled workforces in the towns within the region (particularly competing with the mining industry)
3. Population and settlements – supporting Aboriginal people to move to towns in the pursuit of employment, addressing increasing demand for facilities and services for older people and utilities for all, addressing housing affordability, and supporting tourism
4. Infrastructure and service provision – Improving and expanding public infrastructure and services and considering the implications of seasonal and transient populations.

The plan's aims for the Far North for the period 2010 – 2036 are to (DPLG 2010):

- manage population and industry growth, focussing on Port Augusta, Roxby Downs and Coober Pedy
- build sustainable local towns that are supported by strategic infrastructure and services planning
- strengthen the tourism industry and capitalise on the region's natural and cultural assets
- expand the mining and defence industries and associated infrastructure
- introduce sustainable approaches to securing water and energy in the region
- manage natural resources sustainably; no further loss of species and protection of areas of high natural value.

Figure 6-1 illustrates the Far North Regional Plan (DPLG 2010).

Figure 6-1 Far North Regional Plan



Source: DPLG 2010

6.2 Local Environment and Amenity

The Far North encompasses two of South Australia's most notable tourism attractions – the Flinders Ranges and the Outback, the majority of South Australia's mineral and mining activity (accounting for 70 per cent of the State's mining output (DPLG 2010)), and the 'central corridor' (described as the corridor linking South Australia to the Northern Territory) which includes Roxby Downs, Pimba, Woomera and Andamooka (RDAFN 2017).

The Study Area is contained within the South Australian Arid Lands Natural Resource Management (NRM) Region. This NRM region contains over 9 million hectares of park area made up from 6 national parks, 5 conservation parks, 4 regional reserves and 1 conservation reserve). Lake Torrens National Park is the closest park to the transmission line but it, and the other parks in the region, falls outside of the Study Area (DEWNR 2017).

Lake Torrens National Park comprises of sparse wilderness vegetated by samphire, saltbush and bluebush and the Lake Torrens salt lake that stretches for 250km. The National Park is listed in the Directory of Important Wetlands in Australia (Inland Saline Lakes) (DEE 2017).

Another unique attraction of the Far North is the Australian Arid Lands Botanic Garden, located on the outskirts of Port Augusta, and considered an internationally recognized showcase of arid environmental diversity (Carne 2015).

6.3 Pastoral Activity

Much of the Regional Study Area comprises pastoral properties (stations) used for sheep and cattle production. The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs and Andamooka (refer to Section 3.2).

There are more than 200 pastoral properties in the unincorporated areas of the Far North region, and approximately 50 primary production leases in council regions. Collectively they cover an area of approximately 411,000km^2, or 52 per cent of the Far North region's land mass (RDAFN 2013).

Table 6-1 shows the pastoral properties in the Far North by type.

Table 6-1 Pastoral properties in the Far North by type

Production type	% of total pastoral landmass	% of total pastoral properties
Cattle only	57%	23%
Mainly cattle with some sheep	8%	3%
Sheep only	27%	54%
Mainly sheep with some cattle	6%	9%
Sheep grazing, grain farming and some cattle	1%	10%
Destocked properties	1%	1%
Total	100%	100%

Source: RDAFN 2013

The Far North region accounts for a significant proportion of South Australia's sheep and cattle production generating around $385 million in gross value of production in 2015-16[5] (ABS 2017d) and 654 jobs (see Appendix Table 2.6). Production varies from year-to-year with fluctuations in climate and markets. Over the decade, the South Australian sheep industry has generally declined and shifted from wool to meat production, as the value of wool on the world market decreased. Sheep numbers in South Australia haven fallen by tens of millions since the peak of the industry in the 1950s (ABS 2010).

Table 6-2 shows that across the Regional Study Area, agriculture was a prominent occupation in the Outback region and to a much greater extent than South Australia or Australia.

Table 6-2 Employment in agriculture, 2016

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Outback (SA2)[a]	Whyalla	Port Pirie City and Dists (M)	South Australia	Australia
Industry of employment (population aged 15 years and over) (%)								
Agriculture, Forestry and Fishing	3.2%	0.0%	1.9%	12.5%	0.2%	3.9%	4.2%	2.6%

[a] Outback (SA2) is comprised of the Andamooka, Woomera, Pimba and residual areas of Outback (SA2).

Source: ABS 2017a

6.4 Tourism

The Regional Study Area corresponds with the Flinders Ranges and Outback tourism region, which is the largest geographically in South Australia and generates the second largest amount of regional tourism activity (RDAFN 2013). It supports approximately 700 tourism businesses in the region (SATC 2017).

[5] Gross value of production for wool and Livestock slaughtered for South Australia – Outback (SA4) region.

The Flinders Ranges and Outback attracted an annual average 665,000 overnight visitors, from international (6 per cent) and domestic (94 per cent) visitors in the three years to December 2016. Visitors stayed for 2.8 million nights. Of domestic visitors, 66 per cent came from within the State, while 34 per cent came from interstate. There were approximately 626,000 day trips annually over the same period (SATC 2017).

In 2013-14, the tourism industry contributed an estimated $281 million to the Flinders Ranges and Outback regional economy (6.0 per cent of gross regional product) and directly employed approximately 1,400 people (5.2 per cent of regional employment). In 2013-14, the tourism activity in Flinders Ranges and Outback generated:

- $203 million and $331 million in direct and indirect tourism output, and $535 million in total tourism output
- $114 million and $136 million in direct and indirect tourism GVA, and $250 million in total tourism gross value-added
- $123 million and $158 million in direct and indirect tourism GRP and $281 million in total tourism GRP
- 1,400 jobs for people employed directly by the tourism industry, 1,300 indirect jobs and a total employment impact of 2,700 people (SATC 2017).

Unlike the mining industry, those who work in tourism are likely to live in the region with their families. Jobs in tourism tend to generate a significant level of flow-on economic activity in sectors such as health and education (URPS 2008). The Oodnadatta and Birdsville tracks are important tourism routes located north of the Regional Study Area.

The region also hosts large and small-scale cultural and arts events (such as Opera in the Outback), has been the setting for films, television series and commercials, and is increasingly attracting national and international attention for Aboriginal arts and crafts.

Table 6-3 shows that across the Regional Study Area, tourism-related occupations were prominent and particularly high in Port Augusta, Coober Pedy and Whyalla.

Table 6-3 Employment in tourism associated industries, 2016

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Outback (SA2)[a]	Whyalla	Port Pirie City and Dists (M)	South Australia	Australia
Industry of employment (population aged 15 years and over) (%)								
Accommodation and Food Service:	9.6%	5.0%	16.7%	6.8%	8.5%	7.3%	6.9%	7.2%

[a] Outback (SA2) is comprised of the Andamooka, Woomera, Pimba and residual areas of Outback (SA2).

Source: ABS 2017a

6.5 Defence

The State Government lists defence and aerospace initiatives in the Far North as being of "significant" importance to the State. An expansion is currently underway at the army training facilities at Cultana, between Whyalla and Port Augusta on the Upper Spencer Gulf. The

expansion, by the Department of Defence, extends the Cultana Training Area westward and increases its total size from approximately 50,000 hectares to 209,300 hectares. The expansion has been possible with the acquisition of six pastoral properties (Defence SA 2018).

The training area was granted a miscellaneous lease for defence purposes in June 2014. Under the terms of the lease, the Department of Defence controls access to the land for 75 years with an option of a further 25 years. The area is also affected by a registered native title claim by the Barngarla native title group and other Indigenous groups have expressed interest also in the area. An Indigenous Land Use Agreement between Defence, Barngarla and the State of South Australia was signed and registered by the National Native Title Tribunal on 28 June 2013.

The State Government acknowledges that it does not envisage that the expansion will bring permanent population increases to Port Augusta or other towns in the Far North, however it anticipates that personnel are likely to spend money on recreation and shopping in the area, as well as supporting catering and laundering services (DPLG 2010).

The Woomera Range Complex, operated by the Department of Defence, is used for the testing of war material under the control of the Royal Australian Air Force. The Complex is located on the Woomera Prohibited Area, which covers 122,188km^2 in the Far North and is the largest land testing range in the world. The majority of the Woomera Prohibited Area is South Australian Crown land and is covered by pastoral leases and mining tenements granted by the South Australian Government. The Department of Defence consider it significant in contributing to Australia's national security (DoD 2018).

Table 6-4 shows the importance of defence employment to Woomera.

Table 6-4 Employment in defence industry, 2016

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Outback (SA2)[a]	Whyalla	Port Pirie City and Dists (M)	South Australia	Australia
Industry of employment (population aged 15 years and over) (%)								
Defence	0.2%	0.0%	0.0%	1.0%	0.0%	0.0%	0.8%	0.7%

[a] Outback (SA2) is comprised of the Andamooka, Woomera, Pimba and residual areas of Outback (SA2).

Source: ABS 2017a

6.6 Mining and Petroleum

Mineral resources contributed approximately $4.0 billion (11.3 per cent) of South Australia's total exports (EconSearch 2017). Gas and oil exploration and production is also significant in the region, primarily from the Cooper and Eromanga basins. Petroleum production was approximately $1.1 billion in GVP in 2016-17 (DPC 2018b).

Mining in the Far North generates around 40 per cent of the region's economic output and 60 per cent of South Australia's total mining output (EconSearch 2017). Approximately 400,000 km^2 of the Far North is under exploration leases (RESA 2013a), and the region hosts around 40 per cent of South Australia's current operating and developing mineral projects (Table 6-5).

6.6.1 State Strategic Plan

South Australia's Strategic Plan has 100 targets that it uses to measure its progress towards achieving its seven strategic priorities (one of which is to realise the benefit of the mining boom for all). Target 42 relates to minerals production and processing and aims to increase the value of minerals production and processing to $10 billion by 2020 (DPC 2011).

The value of minerals production and processing in South Australia increased from almost $1.98 billion in the 2002-03 baseline year to $4.67 billion in 2016-17 (DPC 2017), and mining could add an additional $22.5 billion to South Australia's gross state product in the next two decades and create around 5,700 full time equivalent jobs (DSD 2014).

6.6.2 Industry developments

The region's minerals production aspirations were impeded in 2012 when BHP Billiton announced that its $30 billion-plus expansion of Olympic Dam was not proceeding. BHP Billiton confirmed in 2016 that it had no intention of reviving the expansion plans. The Olympic Dam operation shed 550 jobs in the 2015-2016 year, but expected that copper production would exceed 200,000 tonnes in 2016 (Evans 2016).

Two major contributors to mineral processing in South Australia are situated in the Regional Study Area – Liberty Onesteel's[6] Whyalla Steelworks which manufacturers steel from iron ore mined in the Middleback Ranges; and Nyrstar's Port Pirie plant which produces copper, lead, zinc, gold, silver and sulphuric acid from ore from around Australia. The Nyrstar facility at Port Pirie began a $600 million redevelopment in 2015 (with funding support from the Government of South Australia and the Australian Government's Export Finance and Insurance Corporation). The redevelopment opened in January 2018, securing more than 700 jobs (Moret 2018).

6.6.3 Mining activity

South Australia experienced a significant expansion in mining exploration activity over the 10-year period 2004 and 2013, much of it driven by the South Australian Government's Plan for Accelerating Exploration. Total exploration expenditure from both mineral and petroleum sectors has increased 400 per cent from $123 million in 2002-03 to $617 million in 2012-13 (DSD 2014). As a proportion, the mineral sector attracted $230.4 million during the 2012-13 period with approximately 21 per cent of this expenditure directed at iron ore and 46 per cent directed at copper discoveries.

Table 6-5 summarises the number of developing and operating mineral projects by region, and demonstrates the prominence of the Far North region in hosting major minerals and infrastructure projects in the State.

[6] formerly owned by Arrium. In April 2016 the company went into voluntary administration with debts of more than $2 billion. In September 2017 it was acquired by British-owned GFG Alliance (Liberty OneSteel 2017).

Table 6-5 Operating and developing mineral projects by region, SA

Region	Operating and Approved	Developing
Far North	13	8
Eyre and Western	7	13
Adelaide Hills, Fleurieu and Kangaroo Island	2	1
Murray and Mallee	1	0
Yorke and Mid North	2	8

[a] Includes mines that are operating, approved, in rehabilitation and in care and maintenance.

Source: DPC 2018c, 2018d

Table 6-6 summarises the operating and approved mines in South Australia. Developing projects in South Australia are summarised in Table 6-7. Mineral projects that occur in the Regional Study Area are highlighted in grey.

Table 6-6 Major operating and approved mines in South Australia

Major operating and approved mines	Commodity	Company	Region	Status
Angas Zinc Mine	Zinc, Lead, Silver, Gold, Copper	Terramin Australia Ltd	Fleurieu Peninsula and Kangaroo Island	Care and maintenance
Beltana: Flinders Zinc Project	Zinc	Perilya Ltd	Far North	Care and maintenance
Beverley and Beverley North Mines	Uranium	Heathgate Resources Pty Ltd	Far North	Operating
Cairn Hill	Magnetite, Copper, Gold	Cu-River Mining Australia Pty Limited	Far North	Operating
Campoona Graphite Project	Graphite	Pirie Resources Pty Ltd (a wholly owned subsidiary of Archer Exploration Ltd)	Eyre and Western	Mining lease granted
Carrapateena	Copper, Gold, Silver	OZ Minerals Carrapateena Pty Ltd and OZM Carrapateena (Pty Ltd) (collectively referred to as OZ Minerals)	Far North	Mining lease granted
Central Eyre Iron Project	Magnetite	Iron Road Ltd	Eyre and Western	Mining lease granted
Challenger	Gold	WPG Resources Ltd	Far North	Operating
Four Mile Uranium Mine	Uranium	Quasar Resources Pty Ltd	Far North	Operating
Hillside	Copper, Gold	Rex Minerals Pty Ltd	Yorke and Mid North	Mining lease granted
Honeymoon	Uranium	Boss Resources Limited	Yorke and Mid North	Care and maintenance
Jacinth-Ambrosia Sand Project	Heavy mineral sands	Iluka Resources Ltd	Eyre and Western	Operating
Kanmantoo	Copper, Gold, Silver	Hillgrove Resources Limited	Fleurieu Peninsula and Kangaroo Island	Operating; currently open cut
Kookaburra Gully Graphite Project	Graphite	Australian Graphite Pty Limited (AGL) (a subsidiary of Lincoln Minerals)	Eyre and Western	Mining lease granted, PEPR pending
Leigh Creek	Coal	Alinta Energy Services Ltd	Far North	Rehabilitation

Major operating and approved mines	Commodity	Company	Region	Status
Middleback Ranges	Iron ore - Hematite, Magnetite	OneSteel Manufacturing Pty Ltd (part of the SIMEC Mining Group)	Far North	Operating; open cut
Mindarie	Heavy mineral sands	Murray Zircon Pty Ltd	Murray and Mallee	Care and maintenance
Olympic Dam	Copper, Uranium, Gold, Silver	BHP	Far North	Operating; underground
Peculiar Knob	Hematite	Southern Iron Pty Ltd (subject to deed of company arrangement)	Far North	Care and maintenance
Portia	Gold	Benagerie Gold Pty Ltd - a wholly owned subsidiary of Havilah Resources Ltd	Yorke and Mid North	Operating
Prominent Hill (Ankata and Malu)	Copper, Gold, Silver	OZ Minerals	Far North	Operating; underground (Ankata) and open cut (Malu)
Tarcoola Gold	Gold, Silver	Tarcoola Gold Pty Ltd (a subsidiary of WPG Resources)	Far North	Operating
Uley Graphite Mine	Graphite	Quantum Graphite Operations Ltd (now under administration)	Eyre and Western	Care and maintenance
White Dam	Gold	Exco Resources Ltd	Far North	Operating
Wilgerup	Hematite	Centrex Metals Ltd	Eyre and Western	ML granted and PEPR approved

Source: DPC 2018c

Table 6-7 Developing projects in South Australia

Mineral Project	Commodity	Company	Region	Status
Arckaringa Project	Coal-to-liquids	Arckaringa Coal Chemical Joint Venture Co Pty Ltd	Far North	JORC resource defined
Atacama	Heavy minerals	Iluka (Eucla Basin) Pty Ltd	Eyre and Western	Feasibility studies
Barns	Gold	Andromeda Metals Ltd	Eyre and Western	JORC resource defined
Bird-in-Hand	Gold	Terramin Australia Limited	Adelaide Hills	Developing mining proposal
Bungalow	Magnetite	Centrex Metals Ltd (a joint venture with Baotou Iron & Steel Co Ltd (Baogang)	Eyre and Western	JORC resource defined
Crocker Well Uranium Project	Uranium	Sinosteel Uranium SA Pty Ltd	Yorke and Mid North	JORC resource defined
Flinders	Zinc	Perilya Ltd	Far North	JORC resource defined
Fusion Magnetite Project	Magnetite	Eyre Iron Pty Ltd, Centrex Metals Ltd, Wuhan Iron & Steel (Group) Co	Eyre and Western	JORC resource defined
Goulds Dam	Uranium	Boss Uranium Pty Ltd	Yorke and Mid North	JORC resource defined
Gum Flat	Hematite, Magnetite	Lincoln Minerals Ltd	Eyre and Western	JORC resource defined
Hawks Nest	Hematite, Magnetite	Southern Iron Pty Ltd	Far North	JORC resource defined
Junction Dam	Uranium	Marmota Energy Ltd	Yorke and Mid North	JORC resource defined
Kalkaroo	Copper, Gold	Havilah Resources NL	Far North	Assessment

Mineral Project	Commodity	Company	Region	Status
Khamsin	Copper, Gold, Silver	OZ Minerals Ltd	Far North	JORC resource defined
Maldorky	Magnetite	Havilah Resources Ltd	Yorke and Mid North	Assessment
Menninnie Dam	Lead, Zinc, Silver	Terramin Australia Ltd	Eyre and Western	JORC resource defined
Mutooroo	Copper, Cobalt	Havilah Resources Ltd	Yorke and Mid North	Feasibility studies
Mutooroo Magnetite Project	Magnetite	Minotaur Exploration Pty Ltd (joint venture partner with Sumitomo Metal Mining Oceana Pty Ltd)	Yorke and Mid North	JORC resource defined
North Portia	Copper, Gold, Molybdenum	Havilah Resources Limited	Yorke and Mid North	JORC resource defined
Oakdale Graphite Project	Graphite	Oakdale Resources Limited	Eyre and Western	JORC resource defined
Paris	Silver	Investigator Resources Ltd Joint venture with Mega Hindmarsh Ltd	Far North	JORC resource defined
Poochera	Kaolin	Minotaur Exploration Pty Ltd	Eyre and Western	JORC resource defined
Razorback Iron Ore Project	Magnetite	Magnetite Mines Pty Ltd	Yorke and Mid North	Feasibility studies
Samphire Project	Uranium	Samphire Uranium Pty Ltd (wholly owned subsidiary of UraniumSA)	Eyre and Western	JORC resource defined
Siviour	Graphite	Renascor Resources Limited	Eyre and Western	Feasibility studies
Snaefell	Magnetite	Cu-River Mining Australia Pty Ltd	Far North	JORC resource defined
Sonoran	Heavy Minerals	Iluka Pty Ltd	Eyre and Western	Feasibility studies
Tripitaka	Heavy Minerals	Iluka Resources Ltd	Eyre and Western	JORC resource defined
Tunkillia	Gold, Silver	WPG Resources Ltd	Far North	Developing mining proposal
Typhoon	Heavy Minerals	Iluka Resources Ltd	Eyre and Western	Feasibility studies

Source: DPC 2018d

6.6.4 Mining workforce

Table 6-8 shows the proportion of mining employment across the Regional Study Area.

Table 6-8 Employment in the mining industry, 2016

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Outback (SA2)[a]	Whyalla	Port Pirie City and Dists (M)	South Australia	Australia
Industry of employment (population aged 15 years and over) (%)								
Mining	0.1%	51.9%	9.6%	46.5%	6.7%	0.8%	1.2%	1.7%

[a] Outback (SA2) is comprised of the Andamooka, Woomera, Pimba and residual areas of Outback (SA2).

Source: ABS 2017a

Resources and Engineering Skills Alliance (RESA), published a workforce analysis of mineral, mining and infrastructure projects in South Australia in 2013. It assessed the workforce needs of 40 mineral and infrastructure projects that were either approved or being assessed and projected the workforce and occupation requirements for them between 2014 and 2030 (RESA 2013b). Using what it described as the "likely scenario" in the RESA (2013b) report, which assumes 16 of the 40 developing mineral projects enter into production between 2014 and 2030, it is predicted that:

Additional labour force demand

- The mining sector would need to create approximately 14,120 new roles to construct 16 projects
- The mining sector would need to create approximately 13,322 new roles once those 16 projects moved to full production
- As a result, approximately 27,442 new roles would be created in construction and production phases between 2014 and 2030

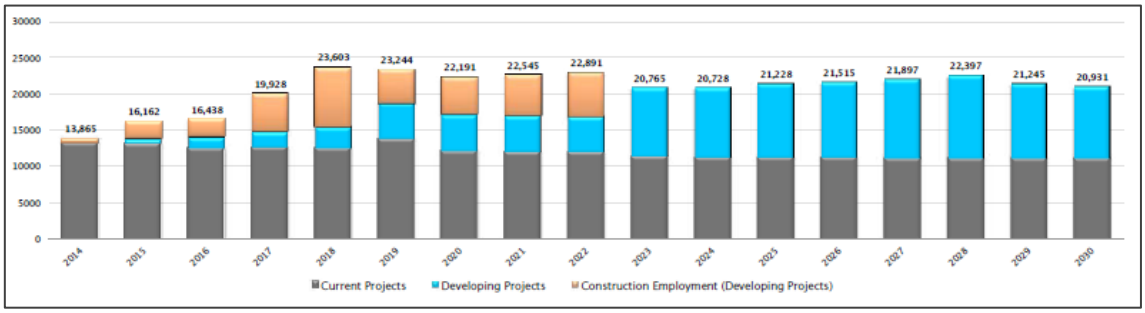
Total labour force demand

- total employment across currently operating mines and developing projects (including construction employment) would peak at 23,603 in 2018.
- Across the mining sector, the highest projected labour demand would come from copper mines, peaking at 8,120 jobs (for construction and production) by 2029, and iron ore mines, peaking at 4,774 jobs (for construction and production) by 2016
- The highest occupation category in demand would be for skilled workers (mainly production and process operators) with a peak of 4,127 workers required by 2021, and technical workers (mainly technicians) with a peak of 2,874 workers required by 2021.

Figure 6-2 shows total employment by 21 existing mines in South Australia and 16 "likely" mines identified by RESA.

Figure 6-3 shows predicted workforce demands according to project commodity under RESA's "likely" scenario. Copper has been identified as the commodity in which the highest workforce numbers will be required.

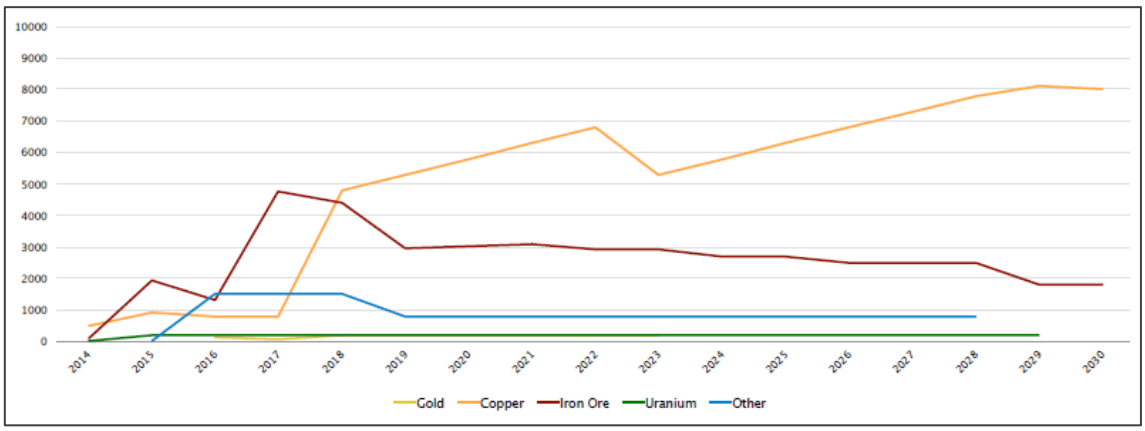
Figure 6-2 Total employment (jobs) forecasts in the mining sector, SA[a]



[a] 21 existing mines and 16 developing projects.

Source: RESA 2013b

Figure 6-3 Total employment (jobs) forecasts by mining commodity, SA[a]



[a] 21 existing mines and 16 developing projects.

Source: RESA 2013b

Mining sector expansion is expected to have a significant impact on development and community dynamics of the Far North region. Along with the increased investment and commercial activity that would be expected, the increased mining activity will also result in some influx of temporary and permanent residents to the region (RESA 2013b).

The distance from established townships of almost all mines in the Far North means these operations will rely heavily on labour sourced from outside the area. It is likely the remoteness of the new operations will promote the development of company built and operated towns to house the growing workforces and provide basic social services such as such health and education, social infrastructure such as housing, water and sewerage and broader community and recreational services such as pools, gymnasiums, cafes and retail facilities (RESA 2013b).

The requirement to accommodate workers from outside the region may necessitate the investigation of new or expanded airports to these labour sources (RESA 2013b).

6.7 Other Industries

The renewable energy sector is expected to grow in importance in the Far North region as new generation is developed. The Generation Information Page on the AEMO website (AEMO 2018) lists seven wind, solar and stored hydro projects under development in the Regional Study Area, as of March 2018, with a combined capacity of around 1.3 gigawatts. For comparison, this is equivalent to the capacity of the natural gas powered generation on Torrens Island. The seven projects are located near Port Augusta and Whyalla:

- Aurora Solar Energy Project
- Bungala Solar Power Project
- Port Augusta Graphite Energy (solar)
- Port Augusta Renewable Energy Park (Stage 1) (wind)
- Port Augusta Renewable Energy Park (Stage 2) (solar)
- Spencer Gulf Pumped Storage Hydro
- Whyalla Solar Farm (Energy Pacific Vic Pty Ltd)
- Whyalla Solar Farm (Adani Rugby Run Pty Ltd).

6.8 Planning Schemes

The Government of South Australia's vision for sustainable land use and built development is outlined in the South Australian Planning Strategy (DPC 2018e) which contains a number of volumes. The Strategy covers social, economic and environmental issues and guides policies across Government and in local area development plans. The Strategy is required under Section 22 of the *Development Act 1993*.

The Project Area is proposed to be situated on land zoned under the following development plans:

- Land Not Within a Council Area (Flinders): on land zoned as 'Pastoral'
- Land Not Within a Council Area (Eyre, Far North, Riverland and Whyalla): on land zoned as 'Remote Areas'
- Roxby Downs Council Development Plan – Buffer Zone and Rural Landscape Zone.

A separate assessment of the Project against the objectives and principles of the relevant Development Plans has been undertaken and will be presented as Appendix to the Development Application document.

6.9 Other Planning Initiatives

The Far North region has experienced significant State interest and investment in regional assessment in order to inform regional planning schemes, particularly around the development

and utilisation of regional infrastructure for mining and resource development. Recent reports relating to infrastructure planning and economic development in the Far North are summarised in this section.

6.9.1 Resources and Energy Infrastructure Demand Study

The Resource and Energy Sector Infrastructure Council engaged Parsons Brinckerhoff to undertake the 2011 Infrastructure Demand Study (Parsons Brinckerhoff 2011) across the resources and energy sector in South Australia, in acknowledgement of the growing industry and the barriers that inadequate infrastructure might place in the way of that growth. It identified a number of critical points including those discussed below:

- Common/shared infrastructure: Uncertainty over total capital costs required to fund full project infrastructure by project proponents who were unaware of existing and planned infrastructure in their regions, or the interrelationships with other possible users of common infrastructure and those costs
- Regional clustering relationships: Respondents were interested in the concept and perceived benefits of regional partnerships enabling longer-term ability to plan and solve complex infrastructure issues which was otherwise not possible from variable project timelines
- Investment funding: Many proponents were looking to other sources of funding for infrastructure such as government agencies and commercial business in order to remove such costs from their balance sheets.

Electricity and water presented specific uncertainties for project proponents who expressed concern about existing capacity remaining in existing supply / transmission networks and timing for the development of new supply / infrastructure.

Rail and ports also caused concern over the uncertainty of suitability: rail gauge inconsistencies and the lack of deep water bulk commodity port facilities were of specific concern.

6.9.2 Regional Mining and Infrastructure Planning Project – Far North

The Government of South Australia commissioned the Regional Mining and Infrastructure Planning project, conducted by Deloitte, to consider the infrastructure best able to facilitate the development of the mining sector (Deloitte 2013a). The Far North report is one of three that will be developed for each of the regions in which existing and potential mining operations are concentrated. With regards to future needs, the study found the following key issues:

- Lack of bulk commodity export port accessible by South Gawler and Mount Woods cluster mines
- Inadequate mine to port bulk transport links connecting Mount Woods mines
- No existing electricity transmission links to South Gawler mines
- No identified suitable source of water for South Gawler mines

- Lack of adequate electricity transmission to north western Far North mines (Tarcoola and Mount Woods)
- Lack of adequate water supply to the Far North region under significant additional demand.

The report found that the existing electricity transmission infrastructure at the time, provided by ElectraNet and BHP, had capacity to support short term growth. The report supported the subsequent South Australian Government's recommendation (SA Government 2014) to utilise transmission lines to supply power to mines as the industry develops, rather than on-site generation, as 'In addition to being cost effective for miners, transmission lines have significant benefits for regional communities and industry as well as reduced environmental impacts.' (SA Government 2014).

6.9.3 Regional Development Australia Far North Economic Growth and Investment Strategies

In 2016, Regional Development Australia Far North (RDAFN) commissioned the development of economic growth and investment strategies for four key regions to identify opportunities for economic development in each region and actions to realise them:

- Outback Communities Authority Region Economic Growth and Investment Strategy (SC Lennon & Associates 2016a)
- Roxby Downs Region Economic Growth and Investment Strategy (SC Lennon & Associates 2016b)
- Port Augusta Economic Growth and Investment Strategy (Strategic Economic Solutions 2016)
- Flinders Ranges Economic Growth and Investment Strategy (SC Lennon & Associates 2016c).

Taken together, the strategies focus on developing the traditional drivers of economic growth in the Far North (mining and agriculture) while also strengthening and diversifying local industry in order to create regions sustainable communities with endogenous drivers of growth. The strategy for each region is summarised briefly below.

Outback Communities Authority Region

The Outback Communities Authority Region strategy (SC Lennon & Associates 2016a) focuses on economic development opportunities in traditional industries in agriculture and mining, tourism and knowledge-intensive industries (such as alternative energy generation and services to mining). The strategy identifies four action areas to realise these opportunities:

1. Support the growth of a sustainable pastoral industry
2. Support growth and development of mining and mining services
3. Support the development of the Outback Region's visitor economy

4. Articulate and address the regions strategic infrastructure priorities.

Roxby Downs

The Roxby Downs strategy (SC Lennon & Associates 2016b) focuses on economic development opportunities in traditional industrial activities in mining, tourism and knowledge-intensive industries (such as alternative energy generation and services to mining). The strategy identifies three action areas to realise these opportunities:

1. Support development of Roxby Downs as a sustainable community
2. Support growth and development of mining
3. Support Development of the Roxby Downs Region's Visitor Economy.

Port Augusta

The Port Augusta strategy (Strategic Economic Solutions 2016) identifies a strong culture of waiting for *the Next Big Thing* and focuses on strengthening local industry capability in order to accelerate endogenous growth in diverse industries and prepare a stronger platform for engaging with external opportunities. The strategy identifies ten action areas to drive economic growth in the region:

1. Entrepreneurship and active business networking
2. Townscape and amenity
3. Transport and logistics
4. Heavy industry
5. Renewable energy
6. Education
7. Tourism
8. Defence
9. Health and aged care
10. Arid lands horticulture.

Flinders Ranges

The Flinders Rangers strategy (SC Lennon & Associates 2016c) focuses on economic develop opportunities in tourism and traditional agriculture industries. The strategy identifies four action areas to realise these opportunities:

1. Support the Flinders Ranges Council region's tourism sector
2. Support sustainable agriculture in the Flinders Ranges Council region
3. Monitor investigations into the national radioactive waste management facility
4. Promote the Flinders Ranges Council region as a location of choice from investment, working, learning and outback living.

7. EXISTING INFRASTRUCTURE AND SERVICES

7.1 Infrastructure

The region has limited existing infrastructure, due to its remoteness from major population centres. Lack of infrastructure (particularly water, road, telecommunications infrastructure and emergency services) is considered a significant restriction on economic development within the region (Deloitte 2013a). Major existing infrastructure is described in the following sections.

7.1.1 Transport

The National Land Transport Network (road and rail) provides transport links across the nation and connects South Australia with interstate markets and major export ports. The rail network links Adelaide to Darwin and Sydney to Perth, converging at Port Augusta.

Road

The Stuart Highway and Olympic Dam Highway, running between Port Augusta to Alice Springs and Pimba to Roxby Downs respectively, are the major primary roads in the Regional Study Area. A section between Port Augusta and Pimba was sealed to provide 3.5 m lanes and 1.5 m shoulders as conditioned by the Government of South Australia on BHP Billiton and undertaken during 2012 for the proposed Olympic Dam Expansion. North of Pimba, shoulder lane widths are reduced to 0.5 m. The Olympic Dam Highway services the Pimba to Roxby Down/Olympic Dam road freight route.

Other key road routes for freight and tourist movement include Port Augusta to Moomba via Leigh Creek freight route; Peterborough to Port Augusta and Hawker freight route; Leigh Creek to Marree route; and the Birdsville, Oodnadatta and Strzelecki tracks. A number of smaller, sealed and unsealed roads occur throughout the Study Area. An extensive network of unsealed roads and tracks located on private land are maintained by pastoral stations (approximately 10,000 km of roads in the Far North are in unincorporated areas and are unsealed) (DPLG 2010).

The Far North region generates the largest intrastate freight movement outside Adelaide, and an estimated 40 per cent of interstate freight moves through the region (DLPG 2010). The road network is also used by residents, tourist, goods and service providers, and other industries.

The DPTI online RAVNet system identifies a number of roads in the Far North that are gazetted for a range of restricted access vehicles including:

- 53.5m road trains
- 32m and 36.5m road trains
- B-doubles
- Higher Mass Limit vehicles.

A number of roads are used for transporting loads that are over-sized (either over-dimension and/or over-mass) (Deloitte 2013a).

Roads of specific interest in the Regional Study Area include Port Wakefield Road, Lincoln Highway, Eyre Highway, Port Augusta Highway, Stuart Highway, Olympic Dam Highway, Olympic Way and Opal Road. Existing traffic volumes on those roads were (DPTI 2015a and BHP 2008):

- Port Wakefield Road 9,600 annual average daily traffic (AADT) estimate
- Lincoln Highway 2,000 ADDT
- Eyre Highway 2,700 ADDT
- Port Augusta Highway (Port Wakefield to Port Pirie) 3,700 AADT
- Port Augusta Highway (Port Pirie to Port Augusta) 4,100 AADT
- Stuart Highway (from Port Augusta to Pimba) 900 AADT
- Olympic Dam Highway (from Pimba to Roxby Downs) 450 AADT
- Olympic Way 430 AADT
- Opal Road 167 AADT.

Deloitte (2013a) determined it was:

> *likely that as the volume of traffic increases on these roads, the inclusion of overtaking lanes over the short to medium term will provide the operational and safety capacity and likely negate the need for road duplication over this period.*

Notwithstanding infrastructure upgrades, roads within the Regional Study Area can generally be classified as high capacity and are capable of accommodating up to an estimated 15,000 daily vehicle movements. Additionally, the expected route is already approved for vehicle up to 53.5m long vehicle (GHD 2018).

South Australia's Integrated Transport and Land Use Plan (DPTI 2015b) describes road infrastructure initiatives in the Far North that will focus on supporting growth in the mining and tourism industries. The plans target upgrades to the Stuart, Eyre, Augusta and Barrier Highways and the Strzelecki Track aimed at improving the efficiency and safety of truck and tourist vehicle movements through the region. Road upgrades are also planned for the APY Lands. The plan also outlined the Government's intention to work with local councils, the Outback Communities Authority and remote communities, and to investigate the potential to upgrade Yorkey's Crossing in Port Augusta.

Table 7-1 shows the implementation timeframe for road upgrade initiatives outlined in the Integrated Transport and Land Use Plan (DPTI 2015b).

Table 7-1 Implementation timeframe for road upgrade initiatives, Far North

Implementation timeframe	Short[a]	Medium[a]	Long[a]
Road improvements in the Anangu Pitjantjatjara Yankunytjatjara Lands			
Stuart Highway road widening, shoulder sealing and rest areas			
Augusta Highway – road widening, shoulder sealing and implementation of priority treatments in the Port Augusta Road Management Plan			
Strzelecki Track – upgrade and sealing			
Barrier Highway – road and bridge widening to improve safety and efficiency for High Productivity Vehicles			
Hesso – grade separation of the Stuart Highway and interstate rail line			
Eyre Highway – road widening, shoulder sealing, overtaking lanes and rest areas			
Duplication of the Joy Baluch AM Bridge			
Work with local council to develop options for upgrade of Yorkey's Crossing			

[a] Short-term: next 5 years; medium-term: 5 to 10 years' time; Long-term: 15 or more years'-time.

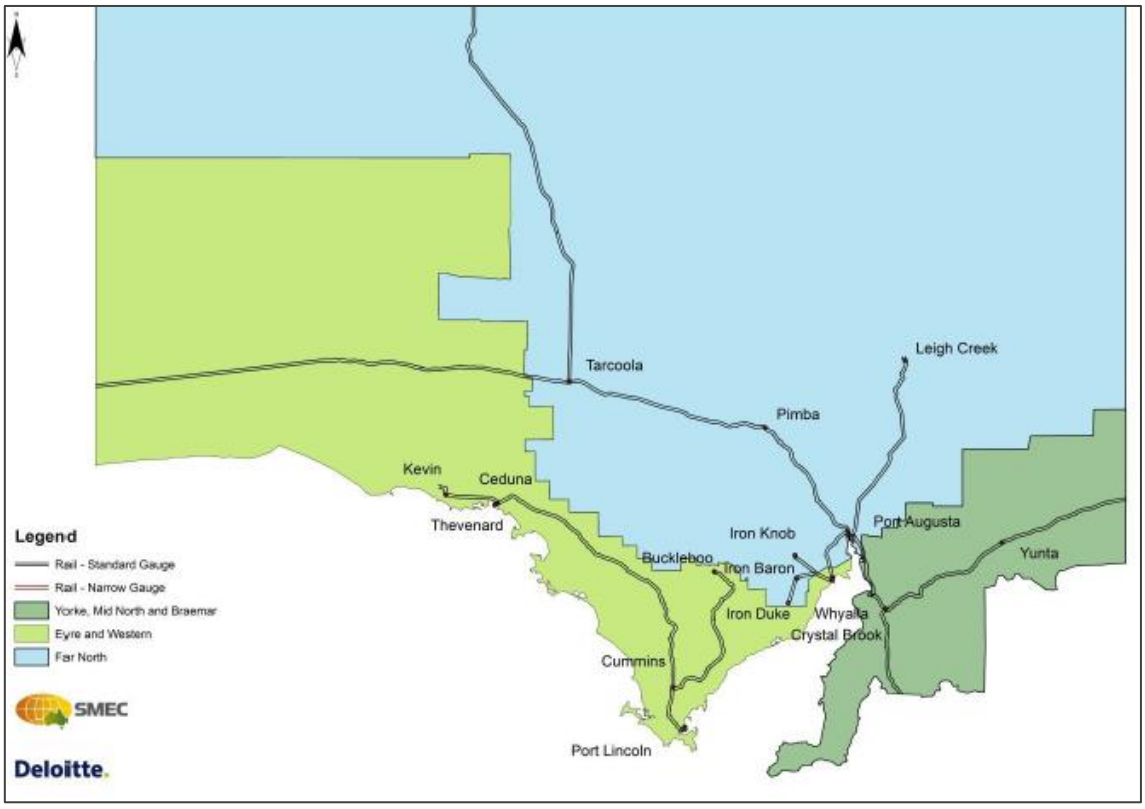
Source: DPTI 2015b

Rail

Railway infrastructure in the Far North comprises mainly standard gauge line. A short narrow gauge segment services Whyalla port from the west (Deloitte 2013a). The network, shown in Figure 7-1 comprises:

- Narrow gauge rail link between Iron Knob and Iron Baron and Whyalla. Capable of operating at a 25 tonne axle load with a carrying capacity of 9.4mtpa, with no available capacity for additional freight movements
- Standard gauge rail link between Port Augusta and Whyalla and between Port Augusta and Tarcoola. Capable of carrying 1800m trains with 25 and 23 tonne axle loads respectively, with no available capacity (work is planned by owner Australian Rail Track Corporation to add two additional passing loops between Port Augusta and Tarcoola)
- Standard gauge rail link between Tarcoola and Northern Territory. Operates at 23 tonne axle load and is near full capacity
- Standard gauge rail link between Leigh Creek and Port Augusta. Capable of carrying 23 tonne axle loads and 2.5mtpa of coal (currently), with some available additional freight capacity

Figure 7-1 Far North rail network



Source: Deloitte 2013a

Table 7-2 shows the implementation timeframe for rail freight upgrade initiatives outlined in the Integrated Transport and Land Use Plan (DPTI 2015b).

Table 7-2 Implementation timeframe for rail freight upgrade initiatives, Far North

Implementation timeframe	Short[a]	Medium[a]	Long[a]
Work with the private sector and ARTC to implement capacity improvements on the Adelaide to Perth rail line between Tarcoola and Port Augusta			
Work with the private sector and ARTC to investigate the impact of a potential rail bypass of Port Augusta, including the potential relocation of Spencer Junction and development of a new intermodal site			
Potential future rail to Northern Gawler Craton			

[a] Short-term: next 5 years; medium-term: 5 to 10 years' time; Long-term: 15 or more years'-time.

Source: DPTI 2015b

Air

There are three commercial passenger air transport providers servicing the Far North; Sharp Airlines, Alliance Airlines and Regional Express, and three commercial airports operate in the Far North; Port Augusta, Olympic Dam and Coober Pedy (RDAFN 2013).

Around 75 airstrips are located in towns and remote areas of the State and are used for medical services Flying Doctor Service (RFDS), policing, education, mine access, charter traffic and basic community access. The airports in the vicinity of the Study Area include:

Airports with scheduled air services

- Port Augusta (Council) – Sharp Airlines
- Olympic Dam (BHP Billiton) – Alliance Airlines
- Coober Pedy (Council) – Regional Express.

Defence airports (private)

- Woomera (Australian Government).

Unincorporated areas

- Glendambo (Progress Association)
- William Creek (Progress Association)
- Marree (Progress Association).

Northern areas aerodromes

- Hawker (Council)
- Quorn (Council)
- Leigh Creek (Mining, leased to Flinders NRG)
- Rawnsley Park (private).

National Parks

- Wilpena Pound (leased).

In addition, most pastoral stations in the Far North operate private airstrips, generally consisting of graded earth and with no other services or infrastructure.

According to RDAFN (2013) aviation firms and pilots have been attracted to the Far North region in recent years, with an increase in air traffic due to:

- flooding of Lake Eyre, the world's biggest salt lake, which can bring more than 50 aircraft per week into remote areas such as William Creek and challenges for commercial operators
- mining's fly-in-fly-out operations across the region which has increased pressure on regional airports. One of the main issues is the upgrading of security, for which options are currently being investigated.

An upgrade of the Port Augusta airport terminal, tarmac and car park was completed in 2014. It provides seating for 68 people at the terminal waiting lounge. The upgrade cost approximately $1.2 million with funding provided by the Commonwealth Government through the RDA Fund,

the State Government through the Far North and Outback Enterprise Zone Fund and the Port Augusta Council (Port Augusta City Council 2018b).

The Outback Communities Authority secured more than $2 million worth of Federal and State funding to improve the safety of the airstrips at Oodnadatta, Balcanoona, Glendambo and Mintabie (OCA 2010). Aerodromes in the Far North that provide access for emergency medical services by the RFDS have been upgraded with funding provided by the Australian Government's Remote Airstrip Upgrade Program (to which the State contributes matching funding) to improve the 24-hour all weather capability of these aerodromes for RFDS operations (DIRDC 2018).

Table 7-3 shows the implementation timeframe for airport upgrade initiatives outlined in the Integrated Transport and Land Use Plan (DPTI 2015b).

Table 7-3 Implementation timeframe for airport upgrade Initiatives, Far North

Implementation timeframe	Short[a]	Medium[a]	Long[a]
Work with local councils and the Outback Communities Authority to identify upgrades of strategically important local airports and airstrips, including Port Augusta, Coober Pedy, Olympic Dam and Innamincka airports and airstrips at Quorn, Hawker and in the APY Lands			

[a] Short-term: next 5 years; medium-term: 5 to 10 years' time; Long-term: 15 or more years'-time.

Source: DPTI 2015b

7.1.2 Water

Water Supply

South Australians use more than 200 GL of water per annum (Deloitte 2013a) from the following sources:

- Surface water - 46.6 per cent
- River Murray - 45.6 per cent
- Ground water - 6.0 per cent
- Sea water - 1.8 per cent.

Apart from the River Murray water main owned by the Department of Defence at Woomera, there are no mains water supplies north of Port Augusta. Third-party access to this pipeline is available subject to agreement from the Department of Defence (or the Woomera administrator) and some pastoralists use it currently.

Water supply and quality have been identified as critical issues in the Far North and are potential constraints to the economic development of the region (RDAFN 2013). Existing resources have high salinity levels and/or are of limited quantity (in the case of perched aquifers) and are therefore of limited use, and low and irregular rainfall and high evaporation affect the quantity of surface water.

Roxby Downs and Andamooka are supplied by desalinated water drawn from the Great Artesian Basin (GAB) that is pumped 200 km to BHP Billiton's mining lease where it is cooled and stored. Roxby Water purchases the water from BHP Billiton and distributes the water around the town. Roxby Water operates its retail operations under similar provisions to standard Council Electricity operations, and along comparable lines to SA Water. These provisions are addressed under a Water Industry Licence issued to Council as an Intermediate Retailer by the Essential Services Commission of South Australia (Roxby Council 2018e).

Extraction of water from the GAB has been halved over the past 30 years as a result, largely, of capping and/or closure of pastoral bores and bore drains. The Australian Government and relevant State / Territory Governments are investigating improving the long-term management of the GAB. Since the commencement of the GAB sustainability initiative program in 1999, with the aim of capping free-flowing bores and installing pipelines to replace open drains, 1,143 bores had been capped and 27,000 kilometres of pipelines were installed by mid-2013. This had resulted in 191,862 ML water savings annually (DEWNR 2014). The feasibility of developing desalination plants and investigations into the state of groundwater supplies are underway at a number of towns in the region. Further data are required on the capacity of surface and groundwater resources across the region to underpin potential mining and energy development (DTEI 2010).

Port Augusta, Port Pirie and Woomera are supplied by reticulated water from the River Murray via the Morgan-Whyalla pipeline. Whyalla, Woomera and Pimba also access this water via the Port Augusta-Woomera pipeline (SA Water 2018). Other communities rely on community maintained bores and rain water. Dams, tanks and bores support stock on pastoral leases.

RDAFN's (2013) Far North Regional Plan 2013-2016 includes 30-year water projections for the Upper Spencer Gulf:

- Growth in connections: 19 per cent over next 30 years (in the range from 11–35 per cent)
- Water demand: 15 per cent over next 30 years (in the range from 10-35 per cent)
- Water sources: Treated River Murray water, supplied via the Morgan-Whyalla pipeline
- Water treatment: Morgan Water Treatment Plant to continue treating River Murray supply
- Water storage: Possible upgrades to Winninowie and Baroota Tanks if required
- Port Augusta: SA Water to improve capacity over next 10 – 15 years.

Wastewater

Small wastewater treatment plants operated by SA Water provide a combination of sewer and septic system wastewater treatment at Port Augusta and Whyalla. The treated water is used for irrigation of community open spaces in both cities (SA Water 2018). Port Augusta is seeking to maximise the re-use of wastewater and has already reduced outflows into the marine environment by one-third (DPLG 2010).

Roxby Downs has a wastewater treatment plant managed by Roxby Downs Council which pumps the sewage to a series of lagoons located to the west of the town (Roxby Council 2018e). Woomera has a wastewater treatment plant and associated lagoons managed by Department of Defence. In both towns, treated effluent is used to irrigate parkland and playing fields. As Andamooka and Pimba have no reticulated sewerage systems residents rely on small onsite wastewater storage, such as septic tanks.

7.1.3 Energy

Electricity is supplied to Port Augusta, Roxby Downs and Woomera from the National Electricity Market (NEM) via the interconnected power system, administered by the Australian Energy Market Operator (AEMO). South Australia's electricity transmission network is connected to the NEM through the Murraylink and Heywood interconnectors. This allows electricity to flow between Victoria and South Australia to cope with the varying electricity demands of each state. The Murraylink interconnector has a transfer nominal rating of 220 MW and the Heywood interconnector currently transfers 600 MW (AEMO 2017).

South Australia's domestic electricity supply comes from a range of renewable and non-renewable sources, the three main electricity generators being gas-fired generation, wind energy and rooftop photovoltaics systems. Following the closure of the coal-fired Playford and Northern power stations in Port Augusta, South Australia no longer produces electricity from coal. The South Australian Government has entered into a generation project agreement with the planned Aurora Solar Energy Project, a 150MW solar thermal plant near Port Augusta, operated by Solar Reserve (AEMO 2017, SolarReserve 2018). In the Far North Region, Port Augusta, Woomera, Roxby Downs and some towns along the transmission line to Leigh Creek are connected to the national electricity grid. Most Outback communities however, rely on diesel generators to provide power, particularly the small remote towns across the region, including Glendambo, Pimba, Innamincka, William Creek, Marree, Oodnadatta and Yunta. Some towns have been exploring the use of small-scale hybrid plants based on renewable energy and gas or diesel (SC Lennon & Associates 2016a).

South Australia's electricity consumption was 12,484 gigawatt-hour (GWh) in 2016–17, 3.7 per cent (482 GWh) lower than in 2015–16. Electricity consumption is forecast to decline in the long-term outlook period (2016–17 to 2026–27) from 12,442 GWh in 2016–17 to 11,989 GWh in 2026–27. (AEMO 2017).

Table 7-4 summarises the local electricity supply breakdown for 2016–17. Gas powered generation supplied 50.5 per cent of power, followed by wind generation at 39.2 per cent of generation (AEMO 2017).

Table 7-4 Registered capacity and local generation by energy source, SA, 2016–17

Energy source	Registered Capacity		Electricity generated	
	MW	% of total	GWH	% of total
Gas	2,668	49.1%	5,596	50.5%
Wind	1,698	31.2%	4,343	39.2%
Coal	0	0.0%	0	0.0%
Diesel and SNSG[a]	289	5.3%	122	1.1%
Rooftop PV[b]	781	14.4%	1,016	9.2%
Total	**5,436**	**100%**	**11,077**	**100%**

[a] Diesel and SNSG includes small and large diesel, small landfill methane, hydro generating schemes and photovoltaic non-scheduled generation.

[b] Rooftop photovoltaic systems.

Source: AEMO 2017

Over the last decade, South Australia has predominantly been a net importer from Victoria. From 2007–08, there has been a steady increase in annual imports from Victoria to South Australia, due to the reduction of local GPG and coal-fired generation (offset by increased renewable generation). In 2016–17, South Australia imported 2,889 GWh, mainly via the Heywood Interconnector. This was the highest import in 10 years. The average annual import increase through Victoria to South Australia since 2007–08 is 246 GWh, or 18 per cent. A variety of factors have led to greater imports, including:

- Reduced local installed baseload capacity in South Australia due to generating plant withdrawals
- Increased interconnector capacity.

In 2016–17, total imports from Victoria represented approximately 21 per cent of South Australian consumption, while net imports (total imports less total exports) accounted for around 20 per cent. (AEMO 2017).

South Australia's future capacity under a medium demand scenario (with the incorporation of withdrawn or reduced generation capacity), will avoid reliability standard breaches if additional generation capacity is made, and planned renewable projects are implemented (AEMO 2017).

The capacity of existing or withdrawn generation, and committed or proposed projects, in South Australia is shown by energy source in Table 7-5. As of 1 July 2017, 1,515 MW of solar generation and 3,178 MW of new wind generation projects are either committed or proposed in South Australia (AEMO 2017).

Table 7-5 Capacity (MW) of existing and withdrawn generation, committed and proposed projects, SA, 5 June 2017

Status	Coal	CCGT[a]	OCGT[b]	Gas Other	Solar	Wind	Water	Biomass	Other	**Total**
Existing	0	658	919	1,280	0	1,595	3	129	129	**4,598**
Announced withdrawal	0	0	0	0	0	0	0	0	0	**0**
Committed	0	0	0	0	220	211	0	0	0	**431**
Proposed	0	460	320	0	1,295	2,966	200	15	29	**5,285**
Withdrawn	-786	0	0	0	0	0	0	0	0	**-786**

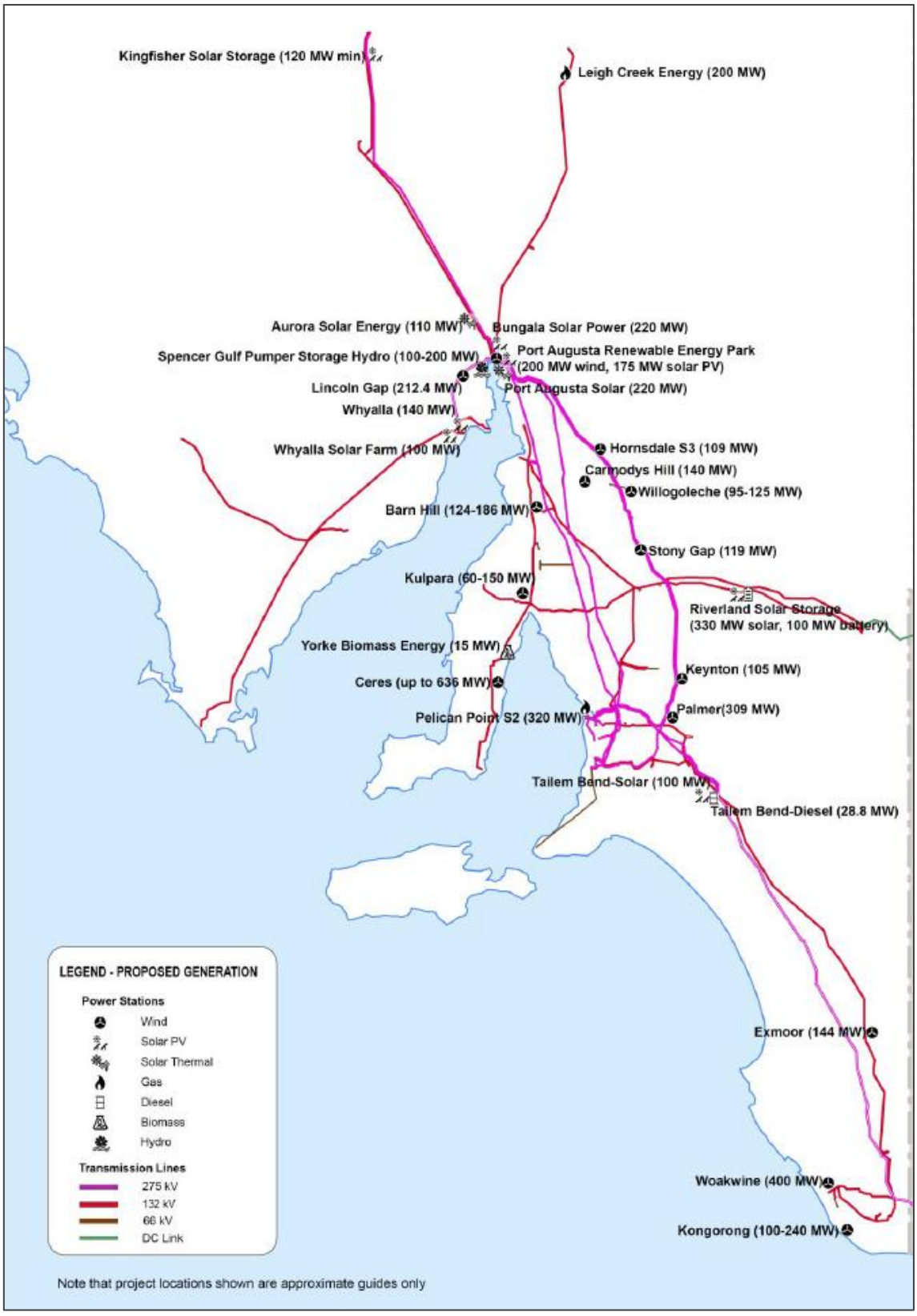
[a] CCGT: Combined-cycle gas turbine.

[b] OCGT: Open-cycle gas turbine.

Source: AEMO 2017

Figure 7-2 shows the location and capacity of proposed generation projects in South Australia, 10 of which are located in the Regional Study Area.

Figure 7-2 Location and capacity (MW) of proposed generation projects, South Australia



Source: AEMO 2017

7.1.4 Communications

Information and communications technology varies across the Regional Study Area. Mobile telephone coverage by both Telstra and Optus is show in Table 7-4. The table shows the coverage type in each town in the region. 4GX is the fastest internet speed available at most study area towns, except Andamooka where coverage is patchy, and provided by Telstra. Slowest internet speed is 3G available only at Andamooka. Telstra has at least 3G coverage along the highway linking the towns and stronger coverage within the towns, whereas Optus has slightly less coverage within the towns and also requires external antennas to maintain coverage along the highway (Telstra 2018; Optus 2018).

Table 7-6 Mobile telephone coverage in the Regional Study Area

Towns	Telstra	Optus
Coober Pedy	4GX	4G
Woomera	4GX	4G
Pimba	4GX	4G and 3G
Roxby Downs	4GX	4G and 3G
Andamooka	4GX and 3G	3G
Port Augusta	4GX	4G
Whyalla	4GX	4G

Source: Telstra 2018, Optus 2018

Broadband Internet access is available in all towns and cities in the Regional Study Area, and is still the most commonly used form of internet connection. The most current data showing internet connections to private dwellings in the Regional Study Area is shown in Appendix 2.

The rate of household connections is particularly high in Roxby Downs (93. per cent), which is higher than the State average. The remaining towns and cities within the Regional Study Area have lower household internet connections than the State average. Pimba and Andamooka have relatively low household internet access with 53 per cent and 65 per cent of households respectively. This lower internet access suggests a need for greater face-to-face and written communication in this area, rather than reliance on a website to display information. Where information is provided electronically, small file sizes would be required to facilitate downloading.

According to the Government of South Australia, improved ICT networks, particularly broadband, would be critical to supporting the expansion of mining, defence and tourism activities and delivering health, education and other services to people in remote communities (DTEI 2010).

The national broadband network (NBN) is available in Port Augusta (including Stirling North), Whyalla town (including Whyalla Norrie and Whyalla Jenkins, but not surrounding areas), Roxby Downs township and parts of Coober Pedy (NBNCo 2018).

7.2 Services

7.2.1 Health

Health services are located at Andamooka, Roxby Downs, Woomera, Whyalla and Port Augusta, with hospitals at Port Augusta (55 beds, 24-hour accident and emergency, two operating theatres), Whyalla (73 inpatient beds, 20-day surgery beds, 24-hour emergency, two operating theatres) and Roxby Downs (accident and emergency, attendant nurse, doctor on call).

The Royal Flying Doctor Service (RFDS) has a base in Port Augusta and provides emergency medical services as well as routine clinics to people in remote and isolated areas of South Australia (DTEI 2010). Although most communities have some form of health service, improving access to appropriate care, medical specialists and emergency services is an ongoing priority for remote communities. Many remote communities find it hard to attract medical practitioners. Patients are often required to travel to Adelaide for specialist medical services, (DTEI 2010).

Pika Wiya Health Service Aboriginal Corporation is located at Port Augusta and is the centre for Aboriginal health services in the Far North region.

Woomera

Woomera's 44-bed hospital, which opened in 1959, closed in 2014. In its place is a general health service with a GP two days per week and a nurse in attendance six days per week.

Roxby Downs

Roxby Downs Hospital offers the following services:

- Accident and emergency – A registered nurse offers assessment and treatment and there is a doctor on call
- Medical and surgical services – General medical and surgical care, including day surgery and outpatient services
- Allied health services – Specialist visits from dietician, diabetes educator (monthly visits), child and youth health clinics, immunisation, occupational therapist, physiotherapist, podiatrist, speech pathologist
- Community midwife – the nearest birthing facilities are at Port Augusta but at Roxby Downs a shared care arrangement with GPs and community midwives assists women before, during and after childbirth
- Mental health – A Child and Adolescent Mental Health Services (CAMHS) and a community mental health worker visit fortnightly.

Andamooka

The Andamooka Health Service provides a Registered Nurse primary health care service, home visiting, referrals and a 24-hour medical consultation and ambulance service. (Healthdirect 2018).

Port Augusta

Port Augusta Hospital began operation in 1875. The current purpose-designed hospital building opened in 1997. The Port Augusta Health Service is the major regional health provider for the Flinders and Outback Health Service. Facilities include:

- 55 public beds
- 24-hour accident and emergency
- two operating theatres
- same day and overnight stay
- specialist consulting rooms
- youth health services.

Whyalla

The Whyalla Hospital and Health Services facility is the major regional health provider for the Whyalla, Eastern Eyre and Far North area. It is one of the four designated general hospitals in Country South Australia and offers services using local general practitioners, resident specialists, visiting specialists, and telemedicine.

Facilities include:

- 73 inpatient beds
- 24-hour emergency department
- 20-day surgery beds/chairs
- two chair renal dialysis unit
- two chair chemotherapy room
- two operating theatres
- endoscopy suite
- specialist consulting rooms.

Port Pirie

Port Pirie is the base of major health services in the Mid North through the Port Pirie Regional Health Service, which provides an accident and emergency service, mental health service, and a range of medical and surgical services (SA Health 2012). The hospital has between 50 and 99 beds, with services including:

- Acute renal dialysis unit
- Alcohol and drug unit
- Domiciliary care unit
- Emergency department

- Geriatric assessment unit
- Hospice care unit
- Nursing home care unit
- Obstetric services
- Oncology unit
- Paediatric service.

Coober Pedy

The Coober Pedy Hospital is a 24 bed facility with 14 acute beds, 10 high level residential aged care beds and an accident and emergency department. The Coober Pedy Community Health Centre is attached to the hospital and offers a range of support services, early intervention programs and a space for visiting specialists and Allied Health staff to conduct regular clinics (SA Health 2017).

7.2.2 Education and training

Childcare, preschool and primary school facilities are located in Coober Pedy, Woomera, Roxby Downs, Andamooka, Port Augusta, Port Pirie and Whyalla, with secondary schooling available at Coober Pedy, Woomera, Roxby Downs, Port Augusta, Port Pirie and Whyalla. There are 54 schools in the Far North region comprising 12 Aboriginal schools, 24 preschools and 18 primary and secondary schools (ORESJ 2013). There are 5 government preschools, 4 primary schools and one senior school in Port Pirie and 5 preschools, 5 primary schools and 3 secondary schools in Whyalla (Department of Education 2018).

Childcare and education facilities in the Regional Study Area are summarised in Table 7-7 and Table 7-8.

Vocational education and training facilities include TAFE SA campuses at Port Augusta, Port Pirie, Whyalla, Roxby Downs and Coober Pedy. The Port Augusta campus offers a wide range of trade, business and engineering (mining) studies as well as delivering conservation and land management studies tailored for Indigenous students.

The University of Adelaide has a regional campus in Port Augusta. The campus currently offers the Wilto Yerlo University Preparation Program which helps Aboriginal and Torres Strait Islander students prepare for university.

The University of South Australia has a Whyalla campus (the largest regional university campus in South Australia) which houses its Centre for Regional Engagement (ORESJ 2014).

Table 7-7 Childcare facilities in the Regional Study Area

Community	Childcare facility
Coober Pedy	Mini Gems Children's Centre
Woomera	Woomera Area School – Early Learning Centre (Woomera Child Parent Centre)
Roxby Downs	Roxby Early Leaning Community Group Little Rascals Child Centre Roxby Downs Community Child Care Centre Inc.
Andamooka	Andamooka Rural Child Care Service
Port Augusta	Carlton Preschool Flinders Children's Centre Flinders View School Based Preschool Port Augusta Children's Centre Port Augusta West Childhood Services Centre Willsden Childhood Services Centre Bubble 'n' Squeak Child Development Centre
Whyalla	Samaritan College OSHC Wynbring Jida Child Care Centre Gabmiddi Manoo Children & Family Centre McRitchie Crescent Children's Services Centre Memorial Oval Primary School OSHC Neta Kranz Children's Centre Nicholson Avenue Primary School OSHC Norrie Stuart Children's Service Centre Sunrise Christian School Early Learning Centre Whyalla Childcare Centre Whyalla Family Day Care Whyalla Stuart Early Childhood Centre and Kindergarten Whyalla Town Primary School OSHC
Port Pirie	Port Pirie Community Child Care Centre DECD Family Day Care Bubble N Squeak Child Development Centre Kingston Road Early Learning and Kinder Airdale Kids Club Ellendale Kindergarten Port Pirie & District Children's Centre Inc. Port Pirie Community Kindergarten Port Pirie Family Day Care Risdon Park South Kindergarten Solomontown Kindergarten Pamela's Family Day Care Sharon's Day Care

Source: Department of Education 2018

Table 7-8 Education facilities in the Regional Study Area

Community	Name	Sector	Type	Enrolments	Teaching staff
Coober Pedy	Coober Pedy Area School	Government	Combined R-12	237	27
Woomera	Woomera Area School	Government	Combined R-12	16	3
Roxby Downs	Roxby Downs Area School	Government	Combined U, R-12	616	57
	St Barbara's Parish School	Non-government	Combined R-9	117	17
Andamooka	Andamooka Primary School	Government	Primary R-6	19	4
Port Augusta	Port Augusta Secondary School	Government	Secondary U, 8-12	584	58
	Port Augusta Special School	Government	Special U	44	8
	Port Augusta School of the Air	Government	Combined R-12	n/a	n/a
	Port Augusta West Primary School	Government	Primary U, R-7	288	21
	Augusta Park Primary School	Government	Primary U, R-7	283	26
	Carlton School	Government	Combined R-9	96	10
	Willsden Primary School	Government	Primary R-7	159	18
	Caritas College	Non-government	Combined R-12	542	47
	Flinders View Primary School	Government	Primary R-7	158	18
Whyalla	Whyalla High School	Government	Secondary 8-12	438	31
	Whyalla Town Primary School	Government	Primary R-7	342	25
	Whyalla Special Education	Government	Special U	41	9
	Whyalla Stuart Campus	Government	Primary R-7	88	9

Community	Name	Sector	Type	Enrolments	Teaching staff
Whyalla, cont.	Memorial Oval Primary School	Government	Primary R-7	280	15
	Samaritan College	Non-government	Combined R-12	932	84
	Edward John Eyre High School	Government	Secondary 11-12	342	29
	Fisk St Primary School	Government	Primary R-7	118	8
	Hincks Avenue Primary School	Government	Primary U, R-7	185	13
	Long Street Primary School	Government	Primary R-7	360	23
	Nicholson Avenue Primary School	Government	Primary U, R-7	483	32
	Stuart High School	Government	Secondary U, 8-10	178	15
	Sunrise Christian School	Non-government	Primary R-7	146	10
Port Pirie	Port Pirie West Primary School	Government	Primary R-7	249	20
	St Mark's College	Non-government	Combined R-12	983	70
	Mid North Education Centre	Government	Special U	32	7
	Risdon Park Primary School	Government	Primary R-7	420	31
	Solomontown Primary School	Government	Primary U, R-7	216	20
	Airdale Primary School	Government	Primary R-7	108	14
	Mid North Christian College	Non-government	Combined R-12	285	26
	John Pirie Secondary	Government	Secondary U, 8-12	623	48

Source: ACARA 2018

7.2.3 Emergency services

Fire and State Emergency Service

The Regional Study Area falls within Region 4 – Flinders, Mid North and Pastoral Areas of the SA Country Fire Service, which covers 700,000km^2 (SACFS 2018). The region headquarters is located in Port Augusta and has eight groups and 68 brigades (SACFS Promotions Unit 2018). The nearest brigades to the Study Area are located at Andamooka, Roxby Downs and Woomera. (SACFS Promotions Unit 2018).

Whyalla and Port Augusta Fire Stations are operated by the Metropolitan Fire Service. Both are staffed by 25 retained firefighters and operate 24 hours per day, seven days per week (SAMFS 2018).

The State Emergency Service (SES) is a volunteer based organisation established under Commonwealth legislation to provide immediate assistance during emergencies and disasters. It provides trained people to respond to incidents such as vehicle accidents, flood and storm damage, and search and rescue incidents. The SES cooperates closely with other emergency services. SES operations in the region are coordinated out of Whyalla (SASES 2018). The nearest SES volunteer units to the Study Area are located at Andamooka, Roxby Downs and Whyalla (SASES 2018).

Police

Most of the Regional Study Area falls within the Far North Local Service Area of the South Australia Police (South Australian Police 2018). Port Augusta police station is the regional headquarters, with several patrol teams and associated staff. The Port Augusta and Port Pirie police stations operate 24 hours per day, every day. Smaller police stations are located in Woomera, Roxby Downs and Andamooka, operating during business hours and emergencies. Deloitte (2013a) noted the need to continue to monitor the level of policing as population increases in the Far North to ensure adequate resources for community safety.

Ambulance

The South Australian Ambulance Service has bases in Port Augusta, Port Pirie and Whyalla, volunteer stations at Roxby Downs and SAAS supported services at Woomera and Andamooka (SAAS 2018). The service works in collaboration with the RFDS within the region. More than 100 SAAS-trained staff also work at mining sites across the State providing first response to emergency situations under contract to the respective mining operations (SAAS 2018).

7.2.4 Housing and accommodation

Availability

Table 7-9 shows the number of occupied and unoccupied dwellings across the Regional Study Area. Across all locations, the proportion of unoccupied houses are above both the state and national averages (12.6 per cent and 11.2 per cent). In Woomera and Andamooka over 70 per

cent of dwellings are unoccupied at the last census and in Coober Pedy approximately 40 per cent of dwellings were unoccupied.

Table 7-9 Housing availability, 2016

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	South Australia	Australia
Dwelling type										
Occupied private dwellings (no.)	5,021	1,177	694	70	150	19	8,774	6,905	638,792	8,286,077
Occupied private dwelling %	81.5%	72.1%	60.5%	29.8%	26.2%	57.6%	82.2%	86.6%	87.4%	88.8%
Unoccupied private dwellings (no.)	1,143	456	454	165	423	14	1,897	1,068	92,242	1,039,874
Unoccupied private dwellings %	18.5%	27.9%	39.5%	70.2%	73.8%	42.4%	17.8%	13.4%	12.6%	11.2%

Source: ABS 2017a

Affordability

Table 7-10 shows rent and mortgage affordability across the Regional Study Area. Median rents across the Regional Study Area are lower than the state and national equivalents. Likewise, the proportion of households whose rent repayments are more than 30 per cent of household income across the Regional Study Area are lower than the state and national equivalents.

Median mortgage repayments across the Regional Study Area are lower than the state and national equivalents ($1,491 per month and $1,755 per month respectively), with the exception of Roxby Downs ($2,000 per month). The proportion of households whose mortgage repayments are more than 30 per cent of household income across the Regional Study Area are lower than the state and national equivalents (6.6 per cent and 7.2 per cent respectively), with the exception of Whyalla (11.8 per cent). Whilst mortgage repayments are relatively high in Roxby Downs, mortgage stress is relatively low (3.1 per cent of households with mortgage repayments greater than 30 per cent of household income), which can be explained by the relatively high household income. With Whyalla, the converse pattern is seen.

Table 7-10 Rent and mortgage affordability, 2016

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	South Australia	Australia
Median rent ($/weekly)	180	198	150	120	115	n.a.	176	170	260	335
Rent payments more than 30% household income	9.8%	3.2%	5.4%	0.0%	5.7%	n.a.	4.4%	9.4%	10.2%	11.5%
Median mortgage repayment ($/monthly)	1,213	2,000	556	0	929	n.a.	1,235	1,001	1,491	1,755
Mortgage repayments more than 30% household income	3.7%	3.1%	1.9%	0.0%	0.0%	n.a.	11.8%	4.6%	6.6%	7.2%

Source: ABS 2017a

Tourism accommodation

In the Flinders and Outback region there were 1,268 temporary accommodation rooms available supplied by 33 establishments at June 2016, with occupancy overall at 42 per cent (SATC 2017).

The peak occupancy months are August and September with occupancy of 52 and 54 per cent respectively (SATC 2017).

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Disclaimer

The assignment is a consulting engagement as outlined in the 'Framework for Assurance Engagements', issued by the Auditing and Assurances Standards Board, Section 17. Consulting engagements employ an assurance practitioner's technical skills, education, observations, experiences and knowledge of the consulting process. The consulting process is an analytical process that typically involves some combination of activities relating to: objective-setting, fact-finding, definition of problems or opportunities, evaluation of alternatives, development of recommendations including actions, communication of results, and sometimes implementation and follow-up.

The nature and scope of work has been determined by agreement between BDO and the Client. This consulting engagement does not meet the definition of an assurance engagement as defined in the 'Framework for Assurance Engagements', issued by the Auditing and Assurances Standards Board, Section 10.

Except as otherwise noted in this report, we have not performed any testing on the information provided to confirm its completeness and accuracy. Accordingly, we do not express such an audit opinion and readers of the report should draw their own conclusions from the results of the review, based on the scope, agreed-upon procedures carried out and findings.

APPENDIX 1 REGIONAL DEFINITIONS

Appendix Table A1-1 Regional definitions

Census year	Port Augusta	Roxby Downs	Coober Pedy	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists	Far North Total
2006 Geography type / region name	LGA /Port Augusta (C)	LGA / Roxby Downs (M)	LGA / Coober Pedy (DC)	CD / 4010503 CD / 4010505 CD / 4010506	CD / 4010502	CD / 4010504	LGA / Whyalla (C)	LGA / Port Pirie City and Dists (M)	SA3 / Outback - North and East
2011 Geography type / region name	LGA /Port Augusta (C)	LGA / Roxby Downs (M)	LGA / Coober Pedy (DC)	SA1 / 4114109	SA1 / 4114101	MB / 40240260000 MB / 40240380000 MB / 40242600000 MB / 40242610000 MB / 40242620000 MB / 40243070000 MB / 40243220000 MB / 40243440000 MB / 40243460000 MB / 40243570000 MB / 40243690000	LGA / Whyalla (C)	LGA / Port Pirie City and Dists (M)	SA3 / Outback - North and East

Census year	Port Augusta	Roxby Downs	Coober Pedy	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists	Far North Total
2016									
Geography type / region name	LGA /Port Augusta (C)	LGA / Roxby Downs (M)	LGA / Coober Pedy (DC)	SA1 / 4114109	SA1 / 4114101	MB / 40243220000 MB / 40214970900 MB / 40214968300 MB / 40214979400 MB / 40214984900 MB / 40215066800 MB / 40215067000 MB / 40215222300 MB / 40240260000 MB / 40240380000 MB / 40242600000 MB / 40242610000 MB / 40242620000 MB / 40243070000 MB / 40243460000	LGA / Whyalla (C)	LGA / Port Pirie City and Dists (M)	SA3 / Outback - North and East

Key: LGA – Local government association, CD – Collection district, SA1 – Statistical area level 1, SA3 – Statistical area level 3, MB – Mesh block.

Source: ABS 2007, ABS 2012, ABS 2017a and EconSearch analysis

APPENDIX 2 DEMOGRAPHIC INDICATORS

Appendix Table A2-1 Demographic indicators, person characteristics and age

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	Far North Total	South Australia	Australia
Person characteristics											
Population (total number)	13,808	3,884	1,762	146	316	63	21,828	17,364	26,203	1,676,653	23,401,892
Male %	51.0%	57.1%	54.6%	64.3%	54.4%	62.7%	50.0%	49.0%	52.9%	49.3%	49.3%
Female %	49.0%	42.9%	45.4%	35.7%	45.6%	37.3%	50.0%	51.0%	47.1%	50.7%	50.7%
Indigenous origin %	18.3%	3.0%	17.1%	0.0%	4.1%	12.7%	4.7%	3.6%	20.8%	2.0%	2.8%
Age											
0-14 years %	18.9%	26.4%	16.0%	8.2%	12.0%	11.1%	19.2%	17.9%	19.4%	17.5%	18.7%
65 years and over %	16.5%	1.2%	22.6%	3.4%	28.2%	22.2%	17.1%	21.4%	13.8%	18.3%	15.7%
Median age	39	30	46	48	53	39	40	44	37	40	38

Source: ABS 2017a and EconSearch analysis

Appendix Table A2-2 Demographic indicators, main language spoken at home

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	Far North Total	South Australia	Australia
Main language spoken at home											
Speaks English only	83.2%	83.8%	60.3%	90.5%	77.6%	63.5%	86.9%	89.6%	75.1%	78.2%	72.7%
Afrikaans	0.1%	0.8%	0.0%	2.4%	0.0%	0.0%	0.7%	0.2%	0.2%	0.1%	0.2%
Arabic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.6%	1.4%
Australian Indigenous Languages	1.1%	0.0%	2.7%	0.0%	0.0%	0.0%	0.1%	0.1%	7.7%	0.2%	0.3%
Cantonese	0.1%	0.1%	0.2%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.6%	1.2%
Mandarin	0.2%	0.0%	0.5%	0.0%	0.0%	0.0%	0.2%	0.1%	0.2%	1.7%	2.5%
Other Chinese	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%
Croatian	0.0%	0.0%	1.5%	0.0%	0.9%	0.0%	0.2%	0.0%	0.2%	0.2%	0.2%
Dutch	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.2%	0.1%
French	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.2%	0.3%
German	0.2%	0.1%	1.4%	0.0%	0.9%	0.0%	0.4%	0.1%	0.3%	0.4%	0.3%
Greek	0.0%	0.2%	5.0%	0.0%	1.2%	0.0%	0.5%	0.5%	0.4%	1.4%	1.0%
Bengali	0.1%	0.1%	0.5%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%	0.2%
Hindi	0.2%	0.2%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.1%	0.4%	0.7%
Punjabi	0.5%	0.0%	0.6%	0.0%	0.0%	0.0%	0.1%	0.0%	0.3%	0.6%	0.6%
Sinhalese	0.0%	0.5%	3.3%	0.0%	0.0%	0.0%	0.1%	0.0%	0.3%	0.2%	0.3%
Urdu	0.1%	0.2%	0.6%	0.0%	0.0%	0.0%	0.0%	0.2%	0.1%	0.2%	0.3%
Italian	0.5%	0.1%	0.7%	0.0%	1.5%	0.0%	0.4%	0.9%	0.3%	1.7%	1.2%

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	Far North Total	South Australia	Australia
Main language spoken at home (cont.)											
Japanese	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%
Korean	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.5%
Macedonian	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Persian (excluding Dari)	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.2%
Polish	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.3%	0.2%
Russian	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.2%
Samoan	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Serbian	0.0%	0.3%	1.3%	0.0%	1.8%	0.0%	0.1%	0.0%	0.1%	0.2%	0.2%
Filipino	0.0%	0.5%	0.6%	0.0%	0.0%	0.0%	0.5%	0.3%	0.1%	0.2%	0.3%
Indonesian	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.3%
Tagalog	0.1%	0.8%	0.6%	0.0%	0.9%	0.0%	0.5%	0.2%	0.3%	0.3%	0.5%
Spanish	0.0%	0.5%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.1%	0.3%	0.6%
Tamil	0.1%	0.1%	0.2%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.2%	0.3%
Thai	0.0%	0.4%	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.2%
Turkish	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Vietnamese	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	1.1%	1.2%
Other(f)	0.6%	2.1%	3.8%	2.4%	3.9%	22.2%	0.9%	1.0%	1.1%	3.6%	4.0%

Source: ABS 2017a and EconSearch analysis

Appendix Table A2-3 Demographic indicators, family characteristics and income

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	Far North Total	South Australia	Australia
Family Characteristics											
Number of families	3,307	886	351	29	67	7	5,551	4,468	5,781	436,817	5,907,625
Couple families with children %	36.6%	56.7%	33.0%	12.5%	37.5%	0.0%	37.3%	36.7%	39.8%	42.1%	45.5%
Couple families without children %	40.7%	33.9%	46.4%	87.5%	41.7%	33.3%	40.4%	42.3%	40.6%	40.0%	37.2%
One parent families %	20.7%	9.4%	17.1%	0.0%	20.8%	66.7%	21.1%	19.7%	17.8%	16.3%	15.6%
Other families %	2.0%	0.0%	3.4%	0.0%	0.0%	0.0%	1.2%	1.3%	1.8%	1.7%	1.7%
Income											
Median weekly individual income ($)	604	1,547	497	1,179	475	1,342	497	481	640	600	662
Median weekly household income ($)	1,094	2,456	882	1,562	708	890	987	905	1,217	1,204	1,432
Median weekly family income ($)	1,370	2,760	1,329	2,083	1,300	2,062	1,388	1,229	1,474	1,510	1,734
Median rent ($/weekly)	180	198	150	120	115	n.a.	176	170	160	260	335
Rent payments more than 30% household income	9.8%	3.2%	5.4%	0.0%	5.7%	n.a.	4.4%	9.4%	7.3%	10.2%	11.5%
Median mortgage repayment ($/monthly)	1,213	2,000	556	0	929	n.a.	1,235	1,001	1,204	1,491	1,755
Mortgage repayments more than 30% household income	3.7%	3.1%	1.9%	0.0%	0.0%	n.a.	11.8%	4.6%	3.1%	6.6%	7.2%

Source: ABS 2017a and EconSearch analysis

Appendix Table A2-4 Demographic indicators, household type, internet connections and education

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	Far North Total	South Australia	Australia
Household type – occupied private dwellings											
Family households %	58.7%	67.7%	37.9%	38.9%	44.5%	40.0%	59.0%	60.8%	54.2%	64.9%	66.7%
Lone person households %	28.1%	19.7%	35.6%	61.1%	52.7%	20.0%	31.9%	31.4%	27.6%	26.6%	22.8%
Group households %	2.5%	3.0%	1.7%	0.0%	2.7%	16.0%	2.4%	1.7%	2.1%	3.4%	4.0%
Other households	10.7%	9.6%	24.8%	0.0%	0.0%	24.0%	6.7%	6.0%	16.0%	5.2%	6.5%
Occupied private dwellings	5,021	1,177	694	70	150	19	8,774	6,905	8,954	638,792	8,286,077
Unoccupied private dwellings	1,143	456	454	165	423	14	1,897	1,068	3,506	92,242	1,039,874
Type of internet connection – occupied private dwellings											
Internet connection total %	71.9%	93.4%	64.4%	76.0%	64.8%	52.9%	73.8%	71.2%	71.5%	82.6%	85.5%
Internet not accessed from dwelling %	28.1%	6.6%	35.6%	24.0%	35.2%	47.1%	26.2%	28.8%	28.5%	17.4%	14.5%
Education											
Secondary (%)	15.0%	15.1%	7.7%	9.4%	14.3%	0.0%	19.3%	23.1%	14.3%	19.2%	20.1%
Technical or further education (%)	4.1%	8.2%	6.0%	0.0%	0.0%	0.0%	7.8%	6.5%	5.1%	6.5%	5.9%
University or tertiary (%)	3.1%	6.5%	3.5%	0.0%	4.8%	0.0%	5.7%	4.3%	3.8%	16.2%	16.1%

Source: ABS 2017a and EconSearch analysis

Appendix Table A2-5 Demographic indicators, employment status and occupation

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	Far North Total	South Australia	Australia
Employment (population aged 15 years and over)											
In the labour force (total number)	5,872	2,282	707	104	130	44	9,477	7,292	11,788	806,596	11,471,294
Employed full-time %	55.0%	71.4%	56.6%	89.5%	50.7%	82.9%	52.5%	50.4%	59.7%	53.9%	57.7%
Employed part-time %	29.1%	18.7%	24.1%	10.5%	33.3%	17.1%	29.5%	33.5%	25.2%	33.5%	30.4%
Employed but away from work %	6.3%	6.5%	9.4%	0.0%	6.5%	0.0%	5.6%	5.4%	6.5%	5.0%	5.0%
Unemployed %	9.7%	3.5%	9.9%	0.0%	9.4%	0.0%	12.4%	10.7%	8.6%	7.5%	6.9%
Occupation (population aged 15 years and over) (%)											
Managers	8.6%	6.9%	13.9%	19.6%	8.0%	32.3%	7.6%	10.6%	11.2%	12.6%	13.0%
Professionals	14.7%	13.4%	13.1%	7.8%	7.1%	0.0%	14.7%	13.7%	14.4%	20.3%	22.2%
Technicians and Trades Workers	13.6%	26.4%	11.1%	21.6%	23.2%	22.6%	17.9%	14.9%	16.5%	13.4%	13.5%
Workers	17.0%	6.3%	19.2%	11.8%	11.6%	0.0%	11.8%	13.4%	13.8%	12.0%	10.8%
Clerical and Administrative Workers	12.3%	8.4%	11.2%	18.6%	7.1%	0.0%	9.8%	10.8%	10.1%	13.3%	13.6%
Sales Workers	10.4%	4.8%	8.6%	0.0%	5.4%	16.1%	9.4%	11.1%	7.5%	9.6%	9.4%
Machinery Operators and Drivers	9.4%	22.3%	8.6%	6.9%	23.2%	12.9%	15.0%	11.2%	12.2%	6.1%	6.3%
Labourers	11.9%	9.0%	10.9%	13.7%	10.7%	16.1%	11.4%	12.7%	12.1%	11.1%	9.5%

Source: ABS 2017a and EconSearch analysis

Appendix Table A2-6 Demographic indicators, employment by industry, 1 digit ANZSIC level

	Port Augusta (C)	Roxby Downs (M)	Coober Pedy (DC)	Woomera	Andamooka	Pimba	Whyalla	Port Pirie City and Dists (M)	Far North Total	South Australia	Australia
Industry of employment (population aged 15 years and over)											
Agriculture, Forestry and Fishing	166	0	12	16	0	n.a.	14	254	654	30,022	266,946
Mining	7	1,140	62	0	41	n.a.	464	50	3,836	8,698	177,647
Manufacturing	88	54	3	0	0	n.a.	778	990	247	59,528	683,688
Electricity, Gas, Water and Waste Services	68	11	11	5	3	n.a.	82	117	144	9,081	115,753
Construction	364	145	33	50	5	n.a.	429	477	891	56,095	911,056
Wholesale Trade	72	40	0	0	0	n.a.	124	127	151	21,056	307,741
Retail Trade	656	100	87	0	15	n.a.	852	833	1,033	79,614	1,053,816
Accommodation and Food Services	507	110	108	4	11	n.a.	589	470	1,024	49,555	738,231
Transport, Postal and Warehousing	318	54	16	4	4	n.a.	317	208	522	30,806	499,491
Information Media and Telecommunications	44	8	0	0	0	n.a.	36	41	65	9,597	179,521
Financial and Insurance Services	82	13	3	0	0	n.a.	82	85	109	20,236	384,608
Rental, Hiring and Real Estate Services	66	38	4	0	0	n.a.	98	51	131	9,953	182,151
Professional, Scientific and Technical Services	114	19	6	2	2	n.a.	191	137	219	41,104	775,978
Administrative and Support Services	146	101	18	0	8	n.a.	262	152	441	26,614	365,731
Public Administration and Safety	864	67	88	36	0	n.a.	357	361	1,196	52,676	713,135
Education and Training	555	139	63	5	11	n.a.	753	621	1,087	64,429	925,895
Health Care and Social Assistance	898	72	120	3	2	n.a.	1,145	1,216	1,331	110,283	1,351,015
Arts and Recreation Services	41	27	4	0	0	n.a.	86	49	130	10,126	176,667
Other Services	205	58	8	0	6	n.a.	264	241	392	29,057	399,635
Inadequately described	84	26	15	4	0	n.a.	143	123	245	17,299	344,813
Industry of Employment not stated	63	12	16	0	0	n.a.	72	62	150	6,990	130,328
Total	5,389	2,233	677	131	109	n.a.	7,135	6,652	13,987	742,822	10,683,842

Source: ABS 2017a and EconSearch analysis

Appendix G2. Socio-economic Assessment of Effects

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FINAL

Carriewerloo Substation to Prominent Hill Electricity Transmission Line Project
Socio-economic Modelling and Assessment of Effects

A report to

OZ Minerals Limited

Prepared by

econsearch

20 June 2018

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CONTENTS

TABLES

ABBREVIATIONS

ABS	Australian Bureau of Statistics
DIDO	drive-in, drive-out
DPTI	Department of Planning, Transport and Infrastructure (SA)
DTEI	Department of Transport, Energy and Infrastructure
FIFO	fly-in, fly-out
km/h	kilometres per hour
LDC	long distance commute
ROW	right of way
SCAP	State Commission Assessment Panel

1. INTRODUCTION

1.1 Background

OZ Minerals proposes to develop an electricity transmission line approximately 237 km in length, from the proposed Carriewerloo Substation (North-west of Port Augusta) to a location west of Olympic Dam, where it will connect to OZ Mineral's' existing transmission line to Prominent Hill. The transmission line consists of a 275 kV line from Carriewerloo Substation to the Mount Gunson South Substation and a 132 kV line from the Mt Gunson South Substation to Olympic Dam.

This document forms a part of the Development Application submission, under the sponsorship of the Department of the Premier and Cabinet, for lodgement with the State Commission Assessment Panel (SCAP) under Section 49 of the *Development Act 1993*.

This document presents the assessment of potential socio-economic effects[1] of the proposed Project determined by predicting the potential changes to the existing social environment (as established by, and described in the Socio-economic Baseline Assessment Appendix of this Development Application) that may result from the proposed Project's activities and infrastructure (as described in the Project Description Chapter of this Development Application). The Socio-economic Baseline Assessment report (hereby baseline report) and the Assessment of Effects Report (this report) provide the necessary information to allow a quantification of the potential impacts[2] to the socio-economic environment as a result of the implementation of the Project.

1.2 Purpose of the Assessment

The purpose of this socio-economic assessment of effects is to demonstrate that OZ Minerals has understood the socio-economic context in which the proposed Project would occur (as described in the baseline report) and has appropriately identified the Project's potential effects on the socio-economic pathway. It also assesses the degree of reliability in the pathway effects estimation through an uncertainty analysis.

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1 Where an *effect* is defined as: Any certain and defined change to a pathway, whether adverse or beneficial, wholly or partially as a result of a source and identified outputs.

2 Where an *impact* is defined as: Any certain and defined change to a receptor, whether adverse or beneficial, wholly or partially resulting from a source affecting a pathway.

1.3 Project Description

The potential socio-economic effects of the Project have been determined on the proposed activities and infrastructure of the Project as described in the Project Description Chapter of this Development Application.

1.4 Assessment Area

The study area is described in the baseline report. The Study Area is a 5 km buffer on the proposed alignment (i.e. 10 km corridor). A broader Regional Study Area includes key population centres, local towns, and local council areas.

The transmission line corridor, for the purposes of the Development Application, is defined as a 500 m corridor and is referred to as the Project Area.

1.5 Structure of This Report

An outline of the assessment approach employed in this study is provided in Section 2, the pathway modelling and assessment of effects is described in detail in Section 3, and a summary of the socio-economic effects provided in Section 4.

2. ASSESSMENT APPROACH

2.1 Data Sources and Methods of Analysis

The main data and information sources for this assessment were the baseline report and the Project Description Chapter of the Development Application. The pathway effects presented within this report were identified through the impact assessment framework, as well as additional pathway changes identified by EconSearch during the course of this assessment.

These sources were supplemented by published data as referenced within this report. This information was used to quantify changes in pathways, to provide input to the Socio-economic Impact Assessment Appendix of the Development Application (hereby impact assessment report). Comparative studies were also analysed, where available, to identify possible threshold values relevant to the results to inform the impact assessment.

The methods and information sources used, and models developed to assess the pathway effects are described in detail for each pathway change.

2.2 Uncertainty Analysis

Uncertainty analysis of the effects estimates was undertaken to determine the relative reliability of the results described in this report, and to justify the acceptance of uncertainty and assumptions. The uncertainty analysis considered the following three aspects, which were applied as described in the Impact Assessment Appendix to this Development Application:

- Input (data and assumption) quality—nature of assumptions made and the quality of the data that were used in predicting the effect on the pathway, and was ranked in accordance with Table 2-1
- Method quality—methods, including any modelling, used in predicting the effect on the pathway, and was ranked in accordance with Table 2-2
- Sensitivity of results to data and assumptions variation—assessments may vary significantly with changes to data and assumptions, irrespective of the quality of inputs and methods used, sensitivity of results was ranked in accordance with Table 2-3.

Table 2-1 Input uncertainty ranking

Ranking Value	Resilience
A	Extensive data; field verified; limited use of assumptions.
B	Limited data; use of industry recognized or benchmarked data; some assumptions.
C	Plugged data; limited (if any verification); numerous assumptions.

Table 2-2 Method uncertainty ranking

Ranking Value	Resilience
A	Recognised method and application; industry standard approach.
B	New method or application of existing method; not industry recognised.
C	*Ad hoc* methodology; informal approach.

Table 2-3 Sensitivity ranking

Ranking Value	Resilience
A	Predictions not sensitive to input variation.
B	Some sensitivity of predictions to input variation.
C	Predications highly sensitive to input variations; sensitivity not studied/known.

3. PATHWAY MODELLING AND ASSESSMENT OF EFFECTS

The Source-Pathway-Receptor linkage assessment undertaken by OZ Minerals identified the following pathway changes which required further assessment to complete the socio-economic impact assessment (Appendix I of the Development Application). This section describes in detail the pathway modelling and assessment of effects of 18 identified pathway changes.

3.1 Increased Traffic – Time Delays

Increased traffic on public roads associated with the movement of construction and operational fleet and materials to and from the Project Area influences travel times for road users.

3.1.1 Pathway Effect

3.1.1.1 Construction phase

Increased Traffic Volumes

During the construction phase, the Project represents the following increase in traffic volume along the expected vehicle route:

- Port River Expressway, Salisbury Highway, Port Wakefield Road and Port Wakefield Highway: less than 0.1 per cent
- Lincoln Highway: 0.9 per cent
- Eyre Highway: 0.1 per cent
- Port Augusta Highway - Port Wakefield to Port Pirie: less than 0.1 per cent
- Port Augusta Highway - Port Pirie to Port Augusta: 0.2 per cent
- Victoria Parade: 0.1 per cent
- Stuart Highway – Port Augusta to Mount Gunson: 12.5 per cent
- Stuart Highway –Mount Gunson to Pimba: 2.8 per cent
- Olympic Dam Highway – Pimba to Woomera: 13.2 per cent
- Olympic Dam Highway - Woomera to project area to Olympic Way: 21.4 per cent
- Olympic Way: 24.2 per cent
- Opal Rd: 7.8 per cent.

The increase in traffic volume is expected to have no material effect on travel times.

Temporary Road Closures

No delays due to road closures are expected to result from the project.

3.1.1.2 Operation phase

During the operation phase, the Project represents the following increase in traffic volume along the expected route vehicle route:

- Stuart Highway – Port Augusta to Mount Gunson: 0.5 per cent
- Stuart Highway –Mount Gunson to Pimba: 0.1 per cent
- Olympic Dam Highway – Pimba to Woomera: 0.5 per cent
- Olympic Dam Highway – Woomera to Olympic Way: 0.8 per cent
- Olympic Way: 0.9 per cent
- Opal Rd: 0.3 per cent

The increase in traffic volume is expected to have no material effect on travel times.

3.1.2 Supporting Information and Analysis

Vehicle movements during construction of the Project were based on a preliminary estimate of 211 vehicle movements per day (100 construction related and 111 commuting to construction camps). Routes were estimated by distributing worksites evenly over the Project Area (Proposed Transmission Line - 275 kV section and 132 kV section treated separately), which were then associated with an appropriate public road. Expected movements were calculated the given source and destination of materials, equipment and labour, as shown in Table 3-1.

Table 3-1 Origin and destination of materials, equipment and labour

	Proposed Transmission Line - 275 kV section		Proposed Transmission Line - 132 kV section	
Description	Origin	Destination	Origin	Destination
Towers/poles	Adelaide	Worksite	Adelaide	Worksite
Conductors	Adelaide	Worksite	Adelaide	Worksite
Insulators and hardware	Adelaide	Worksite	Adelaide	Worksite
Concrete	Port Augusta	Worksite	Roxby Downs	Worksite
Construction equipment	Port Augusta	Worksite	Roxby Downs	Worksite
Light vehicles	Port Augusta	Worksite	Roxby Downs	Worksite
Other supplies	Port Augusta	Worksite	Roxby Downs	Worksite
FIFO workers	Work site	Port Augusta	Work site	Roxby Downs
DIDO workers	Port Augusta, Port Pirie, and Whyalla	Worksite	Roxby Downs	Worksite

Source: OZ Minerals (pers. comm., 1 May 2018) and EconSearch analysis

Daily vehicle (construction phase) movements were estimated based on a 12-month timeframe to project completion, and therefore represent upper bound estimates of traffic increase. Similarly, other supplies and light vehicle movements were based on the 'worst case' scenario where each journey will involve traveling between the worksite and Port Augusta/Roxby Downs.

Labour movements to and from construction camp sites were sourced from the employment allocations discussed in Section 3.4 and shown in Table 3-5. Movements relating to FIFO (fly-in, fly-out) workers were based on employees working on a one week on and one week off schedule. Workers will arrive at either Port Augusta or Roxby Downs airport and then travel via road to the worksite. FIFO travellers were modelled as four employees per vehicle.

DIDO (drive-in, drive-out) employee movements were based on long distance travellers presented in Table 3-5. All Proposed Transmission Line - 132 kV section DIDO movements were simplified and modelled as travellers from Roxby Downs, given the low expected number of DIDO workers from Woomera and Andamooka. Additionally, DIDO movements were based on a 'worst case' scenario of one employee per vehicle.

The estimated daily vehicle movements were assessed against current vehicle volumes (annual average daily traffic) for the Port River Expressway, Salisbury Highway, Port Wakefield Road, Port Wakefield Highway, Eyre Highway, Port Augusta Highway, Victoria Parade, Stuart Highway, Olympic Dam Highway, Olympic Way (OZ Minerals 2018a; Appendix F1), Lincoln Highway (DPTI 2015) and Opal road (BHP Billiton 2009).

Vehicle movements for the operational phase of the Project were based on an estimated 4 standard vehicle movements per day. Routes were distributed in the same manner as done for the construction phase. Movements were assessed against current vehicle volumes (annual average daily traffic) for the routes Port Augusta to Project Area (Proposed Transmission Line - 275 kV section) and Roxby Downs to Project Area (Proposed Transmission Line - 132 kV section). Operational movements account for visual inspections (typically two per year), but do not factor in movements relating to occasional maintenance of the lines.

Regarding the translation of these traffic volume increases into travel times, Deloitte (2013) determined it was:

> *…likely that as the volume of traffic increases on these roads, the inclusion of overtaking lanes over the short to medium term will provide the operational and safety capacity and likely negate the need for road duplication over this period.*

Additionally, roads in the Regional Study Area are generally classified as high capacity. For example the Stuart Highway is capable of accommodating up to an estimated 15,000 daily vehicle movements. Consequently, any additional traffic generated during the construction phase is likely to have minimal impact on the existing road function.

3.1.3 Uncertainty Analysis

Construction Phase:

Component	Ranking	Notes
Input quality	A, B	For most of the route, field verified data used (A). Existing average annual daily movements for Opal Road were based on an older data source (B).
Method quality	A	Industry standard approach (A).
Sensitivity	A, B, C	Low sensitivity for the Port River Expressway, Salisbury Highway, Port Wakefield Road and Port Wakefield Highway, Lincoln Highway, Eyre Highway, Port Augusta Highway and Victoria Parade (A). Moderate sensitivity for Opal Road and Stuart Highway (full implementation of estimated Project volumes leads to an 8% and 13% increase in traffic volumes respectively). High sensitivity for the Olympic Dam Highway and Olympic Way (full implementation of estimated Project volumes leads to 21% and 24% increase in traffic volumes) (C). The worst case scenario is to assume a 12-month construction period. The daily impact will be lower over a longer construction phase (A). Prudent assumptions were used to model movements per employee to worksites (A). Road closures are not expected due to no expected oversized road movements (A).

Operation Phase:

Component	Ranking	Notes
Input quality	A,B	For most of the route, field verified data was used (A). Existing average annual daily movements for Opal Road were based on an older data source (B).
Method quality	A	Industry standard approach (A).
Sensitivity	A	Low sensitivity ranking for all roads along route (full implementation of estimated Project volumes leads to less than 1% increase in traffic volumes) (A).

3.2 Road Conditions – Time Delays and Disruption

Infrastructure construction works near/on public roads and pastoral tracks influences travel time for road users.

3.2.1 Pathway Effect

Some disruption can be expected for locations where the Project construction activity occurs close to public roads and pastoral tracks. The construction phase will require establishing access tracks for both line construction and maintenance. Where tracks are established in close proximity to existing roads, such as for establishing intersections, travel restriction may be required. These works may include, but are not limited to, establishing shoulders to allow turnoffs to laydown areas on the Stuart Highway and Olympic Dam Highway.

Project construction works (e.g. establishing shoulders to allow turn offs, tower installation immediately adjacent to roads if required or conductor stringing across roads) may affect travellers on the Stuart Highway, Olympic Dam Highway and Olympic Way, traveling along the route Port Augusta to Roxby Downs. The expected delay for these travellers would be less than five minutes per one kilometre construction zone (assuming a 25 km/hr speed limit through roadworks) along the route. However, this delay may be longer depending on requirements for traffic stoppages during construction works.

Disruptions may also occur along Opal Road and relevant pastoral tracks. The expected delay for these travellers would be negligible (estimated to be less than two minutes) per one kilometre construction zone, however delays may be longer depending on requirements for traffic stoppages during construction works. If full closures of tracks are required (e.g. during stringing or construction adjacent to a track, which is very unlikely), OZ Minerals would communicate this with potentially affected pastoralists to allow access through construction areas. If access cannot be provided, pastoralists may have to use alternate routes and accordingly experience increased travel times for the duration of the closure.

3.2.2 Supporting Information and Analysis

Potential time delays for travellers moving along the Stuart Highway and Olympic Dam Highway were based on the time travelled through a temporary speed restriction regime, in contrast to the current speed limit (100 km/h). The temporary speed restrictions were based on two 500 metre buffer zones of 60 and 40 km/h around a one-kilometre-long 25 km/h construction zone (DPTI 2014). Based on vehicles traveling at an average of these limits suggests the following travel times:

- 4.9-minute travel time through temporary speed restrictions
- 1.8-minute travel time under usual conditions.

Although the above figures suggest a shorter delay, the pathway effect of five minutes was conservatively used.

Similarly, vehicle delays were estimated for the following road and track segments

- Olympic Way (60 km/h speed limit): 4.9-minute travel time through temporary speed restrictions and 3.0-minute travel time under usual conditions
- Opal Road (60 km/h speed limit): 4.9-minute travel time through temporary speed restrictions and 3.0-minute travel time under usual conditions
- Pastoral tracks (60 km/h average speed): 4.9-minute travel time through temporary speed restrictions and 3.0-minute travel time under usual conditions.

3.2.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	C	Data unavailable in relation to construction schedule and effect due to restrictions/temporary closures (C). Current and restricted travel speeds are based on assumed values (C).
Method quality	A,C	Industry standard approach for speed restrictions (A). Informal methodology used for full road closure effects (C).
Sensitivity	A, B, C	Partial road closures, if any, are expected to be brief (A). Partial road closures only consider speed restrictions. It is possible that further traffic controls may be required, such as closing of lanes. Note that this can add to the delay time, which is likely to be a few minutes (B). Full road closure effects were unquantifiable and rely on travel route/time assumptions (C).

3.3 Increased Traffic – Road Wear

Increased traffic on the roads from the Project during construction and operations contributes to the general deterioration of condition of the roads over time.

3.3.1 Pathway Effect

During the construction phase, the Project represents the following increase in road wear (contributed by heavy vehicle traffic volumes) along the expected vehicle route:

- Port River Expressway, Salisbury Highway, Port Wakefield Road and Port Wakefield Highway: less than or equal to 0.1 per cent
- Port Augusta Highway - Port Wakefield to Port Pirie: 0.1 to 0.2 per cent
- Port Augusta Highway - Port Pirie to Port Augusta: 0.1 to 0.2 per cent
- Victoria Parade: 0.1 to 0.2 per cent
- Stuart Highway – Port Augusta to Mount Gunson: 1.1 to 3.3 per cent
- Stuart Highway –Mount Gunson to Pimba: 0.3 to 1.0 per cent
- Olympic Dam Highway – Pimba to Woomera: 1.4 to 4.5 per cent
- Olympic Dam Highway - Woomera to project area to Olympic Way: 1.8 to 5.6 per cent
- Olympic Way: 3.7 to 11.6 per cent
- Opal Rd: 0.5 to 1.4 per cent.

In addition to public roads, the Project will use existing tracks for access wherever possible. This may result in more than usual wear to tracks and is discussed in greater detail in Section 3.14.

3.3.2 Supporting Information and Analysis

Road wear due to traffic flows was assessed solely from heavy vehicle traffic movements. This was based on findings from the Productivity Commission in 2006, quoted from Australia's Future Tax System Review (Treasury 2010).

> *Roads deteriorate over time, and require ongoing maintenance to keep them up to standard. Some deterioration is purely time- and climate-related. However, the Productivity Commission's (2006) survey of cost allocation studies for road maintenance expenditure showed that between 32 and 100 per cent of maintenance costs are due to heavy vehicles. The remaining unattributable costs are the same regardless of usage. Cars do negligible damage to roads.*

The variability of the pathway effects reported in section 3.3.1 reflect the Tax Review's finding of a 32 to 100 per cent range for attributing heavy vehicles to road maintenance costs.

The construction phase analysis was based on 13 heavy vehicle movements per day distributed along relevant sections of the Project Area and current vehicle volumes (annual average daily traffic) for the Port River Expressway, Salisbury Highway, Port Wakefield Road, Port Wakefield Highway, Port Augusta Highway, Victoria Parade, Stuart Highway, Olympic Dam Highway, Olympic Way (OZ Minerals 2018a; Appendix F1), and Opal road (BHP Billiton 2009). As no heavy vehicle movements are required to inspect the transmission line, the operational phase is expected to result in no road wear[3]. Table 3-2 provides the current vehicle movements.

Table 3-2 Annual average daily traffic along route, heavy and all vehicles

	All Vehicles	Heavy Vehicles	% heavy vehicle
Port River Expressway	32,350	4,448	13.8
Salisbury Highway	67,300	7,740	11.5
Port Wakefield Road	60,800	8,056	13.3
Port Wakefield Highway	12,850	2,185	17.0
Port Augusta Highway	7,650	1,262	16.5
Victoria Parade	13,200	1,221	9.3
Stuart Highway	850	238	28.0
Olympic Dam Highway - Pimba to Woomera	700	130	18.5
Olympic Dam Highway – Woomera to Olympic Way	430	105	24.5
Olympic Way	430	49	11.5
Opal Rd	167	60	35.9

Source: OZ Minerals 2018a (Appendix F1) and BHP Billiton 2009

[3] This excludes any impact on pastoral tracks. See Section 3.14 for pastoral tracks effects.

3.3.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	A, B, C	For most of the route, field verified data used (A). Existing average annual daily movements for Opal Road were based on an older data source (B). Data unavailable for highway maintenance costs (C).
Method quality	A	Industry standard approach (A).
Sensitivity	A, B, C	Low sensitivity ranking for Port Wakefield Highway, Port Augusta Highway and Stuart Highway (A), moderately sensitive for Olympic Dam Highway and Olympic Way (full implementation of project volumes lead to 5% and 12% increase in road activity induced wear) (B). Road activity's contribution to overall wear could vary from 32 to 100 per cent. E.g. during construction phase, wear due to activity on the Olympic Dam Highway (between Pimba and Olympic Way) may increase by 1.8 to 5.6 per cent, depending on the environmental conditions (C). Average daily vehicle movements were based on a 12-month construction period. The daily impact will be lower over a longer construction phase (A).

3.4 Increased Competition for Labour

Job creation in the Regional Study Area during construction and operation reduces the availability of labour for existing businesses which could lead to a short-term increase in wage costs or shortage of specific skills.

3.4.1 Pathway Effect

No notable increase in competition for labour is expected in Port Augusta, Whyalla, Port Pirie, Pimba, Woomera, Andamooka or Coober Pedy.

An increase in competition for labour with a potential for impacts on local businesses is expected in Roxby Downs. The increase in competition for labour in Roxby Downs is expected as the unemployment rate is low (1.6 per cent) without the Project and is expected to decrease further (to 0.7 per cent) with the Project. The nature of Roxby Downs is such that workers tend to migrate in and out of the town depending on availability of work. This, and the one-year period of construction, means that any increased competition for labour is likely to be short in duration.

No effect is expected during the operation phase as the labour associated with the two expected visual inspections annually and follow-up maintenance is negligible.

3.4.2 Supporting Information and Analysis

Estimating the change in the availability of labour for each residential centre in the Regional Study Area due to the Project requires estimates of current availability of labour, as well as job creation and in-migration due to the Project. The assumptions required to make these estimates are explained in this section.

Current availability of labour

A common measure of availability of labour is the unemployment rate. It is generally accepted that a long-term average unemployment rate of around 5 per cent is normal, a lower rate can increase labour costs and a higher rate can decrease them.

Table 3-3 shows that the unemployment rate is around 10 per cent in Port Augusta, Whyalla, Port Pirie, Andamooka and Coober Pedy. This high rate is likely to indicate low competition for labour in these towns. The unemployment rates of 0 per cent for Pimba and Woomera need to be interpreted differently as the labour force in each town is very small and people don't tend to stay in these towns unless they are employed there. For example, the labour market for jobs created in Woomera is all workers in a much broader area who would be willing to relocate for work and who would likely relocate again once they finish in their role.

The unemployment rate of 1.6 per cent in Roxby Downs is low and is likely an indicator of high competition for labour. The nature of Roxby Downs is somewhat similar to Woomera in that people migrate to and from the town depending on the availability of work. This means that a low unemployment rate in Roxby Downs is less of a problem than the same rate occurring in the larger residential centres in the Regional Study Area such as Port Augusta and Whyalla.

Table 3-3 Labour force and unemployment rate by location

Location	Labour force (persons)	Unemployment rate (%)
Port Augusta	6,595	10.3%
Whyalla	10,274	10.1%
Port Pirie	7,684	10.5%
Pimba	44	0.0%
Woomera	104	0.0%
Roxby Downs	2,453	1.6%
Andamooka	130	9.2%
Coober Pedy	877	11.9%

Source: DOJSB 2018 and OZ Minerals 2018b (Appendix G1)

Job creation and in-migration

Labour will mostly be DIDO or FIFO (drive-in, drive-out or fly-in, fly-out – collectively referred to as FIFO from here forward) and will be based mostly at construction camps (80 per cent), with the balance being LDC (long distance commute) workers residing in nearby towns. Sources of FIFO workers are: 60 per cent from interstate (specialist technical workers), 30 per cent from the Regional Study Area (allocated to the residential centres in proportion to the number of suitable unemployed workers in each) and 10 per cent from Adelaide. These workers, being FIFO, are assumed not to migrate to the Regional Study Area once employed but to remain in their usual residence.

Workers residing in nearby towns will be drawn from existing suitable unemployed persons. If there are insufficient suitable unemployed persons in a given residential centre then workers

and their families[4] are assumed to migrate to the town from outside the Regional Study Area. While some people who are already employed are also likely to leave their job to be employed in construction of the Project, their jobs would then become vacant and would be filled by people who are unemployed, assuming that there are enough unemployed people in the location to find an appropriate person. The number of suitable workers in each residential centre is estimated from the number of unemployed persons multiplied by the per cent of the labour force with occupation: Technicians and trades workers, Machinery operators and drivers, or Labourers (39 per cent for the Regional Study Area).

Which nearby towns LDC workers are likely to reside in will likely depend on the distance from each town to the Project and the amount of suitable labour available in each. Construction work is assumed to centre on two construction camps[5]. The locations of workers residing in each town in the Regional Study Area was estimated using a gravity model. Since these are LDC workers, towns further than two hours by road were excluded. The gravity model assigned a proportion of employees to each town based on the formula:

$$E_i = \frac{\left(\frac{L_i}{D_i}\right)}{T}$$

where E_i is the proportion of employees in town i, L_i is the amount of suitable labour (persons) available in town i, D_i is the distance (minutes by car) between town i and the construction camp and T is the sum of $\frac{L_i}{D_i}$ for all towns. Since two construction camps are planned, a gravity model was run for each and summed. Table 3-4 presents the proportions estimated by the gravity model for each camp. Most LDC workers for North Camp 1 are located in Port Augusta, followed by Whyalla and Port Pirie. Most for North Camp 2 are based in Roxby Downs. Table 3-5 presents the estimated number of employees residing in each town who are LDC or FIFO, as well as the expected in-migration to each location.

Table 3-4 Gravity model proportions by location

Location	North Camp 1	North Camp 2
Port Augusta	39.9%	-
Whyalla	35.6%	-
Port Pirie	24.0%	-
Pimba	0.2%	1.5%
Woomera	0.3%	4.4%
Roxby Downs	-	90.4%
Andamooka	-	3.7%
Coober Pedy	-	-

[4] At the rate of 2.5 persons per worker, the average household size for South Australia in 2015/16 (ABS 2017).

[5] Exact locations are not available for this assessment so are assumed to be equidistant from Port Augusta and Pimba on the Stuart Highway (North Camp 1) and equidistant from Woomera and Roxby Downs on the Olympic Dam Highway (North Camp 2).

Source: EconSearch analysis

Table 3-5 Estimated employees and in-migration of employees and population by location

Location	LDC employees	FIFO employees	In-migration of employees	In-migration of persons[a]
Regional Study Area				
Port Augusta	10	10	0	0
Whyalla	9	20	0	0
Port Pirie	6	12	0	0
Pimba	0	0	0	1
Woomera	1	0	1	3
Roxby Downs	23	1	1	1
Andamooka	1	0	0	0
Coober Pedy	0	1	0	0
Total	***50***	***45***	***2***	***5***
Adelaide	0	15	0	0
Interstate	0	90	0	0
Abroad	0	0	0	0
Total	**50**	**150**	**2**	**5**

[a] Workers multiplied by the average household size in South Australia (ABS 2017).

Source: EconSearch analysis

Change in availability of labour

Comparing the unemployment rate before the Project with the estimated unemployment rate with the Project shows the expected effect of the Project on competition for labour in each residential centre in the Region Study Area. The expected unemployment rate with the Project can be estimated as:

$$u = \frac{Unemployed - Job\ creation + In\text{-}migration\ of\ workers}{Labour\ Force + In\text{-}migration\ of\ workers}$$

This is a conservative estimate as it assumes that no in-migrants accompanying Project workers are in the labour force. Table 3-6 shows that the unemployment rate with the Project remains near 10 per cent in Port Augusta, Whyalla, Port Pirie and Coober Pedy. While it reduces by 0.9 percentage points in Andamooka, it remains well above 5 per cent. In Pimba and Woomera, the very small population makes discussion of unemployment rates irrelevant. No notable increase in competition for labour is expected in Port Augusta, Whyalla, Port Pirie, Pimba, Woomera, Andamooka or Coober Pedy.

An increase in competition for labour with a potential for effects on local business is expected in Roxby Downs due to the Project. This is because the unemployment rate is low (1.6 per cent) without the Project and is expected to decrease further (to 0.7 per cent) with the Project. The nature of Roxby Downs is such that workers tend to migrate in and out of the town depending on availability of work. This, and the one-year period of construction, means that any increased competition for labour is likely to be short in duration.

Table 3-6 Estimated current unemployment rate and unemployment rate with Project

Location	Project employees	Labour force (persons)	Unemployment rate (%)	Estimated unemployment rate with Project (%)
Port Augusta	20	6,595	10.3%	10.0%
Whyalla	29	10,274	10.1%	9.8%
Port Pirie	18	7,684	10.5%	10.3%
Pimba	0	44	0.0%	0.0%
Woomera	1	104	0.0%	0.0%
Roxby Downs	24	2,453	1.6%	0.7%
Andamooka	1	130	9.2%	8.3%
Coober Pedy	1	877	11.9%	11.7%

Source: Table 3-5 and EconSearch analysis

3.4.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Australian Bureau of Statistics and Department of Jobs and Small Business data are used for labour force, household and population characteristics (A). Assumptions about the sources and location of employees are based on ElectraNet pers. comm. And EconSearch judgement (B).
Method quality	A	A gravity model is used to estimate the residence of LDC employees (A). Number of people who already live in each location who are employed during construction is estimated by the number of unemployed and proportion of labour force in technical or trade occupations (A). Five per cent unemployment rate is used as a threshold for increased labour market competition, this is generally accepted (A).
Sensitivity	A	The worst case scenario is to assume all employees are sourced from the unemployed labour force in the Regional Study Area (i.e. all LDC or DIDO from Regional Study Area). The conclusions would not change under this assumption (A).

3.5 In-migration – Social Disruption

The in-migration of construction workers to residential centres and construction camps in the Regional Study Area has the potential to cause social disruption.

3.5.1 Pathway Effect

No social disruption is expected in the residential centres because in-migration is expected to be zero (Port Augusta, Whyalla, Port Pirie, Andamooka and Coober Pedy) or small (Pimba, Woomera, Roxby Downs). Further, where in-migration is expected, the existing workforce is similar to the expected in-migrants.

No social disruption is expected in the local area of the construction camps because contractors and employees will receive a locally sensitive induction and will be held to performance standards that prevent drug and alcohol abuse and anti-social behaviour.

3.5.2 Supporting Information and Analysis

Community consultations and a review of rural mining developments carried out for a development application by Iron Road for a major mine on the Eyre Peninsula (Bowey 2015) identified concerns about social disruption from worker camps and commuting workers. The social disruption concern is focused on 'safety and security, including the misuse of alcohol and drugs, crime and anti-social behaviour and perceptions of safety'. While these concerns related to a permanent camp for a major mine, the same concerns could be expected to transfer to the temporary construction camps for the Project as a comparable type of workforce will be located there.

Table 3-5 (Section 3.4.2) shows that in-migration is expected in Pimba, Woomera and Roxby Downs. Since expected in-migration to each town is small, no social disruption is expected in these towns. Further, a large workforce that is similar to the expected in-migrants already exists in these towns (OZ Minerals 2018b; Appendix G1) so no social disruption is expected if realised migration is higher than expected.

The construction camps are expected to house between 80 and 100 workers each and will likely be located well outside of the residential centres in the Project Area (at least 30 kilometres from any towns). Nonetheless, residents may be concerned about interacting with these workers on highways in the local area of the construction camps and when workers visit nearby towns for recreational reasons or to return to their usual residence. OZ Minerals has published performance standards that set expectations for contractors, partners and employees when working on an OZ Minerals asset (OZ Minerals 2018c). The Fitness for Work Standard includes 'Undertake risk-based drug and alcohol education programs, and perform random screening of Employees, Contractors and visitors for detection and impairment from drugs and alcohol' (OZ Minerals 2017). Further, the Health and Wellbeing Performance Standards require that all employees, contractors and visitors receive a fit-for-purpose induction regarding local sensitivities, risks and expected behaviours (OZ Minerals 2017). Upholding these standards would prevent social disruption at the construction camps.

3.5.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Australian Bureau of Statistics data are used for population characteristics (A). In-migration is estimated through EconSearch analysis described in Section 3.4 (A,B).
Method quality	B	Transfer of issues from a project with a similar type of workforce in a similar area (B). Addressing issues through company policy (B).
Sensitivity	B	The worst case scenario is to assume all employees in-migrate and reside in towns in the Regional Study Area (i.e. no employment from the local unemployed and no FIFO). Under this assumption, around 90 workers would migrate to Roxby Downs. Though in-migrants are

		expected to be similar to the existing population, such a large number of workers staying for a short time could lead to social disruption due to a lack of sense of belonging and accountability (B).

3.6 In-migration – Pressure on Local Services

In-migration of construction workers to residential centres in the Regional Study Area has the potential to put strain on local services (such as social and medical services), reducing their availability to existing residents.

3.6.1 Pathway Effect

In-migration of population is expected in Roxby Downs, Pimba and Woomera. Each of these towns experienced a decrease in population over the 5 years prior to 2016 and the increase in population due to the Project is smaller than the average annual decrease for each. This in-migration, therefore, only moderates a trend of population decrease in these towns and will not put pressure on local services.

3.6.2 Supporting Information and Analysis

Estimating the change in pressure on local services in each residential centre in the Regional Study Area requires an estimate of in-migration and an understanding of population trends in each. If the Project adds to an existing trend of in-migration, then services are likely to be put under strain. If the Project moderates a trend of out-migration, then it won't create strain as demand for services won't increase.

Table 3-7 shows that in-migration due to the Project is only expected in Roxby Downs, Pimba and Woomera. Each of these towns experienced a decrease in population over the 5 years prior to 2016 and the increase in population due to the Project is smaller than the average annual decrease for each. In-migration due to the Project, therefore, only moderates a trend of population decrease in these towns and will not put additional pressure on local services.

Table 3-7 Estimated change to population due to in-migration by location

Location	In-migration (persons)	Population (persons)	10 year change (%)	5 year change (%)	Change in population due to Project (%)
Port Augusta	0	13,808	0%	-1%	0.0%
Whyalla	0	21,828	2%	-1%	0.0%
Port Pirie	0	17,364	1%	0%	0.0%
Pimba	1	63	21%	-45%	1.6%
Woomera	3	146	-51%	-32%	2.0%
Roxby Downs	1	3,884	-4%	-17%	0.0%
Andamooka	0	316	-40%	-47%	0.0%
Coober Pedy	0	1,762	-8%	4%	0.0%

Source: Table 3-5, OZ Minerals 2018b (Appendix G1), and EconSearch analysis

3.6.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Australian Bureau of Statistics data are used for population characteristics (A). In-migration is estimated through EconSearch analysis described in Section 3.4 (A,B).
Method quality	B	Comparison of Project effects to population trends is an appropriate method to determine whether an effect might occur.
Sensitivity	A	The worst case scenario is to assume all employees in-migrate and reside in towns in the Regional Study Area (i.e. no employment from the local unemployed and no FIFO). The conclusions would not change under this assumption (A).

3.7 In-migration – Pressure on Local Businesses

In-migration of construction workers to residential centres in the Regional Study Area has the potential to put strain on local business which may cause shortages of basic services to these communities (for example retail and recreation).

3.7.1 Pathway Effect

In-migration of population due to the Project is expected in Roxby Downs, Pimba and Woomera. Each of these towns experienced a decrease in population over the 5 years prior to 2016 and the increase in population due to the Project is smaller than this decrease. This in-migration, therefore, only moderates a trend of population decrease in these towns and will not put additional pressure on local business. The moderation will only last for the one-year construction period.

3.7.2 Supporting Information and Analysis

Estimating the change in pressure on local business in each residential centre in the Regional Study Area requires an estimate of in-migration and an understanding of population trends in each. If the Project adds to an existing trend of in-migration, then businesses are likely to be put under strain. If the Project moderates a trend of out-migration, then it won't create strain as demand for goods and services won't increase.

Table 3-7 shows that in-migration due to the Project is only expected in Roxby Downs, Pimba and Woomera. Each of these towns experienced a decrease in population over the 5 years prior to 2016 and the increase in population due to the Project is smaller than the average annual decrease for each. In-migration due to the Project, therefore, only moderates a trend of population decrease in these towns and will not put additional pressure on local business.

3.7.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Australian Bureau of Statistics data are used for population characteristics (A). In-migration is estimated through EconSearch analysis described in Section 3.4 (A,C).
Method quality	B	Comparison of Project effects to population trends is an appropriate method to determine whether an effect might occur.
Sensitivity	A	The worst case scenario is to assume all employees in-migrate and reside in towns in the Regional Study Area (i.e. no employment from the local unemployed and no FIFO). The conclusions would not change under this assumption (A).

3.8 In-migration – Housing Pressures

Construction activity encourages people to move to nearby communities, influencing housing availability and/or affordability.

3.8.1 Pathway Effect

No decrease in housing availability or affordability is expected in Port Augusta, Coober Pedy, Andamooka, Port Pirie, Pimba or Woomera. The estimated in-migration of workers to Roxby Downs is expected to decrease housing vacancies by around 1.7 per cent. This decrease in availability has the potential to marginally decrease affordability for residents.

3.8.2 Supporting Information and Analysis

Since most of the construction workforce is expected to be FIFO and accommodated at construction camps, housing pressures can only occur from in-migration of LDC workers and their families to nearby towns. Estimating this effect for each residential centre requires estimates of the trend in availability of vacant housing and in-migration (see Section 3.4). Table 3-5 shows that in-migration due to the Project is expected in Pimba, Woomera and Roxby Downs.

Table 3-8 shows that in March 2018 there were 30 advertised vacant houses in Roxby Downs and that there is a medium-term decreasing trend in vacancies (64 per cent decrease over the last four years). Looking at short-term trends, residential vacancies dropped to just seven houses in September 2017 but has since increased and remained at around 30 since December 2017 (SQM Research 2018). The estimated in-migration of workers to Roxby Downs represents a decrease in housing vacancies of only 1.7 per cent, leaving marginally less housing available in the town. This decrease in availability also has the potential to marginally decrease affordability for residents.

The same vacancy rate data are available for Pimba and Woomera, but the small population and itinerate nature of workers make it less useful. The socio-economic baseline report (OZ Minerals 2018b; Appendix G1) showed that there were 14 unoccupied private dwellings in Pimba and 165 in Woomera. This, paired with the decreasing population in each town (Table 3-7) suggests that

housing occupied by the in-migrating LDC workers would moderate a decreasing trend of housing occupancy in each town. Therefore, no decrease in housing availability or affordability is expected in these towns.

Table 3-8 Estimated change to population due to in-migration by location

Location	In-migration of households	Housing vacancies [b]	4 year change (%)	2 year change (%)	Change in housing vacancy due to Project (%)
Pimba	0	0	-	-	-
Woomera	1	0	-	-	-
Roxby Downs	1	30	-64%	-84%	-1.7%

Source: Table 3-5, SQM Research 2018, and EconSearch analysis

3.8.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Australian Bureau of Statistics data are used for population characteristics (A). In-migration is estimated through EconSearch analysis described in Section 3.4 (A,B).
Method quality	B	Comparison of housing expected to be occupied by in-migrants to residential vacancy rate trend is a direct method of estimating housing availability (A) and an indirect method of determining changes to affordability (B).
Sensitivity	B	The worst case scenario is to assume all employees in-migrate and reside in towns in the Regional Study Area (i.e. no employment from the local unemployed and no FIFO). Under this assumption there would be insufficient housing in Roxby Downs to accommodate the Project workforce which would decrease availability and affordability for residents of the town (C). Housing vacancy would reduce by 75 per cent in Port Augusta, 25 per cent in Whyalla and 40 per cent in Port Pirie. While these towns have sufficient availability for the Project workforce, the decrease in housing availability may also decrease affordability (B).

3.9 Local Price Inflation

The establishment of a relatively highly paid workforce within regional townships influences inflation of prices for goods and services.

3.9.1 Pathway Effect

Although a high average wage is expected for workers at the Project, no local price inflation is expected in any of the residential centres in the Regional Study Area as the number of employees expected to be based in each is small.

3.9.2 Supporting Information and Analysis

Estimating the effect of the Project on local prices in each residential centre requires an estimate of the current level of income, the level of income received by new employees, and the number

of jobs created (see Section 3.4) for each location. If a large number of jobs are created with higher than average income in a residential centre, then local price inflation can be expected.

Estimated personal income for workers at the Project, on average, is around $2,500 per week. This is higher than the median weekly income in each residential centre in the Regional Study Area. Table 3-9 presents the income level, existing employment and job creation by the Project for each residential centre. The table shows that, for most towns, the number of workers employed on the Project is relatively small (one per cent or less at Port Augusta, Whyalla, Port Pirie and Roxby Downs) or small in an absolute sense (one worker or less at Woomera, Andamooka, Coober Pedy and Pimba). Therefore, despite the high average income for workers at the Project, no local price inflation is expected the Regional Study Area.

Table 3-9 Median income, existing employment and job creation by Project, by location

Location	Median weekly personal income ($)	Project employment (persons)	Employed persons in location (persons)	Proportion of labour force employed by Project (%)
Port Augusta	604	20	5,916	0.3%
Whyalla	497	29	9,234	0.3%
Port Pirie	481	18	6,875	0.3%
Pimba	1,342	0	44	0.9%
Woomera	1,179	1	104	1.1%
Roxby Downs	1,547	24	2,413	1.0%
Andamooka	475	1	118	1.0%
Coober Pedy	497	1	773	0.2%

Source: Table 3-5, OZ Minerals 2018b (Appendix G1) and EconSearch analysis

3.9.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Australian Bureau of Statistics data are used for population and income characteristics (A). Worker location is estimated through EconSearch analysis described in Section 3.4 (A,B).
Method quality	B	Comparing the median income of existing employees and new employees is an indirect method of establishing whether the conditions for local price inflation exist.
Sensitivity	B	The worst case scenario is to assume all employees are sourced from the unemployed labour force in the Regional Study Area or in-migrate (i.e. no FIFO). Under this assumption around 90 new high paid workers would reside in Roxby Downs and local price inflation could be expected in the town (B). The conclusions for the rest of the Regional Study Area would not change (A).

3.10 Increased Access to Pastoral Stations

Increased access by construction personnel to Project construction sites and camps located within pastoral stations during construction has the potential to cause social disruption.

3.10.1 Pathway Effect

No social disruption is expected in the local area of the construction camps because contractors and employees will receive locally sensitive induction and will be held to performance standards that prevent drug and alcohol abuse and anti-social behaviour.

3.10.2 Supporting Information and Analysis

As discussed in Section 3.5.2, community consultations and a review of rural mining developments carried out for a development application by Iron Road for a major mine on the Eyre Peninsula (Bowey 2015) identified concerns about social disruption from worker camps. The social disruption concern is focused on 'safety and security, including the misuse of alcohol and drugs, crime and anti-social behaviour and perceptions of safety'. While these concerns related to a permanent camp for a major mine, the same concerns could be expected to transfer to the temporary construction camps for the Project as a similar workforce will be located there. Furthermore, pastoral lessees may have concerns relating to their privacy and running their pastoral business without interruption/interference (Department of Regional Development and Lands 2011).

As discussed in Section 3.5.2, OZ Minerals has published performance standards to set expectations for contractors, partners and employees when working on an OZ Minerals asset (OZ Minerals 2018c). The Fitness for Work Standard includes 'Undertake risk-based drug and alcohol education programs, and perform random screening of Employees, Contractors and visitors for detection and impairment from drugs and alcohol' (OZ Minerals 2017). Further, the Health and Wellbeing Performance Standards require that all employees, contractors and visitors receive a fit-for-purpose induction regarding local sensitivities, risks and expected behaviours (OZ Minerals 2017). Upholding these standards would prevent social disruption at the construction camps.

3.10.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Based on literature review only (B).
Method quality	B	Transfer of issues from a project with a similar type of workforce in a similar area. Addressing issues through company policy (B).
Sensitivity	B	Though construction workers are expected to be similar to the existing population, such a large number of workers staying for a short time could lead to social disruption due to a lack of sense of belonging and accountability (B).

3.11 Value of Pastoral Stations – Permanent Loss of Land

Permanent loss of land as a result of Project activities may be perceived to, or may actually constrain pastoralists' activities in conducting their agricultural businesses.

3.11.1 Pathway Effect

The permanent clearance of areas along the Project transmission line for the transmission line structures and transmission line structure access will reduce areas available for pastoral production. As the Project is at the preliminary design stage, accurate estimates of areas of permanent clearance are not known and quantification of area loss is approximate. All pastoral leases through which the transmission line will traverse, are estimated to each lose less than 0.2 km^2 of area to the Project (which is less than 0.1 per cent of their pastoral lease areas). This quantum of reduction in area is unlikely to require a reduction in stocking rates and is unlikely to reduce the value of pastoral leases.

3.11.2 Supporting Information and Analysis

Permanent clearance of areas will be required for the transmission line structures (towers/poles) and for access to the transmission line structures.

Permanently excluded land - transmission line structures

Lattice towers will be used for the 275kV line and will require 4 footings per tower. The area per footing is unknown, but is assumed to be $4m^2$ per footing. Towers are expected to be required every 450-500m for the 275kV line. Monopoles will be used for the 132kV line and will require 1 footing per pole. The area per pole will be approximately $4m^2$. Poles will be required at approximately 300m spacing. Based on these assumptions, estimates of areas permanently excluded from the pastoral lease are provided in Table 3-10.

Table 3-10 Estimated area excluded from pastoral leases from Project transmission structures

Pastoral Lease	Lease area (km^2)	No. structures	Area excluded (m^2)	Proportion of lease area (%)
Carriewerloo	1,339	10	160	0.0000%
Mt Arden	350	30	480	0.0001%
Kootaberra	1,188	90	1,440	0.0001%
Oakden Hills	1,706	100	1,600	0.0001%
Pernatty	2,216	50	200	0.0000%
Arcoona	3,531	200	800	0.0000%
Purple Downs	750	100	400	0.0001%
Roxby Downs	1,788	30	120	0.0000%

Sources: Project Description Chapter, EconSearch analysis.

Permanently excluded land – transmission line structure access

Access tracks will be required for both line construction and maintenance. A track to the base of each tower of approximately 5 m wide will typically be required. Greater track widths may be required in some areas (e.g. if a passing area or wider turning area is required).

Existing roads and tracks will be used for access wherever possible (e.g. with short sections of new track constructed to access each tower). In areas where there is no existing access track or where use of nearby tracks is not permitted by the owner, a new track generally paralleling the transmission line route would be constructed.

Access to Proposed Transmission Line - 275 kV section (275kV line) and Proposed Transmission Line - 132 kV section (132KV line) south of Woomera is expected to use the existing ElectraNet access track along the 132 kV Davenport to Pimba line. Access to the Proposed Transmission Line - 132 kV section alignment north of Woomera could potentially use the existing BHP access track where it is near the proposed line, subject to BHP approval.

Estimates of areas required for permanent access to transmission line structures were estimated (Table 3-11) based on the following assumptions:

- 5m wide access track standard
- Where Project runs adjacent to existing transmission lines, existing access tracks used. Allowance for 50m of new access tracks per structure
- Where Project line does not ran adjacent to existing transmission lines, new access track built running parallel to Project transmission line.

Table 3-11 Estimated area excluded from pastoral leases from Project access tracks

Pastoral Lease	Lease area (km^2)	Area excluded (m^2)	Proportion of lease area (%)
Carriewerloo	1,339	2,500	0.0002%
Mt Arden	350	7,500	0.0021%
Kootaberra	1,188	22,500	0.0019%
Oakden Hills	1,706	25,000	0.0015%
Pernatty	2,216	12,500	0.0006%
Arcoona	3,531	50,000	0.0014%
Purple Downs	750	139,100	0.0185%
Roxby Downs	1,788	25,400	0.0014%

Sources: Project Description Chapter, EconSearch analysis.

3.11.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Land area requirements per structure/track based on ElectraNet industry standard (A); numbers of structures and length of access track based on high-level assumptions (C)
Method quality	A	Industry standard approach (A).
Sensitivity	A	Doubling the land area excluded does not materially change conclusions.

3.12 Value of Pastoral Stations – Land Fragmentation

Project activities may be perceived to, or may actually constrain pastoralists' activities (as a result of land fragmentation) in conducting their agricultural businesses.

3.12.1 Pathway Effect

The Project may bisect paddocks or other structures relevant to pastoral lease activities, which may restrict access and constrain pastoralists' activities. This may in turn influence the value of the pastoral leases.

The level of detail of Project transmission line route and on-ground assessments limits assessment of this effect. However, based on the following assumptions:

- Visual assessment of aerial photography supplied by the Project is sufficient to identify relevant structures
- Landuse guidelines for electricity transmission corridors (ElectraNet 2013) provide sufficient guidance to identify pastoral activities that could be restricted
- Where Project transmission lines run parallel to existing infrastructure (transmission lines, roads), existing levels of fragmentation will not change.

Changes in existing levels of fragmentation as a result of the Project are unlikely for the following pastoral stations: Carriewerloo, Mt Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs and Roxby Downs.

3.12.2 Supporting Information and Analysis

Easements

It is planned to obtain easements for the Project transmission line route. An easement is a property right that will allow the Project to build, own and maintain the transmission line. Easements are permanent and will be registered on the relevant Certificate of Title and will remain part of the land and title regardless of changes in ownership. For this Project, easements will typically be 50 m wide.

An easement or Right of Way (ROW) provides a safety clearance margin between the high-voltage power lines and surrounding structures and vegetation, and provides a path for ground-based inspections and access to transmission towers for repairs and maintenance. Generally, the ROW will consist of native vegetation or plants, though in some instances, access tracks constitute a portion of the ROW.

Restriction of pastoral activities in easements

The following assessment is based on ElectraNet (2013), Safework Australia (2014) and Royal Flying Doctor Service (n.d.).

Vegetation – needs to be cleared to a height of 3m within 12.5m of the centreline and cleared to a height of 6m between 12.5 and 25m of the centreline of a 275 kV line. Similar restrictions apply to 132 kV line. The vegetation in the Project Area is unlikely to reach these heights, and therefore maintaining pastoral areas in their natural state is unlikely to be affected by the Project activities.

Grazing – permitted activity.

Fences – constructing or maintaining fences across transmission line easements, provided fences are not greater than 2m in height, is a permitted activity.

Gates - constructing or maintaining gates across transmission line easements, provided gates are not greater than 2m in height and do not prevent access for transmission line inspection/maintenance, is a permitted activity.

Access tracks - is a permitted activity. Note that transport loads up to 4.6m in height are unrestricted on public roads (Safework Australia 2014).

Buildings/structures – e.g. sheds, yards, pump houses, housing are permitted outside minimum clearance distances of the transmission lines (i.e. the easements) and must not prevent access to infrastructure for maintenance or inspection.

Storage of materials –not permitted within easement.

Excavation/filling of land - excavation which impacts on the footings of transmission lines is not permitted.

Airstrips – not addressed in ElectraNet (2013) guidelines, but minimum safe distance requirements based on Royal Flying Doctor Service guidance (n.d.) would suggest that airstrips should not be located within 2.5 km of the Project transmission line.

Assessment of potential for pastoral activity fragmentation

Table 3-12 summarises the assessment of potential for pastoral activity fragmentation.

Table 3-12 Assessment of potential for pastoral activity fragmentation

Pastoral lease	Assessment	Notes
Carriewerloo	A	Project transmission line runs adjacent to existing transmission lines
Mt Arden		
Kootaberra		
Oakden Hills		
Pernatty		
Arcoona		
Purple Downs	A	Project transmission line runs adjacent to existing highway
Roxby Downs		

A unlikely to change existing levels of fragmentation.

B potential to change existing levels of fragmentation

Sources: Project GIS, ElectraNet (2013), EconSearch analysis.

3.12.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Limited data; use of industry recognized or benchmarked data (ElectraNet 2013); some assumptions (B).
Method quality	B	Not industry recognised (B).
Sensitivity	C	Sensitivity not studied/known (C).

3.13 Value of Pastoral Stations – Future Development Constraints

Project activities may be perceived to, or may actually constrain pastoralists' activities in conducting their agricultural businesses with respect to future developments.

3.13.1 Pathway Effect

The Project may lead to restriction of some pastoral activities for pastoral leases within the Project Area, as described in Section 3.12.2. This may, in turn, lead to an actual or perceived constraint on future developments by pastoral enterprises. However, the Project has a relatively small footprint within each pastoral lease and this reduces the likelihood of actual development constraints occurring. As the Project is at the preliminary design stage and consultation with affected pastoral leases is incomplete, it is not possible to quantify expected effects. The majority of potential development restrictions would apply to less than 0.5 per cent of each pastoral lease area within the Project Area.

A hypothetical 'worst case' development constraint scenario for each pastoral lease within the Project Area has been used to quantify the maximum likely effect. On this basis the pastoral leases transected by the Project transmission line are unlikely to have future developments constrained by the Project.

3.13.2 Supporting Information and Analysis

A pastoral lease is a title issued for the lease of an area of Crown Land use for the limited purpose of grazing of stock and associated activities. It is a limited property right and does not provide the leaseholder with all the rights that attach to freehold land. Specific conditions are often attached to pastoral leases, including a time period and the type of activity that may be permitted.

The further limitation of a leaseholder's rights would generally be expected to reduce the value of a lease. However, the Project has a relatively small footprint within each pastoral lease and this reduces the likelihood of actual development constraints occurring, because any development constraint resulting from the Project is limited to a relatively small section of the lease.

The majority of potential pastoral activity restrictions apply to the Project easement (50 m, see Section 3.12.2). These potential development restrictions would apply to buildings/structures (e.g. sheds, yards, pump houses, housing), storage of materials (e.g. haystacks) and excavations/filling of land (e.g. bunds, swales). On this basis, the potential development restriction footprint for each pastoral lease is as follows:

- Carriewerloo: 0.1 km^2, 0.01 per cent of pastoral lease
- Mt Arden: 0.6 km^2, 0.18 per cent of pastoral lease
- Kootaberra: 2.0 km^2, 0.16 per cent of pastoral lease
- Oakden Hills: 2.3 km^2, 0.13 per cent of pastoral lease
- Pernatty: 0.6 km^2, 0.03 per cent of pastoral lease
- Arcoona: 2.9 km^2, 0.08 per cent of pastoral lease
- Purple Downs: 1.4 km^2, 0.19 per cent of pastoral lease
- Roxby Downs: 0.4 km^2, 0.02 per cent of pastoral lease.

A hypothetical 'worst case' development constraint scenario for each pastoral lease within the Project Area has been used to quantify the maximum likely effect. The construction of an airstrip for pastoral operations has been used as a development that could be constrained as it represents the maximum area restriction. A 2.5 km exclusion zone (as per guidance described in Section 3.12.2) was applied to the Project transmission line route. The results of this assessment are described in Table 3-13.

Table 3-13 Assessment of worst case scenario development constraint (airstrip)

Pastoral lease	Assessment	Notes
Carriewerloo	A	Project transmission line runs adjacent to existing transmission lines, therefore similar development constraints exist.
Mt Arden		
Kootaberra		
Oakden Hills		
Pernatty		
Arcoona		
Purple Downs	A	Project transmission line runs adjacent to existing highway, therefore similar development constraints exist.
Roxby Downs		

A unlikely to constrain future developments.

B potential to constrain future developments.

Sources: Project GIS, RFDS (n.d.), EconSearch analysis.

3.13.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Limited data; use of industry recognized or benchmarked data (RFDS n.d.); some assumptions (B).
Method quality	B	not industry recognised (B).
Sensitivity	A	Predictions not sensitive to input variation.

3.14 Effects on Pastoralists' Activities – Access Roads

Access to power lines disrupt pastoral operations.

Damage to access roads prevents access by pastoralists.

3.14.1 Pathway Effect

Disruption to pastoral activities

Access during construction phase will use existing tracks wherever possible, and therefore may result in disruptions to pastoralist activities. Similar to effects discussed in Section 3.2, the expected delay for these travellers would be negligible (estimated to be less than five minutes) per one-kilometre construction zone. Longer delays may also be required depending on requirements for traffic stoppages during construction works.

If full closures of the pastoral tracks are required, OZ Minerals would communicate this with potentially affected pastoralists to allow access through construction areas. If access cannot be provided, pastoralists may have to use alternate routes and accordingly experience increased travel times for the duration of construction. Sections of pastoral properties may also become temporarily inaccessible if access through construction areas or alternate routes are not available. The effect from loss of access to pastoral areas is expected to be insignificant, given the limited extent of works to be performed at a given location.

Damage to access roads

The Project could affect the condition of unsealed pastoral access tracks through road wear from additional Project traffic (particularly heavy loads) during the construction phase and through unplanned events (e.g. Project vehicle accidents or bogging) leading to damage to the roads.

These effects, if they occur, are likely to result in nuisance to pastoralists (e.g. discomfort from using tracks in poor condition, time delays or the need to use alternative routes if access tracks become unusable/impassable). Likewise, if these effects occur they could incur costs to pastoralists from having to undertake additional track repair and maintenance.

It is expected that through consultation with pastoralists, the Project will identify pastoral access tracks that are at risk of deterioration due to Project transport activities and will undertake measures to mitigate the effect. Therefore, the effect is expected to be negligible.

3.14.2 Supporting Information and Analysis

Disruption to pastoral activities

Potential time delays for travellers moving along pastoral tracks were based on the time travelled through a temporary speed restriction regime, in contrast to the current speed limit (60 km/h). The temporary speed restrictions were based on two 500 metre buffer zones of 60 and 40 km/h around a one-kilometre-long 25 km/h construction zone (DPTI 2014). Based on vehicles traveling at an average of these limits suggests the following travel times:

- 4.9-minute travel time through temporary speed restrictions
- 3.0-minute travel time under usual conditions.

Although the above figures suggest a shorter delay, the pathway effect of five minutes was conservatively used. This was considered to be in line with travel time delays modelled at various travel speeds. Specifically, these were

- 30 km/h average travel speed: 6.4-minute travel time through temporary speed restrictions and 6.0-minute travel time under usual conditions
- 45 km/h average travel speed: 5.2-minute travel time through temporary speed restrictions and 4.0-minute travel time under usual conditions
- 60 km/h average travel speed: 4.9-minute travel time through temporary speed restrictions and 3.0-minute travel time under usual conditions
- 75 km/h average travel speed: 4.9-minute travel time through temporary speed restrictions and 2.4-minute travel time under usual conditions
- 90 km/h average travel speed: 4.9-minute travel time through temporary speed restrictions and 2.0-minute travel time under usual conditions.

Damage to access roads

A number of factors influence the condition of unsealed roads and the rate at which they deteriorate and these factors include:

- Climatic conditions
- Road base material characteristics
- Quality of construction and maintenance
- Terrain
- Traffic conditions
- Driver behaviours (Mwaipungu & Allopi 2015, Hart 2016).

The Project could affect the condition of unsealed pastoral access tracks through road wear from additional traffic and through unplanned events leading to damage to the roads.

Road wear could be brought about by increased Project traffic during the construction period. The factors influenced by the Project are the number of heavy loads moved on these roads and the driver behaviour of those heavy loads. Hart (2016) identified the trend towards heavier vehicles, from 17 tonne trucks to B-Doubles, travelling at relatively high speeds as having a significant effect on road deterioration and damage on unsealed roads in the Flinders Ranges. The level of wear will be an interaction between these Project-influenced factors and the characteristics of the track (i.e. quality of materials, construction and maintenance, weather conditions and terrain).

Damage to pastoral access tracks could also occur from unplanned events resulting from the Project activities, for example road accidents and bogging of Project vehicles.

These effects, if they occur, are likely to result in nuisance to pastoralists (e.g. discomfort from using tracks in poor condition, time delays or the need to use alternative routes if access tracks become unusable/impassable). Likewise, if these effects occur they could incur costs to pastoralists from having to undertake additional track repair and maintenance.

OZ Minerals has consulted with directly affected landowners throughout the planning of the Project to discuss the effect the transmission line will have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation. It is expected that, through this process, the Project will identify pastoral access tracks that are at risk of deterioration due to Project transport activities and will undertake measures to mitigate the effect (for example, but not limited to, identifying alternative routes, upgrading access tracks prior to Project use, repairing access tracks during and after Project use, managing driver behaviour of Project contractors).

3.14.3 Uncertainty Analysis

Disruption to pastoral activities

Component	Ranking	Notes
Input quality	B, C	Data unavailable in relation to construction schedule and effect due to restrictions/temporary closures (C). Current and restricted travel speeds are modelled on hypothetical values (B).
Method quality	A,C	Industry standard approach for speed restrictions (A). Informal methodology used for full track closure effects (C).
Sensitivity	B, C	Partial track closures only consider speed restrictions. It is possible that further traffic controls may be required, such sectioning off parts of pastoral tracks. Note that this can add to the delay time, which is likely to be a few minutes (C). Full track closure effects were unquantifiable, although likely to be brief (B).

Damage to access roads

Component	Ranking	Notes
Input quality	C	Data unavailable in relation to pastoral access track conditions, construction schedules (C).
Method quality	C	Informal, qualitative methodology used for assessing effects (C). Addressing effects through company policy (B).
Sensitivity	B	Addressing effects through company policy (B).

3.15 Effects on Pastoralists' Activities – Operations

Transmission line clearance requirements disrupts pastoral operations by limiting vehicle access below the transmission line.

Presence of transmission line disrupts pastoral operations by affecting aerial mustering near the transmission line.

3.15.1 Pathway Effect

Vehicle height restrictions

Where the Project transmission line route does not run adjacent to existing transmission lines (i.e. when it traverses Purple Downs and Roxby Downs), there is potential for pastoral operations to be affected when oversize vehicles (greater than 4.3 m in height) are required to move across these properties. As details of on-property trucking routes are not known at this time, it is not possible to quantify the effect.

For the remaining pastoral stations along the Project transmission line route (i.e. Carriewerloo, Mt Arden, Kootaberra, Oakden Hills, Pernatty and Arcoona), the Project transmission line runs adjacent to existing transmission lines and the Project is unlikely to change existing limitations on pastoral operations in this regard.

Aerial mustering restrictions

Where the Project transmission line route does not run adjacent to existing transmission lines (i.e. when it traverses Purple Downs and Roxby Downs), there is potential for aerial mustering operations to be affected when they occur in the vicinity of the Project transmission line route.

For the remaining pastoral stations along the Project transmission line route (i.e. Carriewerloo, Mt Arden, Kootaberra, Oakden Hills, Pernatty and Arcoona), the Project transmission line runs adjacent to existing transmission lines and the Project is unlikely to change existing limitations on aerial mustering operations.

3.15.2 Supporting Information and Analysis

Vehicle height restrictions

Vehicle heights of 4.3m and less are not subject to any restrictions when travelling on roads under transmission lines (DTEI 2008). Vehicles between 4.3m and 4.9m high (maximum permitted height of vehicles in South Australia) are required to confirm their route with SA Power Networks, because of potential transmission line clearance restrictions (DTEI 2008). The minimum clearance distance between a vehicle and load to be transported and transmission lines is 2.4m (132kV line) and 3.2m (275kV line) (*Electricity (General) Regulations 2012* under the *Electricity Act 1996* (SA)). Vehicles transporting large rectangular baled hay are often 4.6m in height as are double deck cattle transporters, and would be subject to these restrictions (DTEI 2010, NHVR 2018).

For the following pastoral stations along the Project transmission line route:

- Carriewerloo, Mt Arden, Kootaberra, Oakden Hills, Pernatty and Arcoona,

the Project transmission line runs adjacent to existing transmission lines and the Project is unlikely to change existing limitations on pastoral operations resulting from vehicle height restrictions. The Project transmission line route does not run adjacent to existing transmission lines when it traverses Purple Downs and Roxby Downs. On these properties there is potential for pastoral operations to be affected when oversize vehicles (greater than 4.3 m in height) are required to move across these properties. As details of on-property trucking routes are not known at this time, it is not possible to quantify the effect.

Aerial mustering restrictions

Aerial mustering is recognised as a “hazard rich activity” which involves low-level flying (CASA 2015). Analysis of reported aerial mustering accidents (66 in total) over a 10-year period (2003-2012) identified wire strike as the cause in 10 per cent of incidents (6 in number), the majority of which occurred during manoeuvring (CASA 2015). It is generally recommended that aerial mustering aircraft fly with a minimum of 100ft (31m) clearance from other objects (FSF 2016). On-going marking of transmission lines, both physically and on aviation maps (CASA 2015) and wire strike avoidance seminars with aerial mustering operators will assist to reduce the hazard (CASA 2015). Aerial mustering operations which occur in the vicinity of transmission lines will need to modify their operations (e.g. be limited to stock spotting) to minimise the risk of wire strike.

For the following pastoral stations along the Project transmission line route:

- Carriewerloo, Mt Arden, Kootaberra, Oakden Hills, Pernatty and Arcoona,

the Project transmission line runs adjacent to existing transmission lines and the Project is unlikely to change existing limitations on aerial mustering operations. The Project transmission line route does not run adjacent to existing transmission lines when it traverses Purple Downs

and Roxby Downs. On these properties there is potential for aerial mustering operations to be affected when they occur in the vicinity of the Project transmission line route.

3.15.3 Uncertainty Analysis

Vehicle height restrictions

Component	Ranking	Notes
Input quality	B	Vehicle heights and vehicle height restrictions based on industry standard (A); on-property vehicle routes unknown (C).
Method quality	B	Approach based on literature rather than on consultations.
Sensitivity	B	Construction planning has already mitigated many of these effects (A). The residual effects are unquantified and sensitivity is unknown (C).

Aerial mustering restrictions

Component	Ranking	Notes
Input quality	B	Aerial mustering hazards and safety of operation standards based on industry standard (A); on-property aerial mustering activity unknown (C).
Method quality	B	Approach based on literature rather than on consultations.
Sensitivity	B	Construction planning has already mitigated many of these effects (A). The residual effects are unquantified and sensitivity is unknown (C).

3.16 Effects on Pastoralists' Activities – Amenity

Construction activity from the Project may cause a loss of amenity for pastoralists through changes to the visual aesthetic of the landscape and restricting lifestyle activities.

3.16.1 Pathway Effect

A loss of amenity is expected by pastoralists as a result of changes to the visual aesthetic of the landscape and the lifestyle of pastoralists. During construction, lifestyle and aesthetic effects are expected to come from temporary clearance of vegetation, light spill from construction camps and exposure to construction activities and workforce. During operation, aesthetic effects are expected to come from permanently cleared vegetation and from the towers and cables of the Project transmission line itself.

3.16.2 Supporting Information and Analysis

Consultation with landholders for a development application by Iron Road for a major mine on the Eyre Peninsula identified concerns about a loss of amenity from dust, noise, light and changes to the visual landscape associated with the mine and related infrastructure corridor (Bowey 2015). While these concerns relate to a major mine and a new infrastructure corridor, they indicate the types of issues that might arise for landholders in the Study Area for the Project

transmission line. The possible effects from the Project are described and their magnitudes estimated below.

During construction

- Exposure to construction activities including light and heavy vehicles and helicopters is expected along the length of the transmission line. Construction is expected to proceed linearly from multiple locations so regular exposure is expected for one year at all nine pastoral stations in proportion to the number of structures associated with the transmission line in each (see Table 3-10).
- Exposure to construction workforce in or around the Study Area. The inconvenience and disruption on pastoral access roads is discussed in Section 3.14. This point relates to the lifestyle and aesthetic impact of having people residing on and travelling around a, usually private, property. The magnitude for each pastoralist is expected to be the same as for exposure to construction activities.
- Temporary clearance of vegetation for access tracks, pole construction areas and structure laydown areas will be carried out along the length of the Project transmission line causing a change to the landscape aesthetic. Use of existing access tracks where possible will minimise the area cleared. These areas will be evenly spaced along the Project transmission line so the magnitude for each pastoralist is expected to be the same as for exposure to construction activities.
- Temporary clearance of vegetation for two construction camps is expected to cause a change to the visual aesthetic of the landscape. The exact locations of the construction camps are not available for this assessment but they will be located on two different pastoral leases, with the effect incident on the pastoralists operating the properties.
- Light spill at night from two construction camps is expected to cause a change to the visual aesthetic of the night time landscape. The incidence of the effect is the same as for temporary vegetation clearance for construction camps.

During operation

- Changed visual aesthetic of the landscape is expected due to permanent vegetation clearance for access tracks. While most cleared area will be rehabilitated, some will remain cleared and gravel will be used to supress dust and prevent erosion. This will cause a permanent change to the visual aesthetic of the landscape but at a lesser magnitude than the temporary clearances discussed above.
- Changed visual aesthetic of the landscape is expected due to the towers and cables of the Project transmission line itself. However, the Project transmission line will run alongside an existing transmission line so the visual change will be smaller than the effect of building a transmission line on undeveloped land.

3.16.3 Uncertainty Analysis

Component	Ranking	Notes
Input quality	B	Land area requirements per structure/track based on ElectraNet industry standard (A). Numbers of structures and length of access track based on high-level assumptions (C).
Method quality	B	Approach based on literature from a comparable project and region rather than on consultations.
Sensitivity	A	Construction planning has already mitigated many of these effects. The residual effects are only marginal. Mitigation would scale in proportion with the magnitude of these effects so sensitivity is low.

4. SUMMARY

Based on the outcomes of the assessment, the Project is expected to have the following pathway effects:

- The increase in Project traffic volumes in both the construction and operation phases is expected to have no material effect on travel times for road users on roads used by Project traffic.
- Infrastructure construction works may temporarily increase travel time for road users. The expected delay for these travellers would be less than five minutes per 1 km road section. The number, duration and specific location of road restricted construction areas is unknown.
- Increased traffic on the roads from the Project during construction is expected to increase deterioration in the condition of the roads by between approximately 0.2 to 11.6 per cent. No road deterioration due to the Project's operations is expected.
- No notable increase in competition for labour is expected in most residential centres in the Regional Study Area during construction. There is potential for an increase in competition for labour with a potential for impacts on local businesses in Roxby Downs. No effect is expected during the operation phase.
- No social disruption is expected in the residential centres in the Regional Study Area during construction because in-migration is expected to be zero or very small. Further, where in-migration is expected, the existing workforce is similar to the expected in-migrants. No social disruption is expected in the local area of the construction camps because contractors and employees will receive a locally sensitive induction and will be held to performance standards that prevent drug and alcohol abuse and anti-social behaviour.
- No pressure on local services is expected as the expected in-migration to the Regional Study Area due to the Project only moderates a trend of population decrease.
- No pressure on local business is expected as the expected in-migration to the Regional Study Area due to the Project only moderates a trend of population decrease.
- No detrimental effect on housing availability or affordability is expected in most of the Regional Study Area. There is potential for a marginal decrease in housing availability and affordability in Roxby Downs during construction.
- Although a high average wage is expected for workers at the project, no local price inflation is expected in any of the residential centres in the Regional Study Area as the number of employees expected to be based in each is relatively small.
- All pastoral leases through which the transmission line will traverse, are estimated to each lose less than 0.2km^2 of area to the Project (which is less than 0.1 per cent of their pastoral lease areas). This quantum of reduction in area is unlikely to require a reduction in stocking rates and is unlikely to reduce the value of pastoral leases.

- The Project may bisect paddocks or other structures relevant to pastoral lease activities, which may restrict access and constrain pastoralists' activities. This may in turn influence the value of the pastoral leases. Changes in existing levels of fragmentation as a result of the Project are unlikely for the pastoral stations through which the transmission line traverses (i.e., Carriewerloo, Mt Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs and Roxby Downs).
- The Project may lead to restriction of some pastoral activities for pastoral leases within the Project Area. This may, in turn, lead to an actual or perceived constraint on future developments by pastoral enterprises. As the Project is at the preliminary design stage and consultation with affected pastoral leases is incomplete, it is not possible to quantify expected effects. The majority of potential development restrictions would apply to less than 0.5 per cent of each pastoral lease area within the Project Area.
- Although negligible, pastoralist travel times may increase (estimated to be less than five minutes per one-kilometre construction zone)Sections of pastoral properties may also become temporarily inaccessible, if access through construction areas or alternate routes are not available. The effect from loss of access is expected to be insignificant, given the limited extent of works to be performed at a given location. The number, duration and specific location of road restricted construction areas is unknown.
- The Project could affect the condition of unsealed pastoral access tracks through road wear from additional Project traffic (particularly heavy loads) during the construction phase and through unplanned events (e.g. Project vehicle accidents or bogging) leading to damage to the tracks. These effects, if they occur, are likely to result in nuisance to pastoralists. Likewise, if these effects occur they could incur costs to pastoralists from having to undertake additional track repair and maintenance. It is expected that the Project will undertake measures to mitigate these effects. Therefore, these effects are expected to be negligible.
- Where the Project transmission line route does not run adjacent to existing transmission lines (i.e. where it traverses Purple Downs and Roxby Downs), there is potential for pastoral operations to be affected when oversize vehicles (greater than 4.3 m in height) are required to move across these properties. As details of on-property trucking routes are not known at this time, it is not possible to quantify the effect. For the remaining pastoral stations along the Project transmission line route (i.e. Carriewerloo, Mt Arden, Kootaberra, Oakden Hills, Pernatty and Arcoona), the Project transmission line runs adjacent to existing transmission lines and the Project is unlikely to change existing limitations on pastoral operations in this regard.
- Where the Project transmission line route does not run adjacent to existing transmission lines (i.e. where it traverses Purple Downs and Roxby Downs), there is potential for aerial mustering operations to be affected when they occur in the vicinity of the Project transmission line route. For the remaining pastoral stations along the Project transmission line route (i.e. Carriewerloo, Mt Arden, Kootaberra, Oakden Hills, Pernatty and Arcoona), the Project transmission line runs adjacent to existing transmission lines and the Project is unlikely to change existing limitations on aerial mustering operations.

- A loss of amenity is expected by pastoralists as a result of changes to the visual aesthetic of the landscape and the lifestyle of pastoralists. During construction, lifestyle and aesthetic effects are expected to come from temporary clearance of vegetation, light spill from construction camps and exposure to construction activities and workforce. During operation, aesthetic effects are expected to come from permanently cleared vegetation and from the towers and cables of the Project transmission line itself.

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Disclaimer

The assignment is a consulting engagement as outlined in the 'Framework for Assurance Engagements', issued by the Auditing and Assurances Standards Board, Section 17. Consulting engagements employ an assurance practitioner's technical skills, education, observations, experiences and knowledge of the consulting process. The consulting process is an analytical process that typically involves some combination of activities relating to: objective-setting, fact-finding, definition of problems or opportunities, evaluation of alternatives, development of recommendations including actions, communication of results, and sometimes implementation and follow-up.

The nature and scope of work has been determined by agreement between BDO and the Client. This consulting engagement does not meet the definition of an assurance engagement as defined in the 'Framework for Assurance Engagements', issued by the Auditing and Assurances Standards Board, Section 10.

Except as otherwise noted in this report, we have not performed any testing on the information provided to confirm its completeness and accuracy. Accordingly, we do not express such an audit opinion and readers of the report should draw their own conclusions from the results of the review, based on the scope, agreed-upon procedures carried out and findings.

Appendix H. Draft Construction Environmental Management Plan

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CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

Draft Construction Environmental Management Plan (CEMP)

July 2018

DISCLAIMER

This Draft Construction Environmental Management Plan (CEMP) has been prepared for submission to the South Australian State Commission Assessment Panel under the *Development Act 1993* (SA). No one other than the South Australian Minister for Planning should rely on the information contained in the Development Application to make, or refrain from making, any decision.

In preparing the CEMP, OZ Minerals Prominent Hill Operations Pty Ltd has relied on information provided by specialist consultants, government agencies and other third parties. OZ Minerals Prominent Hill Operations Pty Ltd has not fully verified the accuracy or completeness of that information, except where expressly acknowledged in the Development Application.

The CEMP has been prepared for information purposes only and, to the full extent permitted by law, OZ Minerals Prominent Hill Operations Pty Ltd, in respect of all persons other than the South Australian Minister for Planning:

- Makes no representation and gives no warranty or undertaking, express or implied, in respect to the information contained herein; and
- Does not accept responsibility and is not liable for any loss or liability whatsoever arising as a result of any person acting, or refraining from acting, on any information contained in this CEMP.

NOTE ON CURRENCY

Where possible, the information contained in this CEMP are up to date as at July 2018. This was not possible where parts of the CEMP were prepared from information provided by third parties (as discussed in in the second paragraph above) prior to the CEMP being finalised.

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1 INTRODUCTION

This Draft Construction Environmental Management Plan (CEMP) has been prepared to accompany a Development Application (DA) for OZ Minerals' proposed construction of a transmission line (the Project) from Carriewerloo Substation to Prominent Hill in the mid-north of South Australia.

This CEMP has been prepared to cover the construction phase only.

1.1 Purpose and Scope

This CEMP outlines the overarching principals to be implemented to avoid and/or minimise any impacts associated with the construction of the Project, and identifies potential mitigation, controls and management strategies that should be implemented during construction.

A final detailed CEMP will be prepared by the respective construction contractor for review and acceptance by the relevant authority prior to constructing commencing.

The CEMP is a working document that will be revised and updated periodically during the construction phase of the Project to ensure that it reflects current best practice environmental management. See Section 3.4.1 for further information on the review process.

1.2 Data Sources

This CEMP has been developed to be consistent with:

- Development Application (DA) (OZ Minerals, July 2018)
- Ecological Impact Assessment (Appendix D2 of DA, developed by EBS Ecology, June 2018)
- Visual Assessment (Appendix E of DA, developed by Urbis, July 2018)
- Traffic Assessment of Effects (Appendix F2 of DA, developed by GHD, June 2018)
- SA Arid Land Natural Resource Management Plan 2017–2027
- EPA Industry Guideline "Construction Environmental Management Plans" July 2018
- ISO 14001:2015 and the Environmental Management System (EMS) being developed by OZ Minerals
- OZ Minerals Performance Standards

2 PROJECT DESCRIPTION

2.1 Project Area

OZ Minerals proposes to construct a transmission line (the Project) to secure the power supply to the existing Prominent Hill mine in northern South Australia. The proposed transmission line will run from 20 km north-west of Port Augusta to 10 km west of Olympic Dam and will be approximately 237 km long. Prominent Hill currently obtains electricity from BHP's 275 kilovolt (kV) transmission line from Davenport to Olympic Dam. The proposed transmission line will connect to the existing OZ Minerals Prominent Hill transmission line that originates at Olympic Dam. It will also connect to the existing Mount Gunson South Substation and provide power to OZ Minerals' Carrapateena mine. The Project location is shown in Figure 2.1.

2.1.1 Transmission Line Route

The proposed transmission line consists of:

- A 275 kV section extending 109 km from the Carriewerloo Substation at the SolarReserve Aurora Project to the Mount Gunson South Substation
- A 132 kV section extending 128 km from the Mount Gunson South Substation to the existing Prominent Hill transmission line near Olympic Dam.

The transmission line will generally be located within a defined 500 m wide corridor, which is referred to as the Project Area. The proposed alignment runs parallel to the existing BHP and ElectraNet transmission lines for approximately 70% of its length, however north of Woomera it diverges east, following Olympic Dam Highway to remain outside the boundary of the Woomera Prohibited Area (WPA), before crossing the highway south of Roxby Downs to re-join the existing alignment of the transmission lines.

2.1.2 Landowners and land use

The land within which the Project is proposed is subject to the Barngarla Native Title Determination (NNTT Number SCD2016/001) and the Kokatha People (Part A) Native Title Determination (National Native Title Tribunal (NNTT) Number SCD2014/004).

The current alignment crosses 15 land titles, which are held under a combination of tenures including freehold, pastoral lease, unalienated Crown land and Crown Leases by a total of eight different parties. For approximately 70% of its length, the transmission line parallels the existing BHP and ElectraNet lines, which are located on a freehold land corridor and easements respectively. Where it parallels both BHP and ElectraNet lines, the proposed line is planned to be offset to the west of the existing ElectraNet 132 kV line.

2.1.3 Topography and Climate

The majority of the transmission corridor comprises sand sheets and clay plains with low topographic relief. Around the Pimba area, between Mount Gunson and Purple Downs, the Arcoona Plateau presents an undulating tableland with maximum elevations of 194 m. The highest point in the vicinity of the transmission corridor is an unnamed hill in the Arcoona area (194 mAHD), located approximately 45 km south-east of Pimba.

The route alignment lies in an arid to semi-arid region, subject to hot summers and cool to mild winters. Rainfall is unpredictable and sporadic throughout the year, often occurring in intense short bursts. Average annual rainfall at Roxby Downs, Woomera and Port Augusta is 150 mm, 184 mm and 220 mm respectively.

2.2 Key Infrastructure Components

A detailed engineering design and construction planning has not yet been undertaken, and as such, the information provided below is indicative of the current understanding of the infrastructure components.

2.2.1 Transmission Structures

The Project is expected to primarily use two types of structures: lattice towers and steel monopoles. Lattice towers consist of a steel lattice framework, while monopoles consist of a single pole.

Lattice towers (typically 50 to 60 m in height) are expected to be used for the 275 kV line with tower spacing 450 to 500 m. This distance may change in locations which involve road crossings, turning of the alignment and environmental crossings, where larger spans (using larger towers) may be used. Alternative designs (e.g. guyed lattice towers with a single footing and a number of supporting steel guy wires) may also be used.

Steel monopoles or smaller lattice towers (typically 25 to 45 m in height) are expected to be used for the 132 kV line, spaced at approximately 300 m. Large lattice towers similar to those used on the 275 kV line would be used in some locations (e.g. where larger spans are required).

Lattice towers will be supported by concrete footings. Four footings (one for each tower leg) would typically be used for lattice towers on a 275 kV line. Monopole towers are generally bolted onto a concrete foundation. Footings and foundations would typically be approximately 5 m deep but may be up to 10 m deep in some soil types. A single footing plus several smaller footings for guy wire anchor points would be required for guyed structures. Footing design will vary with the design loads of the tower.

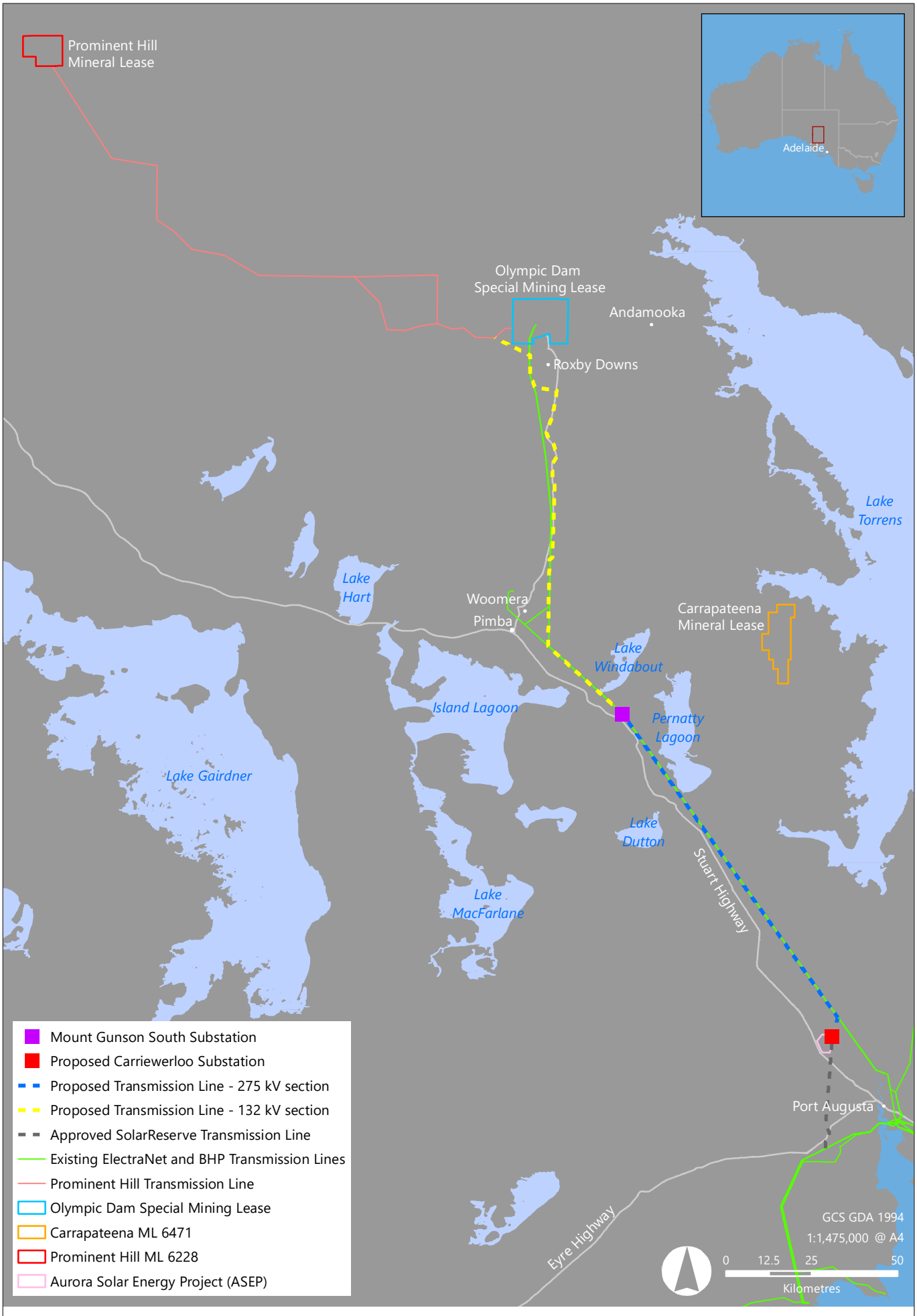

Figure 2.1: Project Location

CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

2.2.2 Structure Laydown Areas

At each structure location there will be a need for a flat cleared laydown area to enable tower or pole footing construction and structure erection, including line stringing and tensioning. Depending upon terrain and structure type, the clearance areas can range from approximately 20 m x 20 m to 50 m x 50 m. Cleared sites will typically be left to naturally regenerate with original topsoil respread back over the area. Some sites may require gravel topping to allow for ongoing maintenance access or to protect the site from erosion and/or dust generation.

2.2.3 Conductors and insulators

Conductors (or wires) for high-voltage transmission lines are typically made from aluminium alloy strands which are wound around a steel core to form a cable. These carry the electricity and are attached to the poles or towers with insulators. Transmission towers also carry an earth wire to reduce the likelihood of direct lightning strikes to the conductors. Dampers are used on conductors to control wind-induced vibration and movement. The proposed transmission lines will be single circuit lines, with three conductors on both the 132 kV and 275 kV.

2.2.4 Telecommunications

Telecommunications are planned to be provided by an optical ground wire, which consists of an optical fibre core within the earth wire discussed above. A repeater optical / amplifier site, which would have a footprint of approximately 400 m^2 (for a solar array) may be required along the 132 kV section of transmission line. A buried optic fibre cable from the proposed transmission line to ElectraNet's Pimba Substation along the one of the existing transmission lines (approximately 8 km) is planned to be installed which will allow connection to ElectraNet's existing telecommunications infrastructure and may avoid the requirement for a repeater / optical amplifier site.

2.2.5 Access

Access tracks are required for line construction and maintenance. A track to the base of each tower of approximately 5 m wide will be required. Greater track widths may be required in some areas (e.g. if a passing area or wider turning area is required, or where the track is established through very sandy dunes). Existing roads and tracks will be used wherever possible. Where there is no existing track, a new track generally paralleling the transmission line will be constructed, typically by light grading. Capping with imported material may be required in limited areas. Access track creek crossings are normally established at the natural surface level, with minimal earthworks undertaken. New access tracks will cross creeks at the natural surface level, with minimal earthworks undertaken. Temporary or permanent crossings with pipes or culverts may be installed in some locations.

2.2.6 Easements

Appropriate tenure will be obtained for the land crossed by the transmission line. This may include easements, licences or crossing agreements; for the majority of land on the alignment it will consist of easements.

The width of a typical easement varies between 40 m and 100 m, depending upon the voltage of the transmission line being erected overhead and the type of support structure proposed..

An easement or Right of Way (ROW) provides a safety clearance margin between the high-voltage power lines and surrounding structures and vegetation, and provides a path for ground-based inspections and access to transmission towers for repairs and maintenance. Generally, the ROW will consist of native vegetation or plants, though in some instances, access tracks constitute a portion of the ROW.

2.3 Project Schedule

Construction of the Project will take approximately 12 to 18 months, commencing with the development of the construction camp, then early works along the infrastructure corridor, and ending with the construction of the transmission infrastructure. Depending on construction staging, it is likely that a peak workforce of approximately 200 people would be required for the construction of the line. The construction of each section (i.e. the 275 kV and the 132 kV) are expected to require a peak workforce of approximately 80 to 100 people each.

3 IMPLEMENTATION

The roles and responsibilities, training and communication mechanisms that underpin implementation of this plan are detailed in the following sections.

3.1 Responsibilities

Effective management of environmental issues and promoting environmental awareness during construction of the Project is key to responsible project management. The CEMP details the environmental aspects and mitigation and control measures that should be implemented to avoid and or minimise construction associated impacts to the environment and to health and safety. All personnel involved in construction of the Project including project contractors and sub-contractors, are required to work in accordance with this CEMP. The roles and responsibilities of key personnel during the construction of the Project are outlined below in Table 3.1.

Table 3.1: Roles and Responsibilities

Role	Responsibilities
Principal The Principal will engage a construction company ('the Contractor') who will be responsible for ensuring the final CEMP is developed and implemented by all staff and their subcontractors involved with the construction works.	Key contact and representative. Ensure contractual documents include environmental responsibilities and adequate. Ensure compliance obligations and environmental requirements are implemented.
Contractor Superintendent	Overseeing the effective implementation of the CEMP. Ensures adequate training is provided to staff to meet environmental obligations. Overseeing Work Health and Safety (WHS) and promoting the culture for a safe work environment. Reporting of environmental incidents to the Environmental Manager Overseeing fire and emergency response management. Promoting the culture for environmental awareness and providing clear expectations and guidelines. Overseeing the management of communications and complaints.
Environmental Manager (assigned by the contractor)	Ensuring all systems, standards and processes are aligned through the Project. Responsible for managing environmental aspects during construction. Checks all environmental requirements, licences and procedures are implemented. Managing the environmental approval process. Advises staff of special requirements.

Role	Responsibilities
	Ensures that environmental mitigation and controls are implemented and maintained during all phases of the Project (construction). WHS including fire and emergency response management and promoting the culture for a safe work environment. Promoting the culture for environmental awareness. Responsible for the emergency response procedure for environmental incidents. Overseeing environmental management and risk on the project. Overseeing training. Providing general environmental support. Conducting incident investigations. Performing environmental risk assessments. Coordinating management reviews, external and internal audits and reporting progress against environmental targets and objectives.
Contractors and Employees	Implement environmental controls as directed. Report environmental.

Under the terms of their respective contracts, contractors will be responsible for managing the potential environmental, social, safety and health impacts of all their contract activities including those of their subcontractors.

Contractors must, as part of their obligations:

- Demonstrate compliance with OZ Minerals' Environmental and WHS policies
- Demonstrate commitment to the CEMP
- Identify individuals responsible for overall environment, social, safety and health management
- Undertake regular environmental, social, health and safety inspections and provide reports to allow for the monitoring and evaluation of performance.

Although the contractors will have the primary roles in delivering on the control and management strategies, OZ Minerals will have the ultimate accountability for ensuring the measures are delivered.

3.2 Induction and Training

All OZ Minerals employees, contractors and sub-contractors will be required to demonstrate an understanding of the CEMP and competency in environmental management and to undertake training prior to commencing any construction works on any element of the Project. Induction training will address:

- Background to the Project
- Approval conditions, and the role of the CEMP
- Legislative requirements of the company and individuals
- Key personnel and roles

- Environmental challenges along the Project Area and relevant management plans and procedures
- Community challenges related to the Project and relevant management plans and procedures including the community feedback and complaints process
- Penalties for non-compliance with required plans and procedures
- Occupational health and safety, Hazard and Incident reporting and management procedures
- Emergency Response Plan (ERP).

The Principal is responsible for overseeing training through the relevant functional (e.g. environment) and area managers.

3.3 Emergency Response

Emergency response procedures will be detailed in the final CEMP, with clear lines of responsibility provided to ensure an effective response with minimal environmental harm or disruption. Emergency response procedures will include the following as a minimum:

- Reporting on environmental incidents; including the steps to notify key personal, procedures for assessment of the potential impact, appropriate mitigation steps and advising the appropriate regulatory authorities.
- An Emergency Response Plan; which details the appropriate responses for emergencies that may occur during the construction phase, such as fire and bushfire, chemical spill, explosion, flooding, wildlife injury, damage to existing infrastructure, seismic activity and personnel injury. Personnel responsible for implementation of the Emergency Response Plan will be provided with appropriate training and resources, and response representatives will be made known to staff on site during inductions.
- Incident and corrective action records; which details the procedures to record, document and follow up on environmental incidents and key personal that should be involved.
- Fire prevention; including a Fire and Emergency Response Strategy to be developed for the construction phase of the Project in consultation with the Country Fire Service (CFS) and other relevant stakeholders. Fire prevention strategies are also covered in Section 4.9.

3.4 Review, Monitoring, Reporting and Compliance

3.4.1 Reviews

This CEMP is a dynamic document that will be subject to regular review (frequency to be determined by the contractor) and continual improvement. A review of the CEMP will include a process of adaptive management, whereby the effectiveness of environmental controls and procedures is continually assessed to ensure best practice environmental management.

The review process will examine the following as a minimum:

- The implemented mitigation and environmental management controls
- Incident reporting and procedures for preventive actions
- Complaints handling procedures
- Emergency response procedures for environmental incidents.

3.4.2 Monitoring Records

Environmental monitoring results (e.g. surface water, identification of acid sulphate soils (ASS), weeds and pests and other key audit/inspection outcomes) will be reported on a regular (to be determined by the contractor) basis to the Environmental Manager. For any monitoring / sampling activity, the following information will be kept as a minimum:

- Date(s) and times of monitoring / samples collected
- The point location where the monitoring / sampling was undertaken
- The name of the person who conducted the monitoring / sampling.

3.4.3 Reporting

The contractor shall provide a report (frequency to be determined) to the Principal to cover the following circumstances:

- A report on any monitoring undertaken in accordance with licences, approvals or consent
- Report of compliance with the CEMP
- Provide a summary of complaints received during the construction phase of this project.

In the event of serious or material environmental harm is caused or threatened, or site contamination has been identified at the site, the reporting and notification processes set out under Sections 83 and 83a of the *Environment Protection Act 1993* (SA) respectively will be followed. These processes include the requirement for a person to notify the Environment Protection Authority (EPA) immediately of the harm or contamination, particularly to the identification of site contamination that affects or threatens underground water.

3.4.4 Compliance

Non-conformances are to be reported immediately to the Environmental Manager and appropriate corrective action shall be undertaken in a prompt manner in conjunction with supervisors. Identified non-conformances and corrective actions will be recorded as part of the CEMP.

4 ENVIRONMENTAL ASPECTS AND OBJECTIVES

OZ Minerals' Development Application (DA) identified, analysed and assessed potential environmental and social impacts, including environmental hazards and risks. This informed the development of environmental objectives and the mitigation and management controls outlined in this draft CEMP. Issue specific management plans include:

- Soil disturbance, erosion and surface water flows management
- Groundwater management
- Air quality control
- Noise and vibration
- Flora and fauna
- Weed and feral animal pest control
- Protection of sites of cultural heritage
- Waste management, chemical handling and storage
- Fire, risks and prevention
- Local community and third-party users.

For each specific management issue detailed below, key legislative considerations and measures to implement in order to avoid and/or minimise environmental impacts associated with the construction are highlighted. The mitigation and management controls represent the minimum requirements that should be adopted during the construction phase, noting that changes may be required based on the final methodology proposed by the chosen contractor. Each section includes summary information that has been used to inform the mitigation and management control process.

In addition, specific management plans will also be required for:

- Construction Traffic Management; a Traffic Management Plan will be developed prior to the construction of the Project as part of the final CEMP.
- Environment and Community Management Plan (ECMP); which will outline how OZ Minerals intends to manage environmental and social aspects of the Project.

4.1 Soil Disturbance, Erosion and Surface Water Flows Management

During the construction phase of the Project, activities including vegetation clearance, excavation, earthworks and creation of stockpiles have the potential to lead to the soil disturbance and erosion, increased sedimentation and changes to surface water flows (i.e. during heavy rainfalls and also to a lesser extent, via placement of infrastructure). Clearance, excavation and earthworks will be required for the construction of tower footings, lay down areas, temporary stringing easements, new access tracks, and temporary site facilities (including construction camp). Table 4.1 describes the mitigation and management controls that will be implemented to minimise soil disturbance, erosion and changes to surface water flows.

Table 4.1: Soil Disturbance, Erosion and Surface Water Flows Mitigation and Management Controls

Aspect	Detail
Objectives	Minimise soil disturbance, erosion and changes to surface water flows (including stormwater) during construction.
Legislation and other guidance	*Environment Protection Act 1993* (SA) *Environment Protection Regulations 2009* (SA) Environment Protection (Water Quality) Policy 2015 National Environment Protection (Assessment of Site Contamination) Measure 1999 *Natural Resources Management Act 2004* (SA) EPA Guidelines: Site Contamination – Acid Sulphate Soil Materials (EPA, 2007) Stormwater Pollution Prevention Codes of Practice: Building and Construction Industry (EPA, 1999) Stormwater Management for Wash Bays (EPA, 2016a).
Potential Impacts	Damage to top soil and subsoil. Increased soil vulnerability to erosion (including runoff from heavy rain events) and weed infestation. Reduction in soil and land quality. Altered surface water regimes in existing creeks and drainage lines. Disturbance of existing site contamination or Acid Sulphate Soils (ASS). Identification of contaminated or unsuitable soil type. Exposure of contaminated soil to surface water.
Mitigation and management controls	Development of a Soil Erosion and Drainage Management Plan (SEDMP). The SEDMP will detail the measures that will be implemented to manage sedimentation and erosion using standard practices; these may include the installation of berms or drainage controls, careful placement and management of soil stockpiles out of potential flow paths and maintenance of sediment/erosion controls. The SEDMP will detail site specific erosion and drainage control strategies which will be developed with regard to the Stormwater Pollution Prevention Codes of Practice: Building and Construction Industry (EPA,1999). The SEDMP will also detail management procedures to be implemented to manage soil compaction and loss of soil quantity. Mitigation and control measures are further outlined below. Restricting area of disturbance to the minimum necessary. Erosion and sedimentation control devices installed prior to commencement of construction.

Aspect	Detail
	Design drainage features or structures to appropriate standards where considered necessary. Disturbed areas will be revegetated as soon as practicable to support erosion control. Install temporary sediment and erosion controls (e.g. berms, drainage controls, sediment fencing). Locate stockpiles away from surface water flows and trafficked areas. Vehicle movements limited to predetermined haul routes. Project infrastructure will be sited to minimise disturbance to any ephemeral drainage lines within the area. Geotechnical investigations undertaken as part of structure foundation design. Ensure compliance with land disturbance approval process. Siting of tracks and transmission structures to minimise erosion potential. Siting of Project infrastructure to minimise disturbance to ephemeral drainage lines. Locate camps and mobile facilities away from watercourses and lakes. Existing tracks incorporated into the design as far as possible. Access tracks constructed in accordance with industry standards and constructed to avoid significant impediment to surface water flows. Siting of the transmission structures and access track to avoid disturbing identified areas of potential acid sulphate soils as far as possible e.g. Lake Windabout inlet. Any potentially disturbed ASS managed in accordance with industry standards based on principals of avoidance, minimisation of disturbance and treatment. • Avoidance – potential areas of ASS will be avoided where practicable when finalising the construction methodology and location of temporary construction areas. • Minimisation of disturbance – when disturbance of potential ASS cannot be avoided, alterations to the design and construction methodology will be investigated to limit the extent of disturbance of potential ASS material. • Treatment – where required, soils will be immediately neutralised and managed, or segregated and isolated from uncontaminated soil and treated at a separate facility. Stockpiling of topsoil and cleared vegetation for re-spreading over areas of temporary disturbance. Spill and emergency response procedures. Equipment maintenance to prevent spills. Licensed chemical and waste transporters. Vehicle wash down areas established and managed in accordance with EPA Information Sheet 'Stormwater Management for Wash Bays' (EPA, 2016a). Monitoring during construction undertaken to identify any areas of erosion with further mitigation measures implemented where required. Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards.

4.2 Groundwater Management

During Project construction, groundwater abstraction is the only activity with the potential to alter groundwater quantity. While the volume of water to be potentially abstracted from groundwater sources is low for the Project, abstraction could have a localised and temporary effect on the quantity of groundwater available if not appropriately managed. There is also the potential for groundwater contamination to occur during construction of the Project via accidental spills, or via disturbance of ASS. While the risk of groundwater contamination has been deemed negligible as a result of the Project during construction, Table 4.2 describes the mitigation and management controls that will be implemented to avoid/minimise changes to groundwater quality, quantity and interactions with surface waters.

Table 4.2: Groundwater Impact Mitigation and Management Controls

Aspect	Detail
Objectives	Minimise/avoid the impact to groundwater quantity, quality and changes to groundwater-surface water interactions
Legislation and other guidance	*Environment Protection Act 1993* (SA) *Environment Protection Regulations 2009* (SA) Environment Protection (Water Quality) Policy 2015 *Natural Resources Management Act 2004* (SA) (NRM Act)
Potential Impacts	Changes to groundwater quantity or quality. Changes to groundwater-surface water interactions.
Mitigation and management controls	New water supply wells assessed to ensure they will not impact existing groundwater users. Spill and emergency response procedures. Equipment maintenance to prevent spills. Licensed chemical and waste transporters. Wastewater managed in accordance with health regulations and Environment Protection (Water Quality) Policy. Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards. Appropriate permits for the construction of water supply wells obtained where required. Abstraction rates and volumes within limits agreed with well owner. All hazardous materials (oils, fuels and chemicals) will be managed in accordance with relevant regulations and guidelines, including appropriate storage and bunding, material safety data sheets (MSDS), spill response etc. as detailed in Section 4.8.

4.3 Air Quality Control

During construction of the Project, there is the potential for localised, short-term changes to air quality to result due dust and exhaust emissions generated during Project construction. Potential sources of dust include the clearance of surfaces, stockpiles, excavations and light and heavy vehicle movements on unsealed surfaces. Sources of greenhouse gas emissions result primarily from the use of diesel fuel for construction machinery, vehicles and generators. The mitigation and management controls that will be implemented to minimise the impacts of construction of the Project on air quality from dust and greenhouse gas emissions are detailed below in Table 4.3.

Table 4.3: Air Quality Mitigation and Management Controls

Aspect	Detail
Objectives	Avoid and or/minimise air quality impacts during construction works
Legislation and other guidance	*Climate Change and Greenhouse Emissions Reduction Act 2007* (SA) *Environment Protection Act 1993* (SA) *Environment Protection Regulations 2009* (SA) Environment Protection (Air Quality) Policy 2016 *National Greenhouse and Energy Reporting (NGER) Act 2007* (Cth) The World Business Council for Sustainable Development The Greenhouse Gas Protocol (WBCSD, 2004)
Potential Impacts	Health impacts from dust emissions. Reduction in amenity values from dust deposition. Dust emissions causing deterioration of air quality. Generation of greenhouse gases generated by construction of the Project.
Mitigation and control measures	Existing tracks will be incorporated into the design where possible to avoid construction of new access tracks, and reduce clearance footprint. Use of emissions control equipment on fixed and mobile plant and equipment. Progressive rehabilitation of disturbed areas (primary, secondary rehabilitation and/or revegetation). Use of low sulphur diesel and regular maintenance of equipment to ensure emissions control devices are functioning correctly. Dust suppression on unsealed roads. Dust suppression on disturbed land (construction) where required. The disturbance footprint will be restricted to the minimum necessary to safely carry out the activities. Maintenance of unsealed roads. Regular maintenance of equipment to ensure emissions control devices are functioning correctly. Complaints register and corrective action program. Community consultation process. Vehicle speed limits will be managed in accordance with construction traffic management plans and site conditions to mitigate wheel-generated dust.

4.4 Noise and Vibration

Sources of noise during construction of the Project include road traffic noise, general construction noise and aircraft (helicopters) noise. Equipment used during construction would include earthmoving equipment for civil works, diesel generators, trucks and cranes with similar noise outputs to farm machinery e.g. Tractors. There is predicted to be an increase in noise associated with blasting activities in the vicinity of the Project, if it is required. This activity, if undertaken, will generate noise but will be infrequent, localised and small-scale. Table 4.4 describes the mitigation and management controls that will be implemented to minimise noise and vibration impacts during construction of the Project.

Table 4.4: Noise and Vibration Mitigation and Management Controls

Aspect	Detail
Objectives	Avoid and or minimise noise and vibration emissions during construction works
Legislation and other guidance	*Environment Protection Act 1993* (SA) Environmental Protection (Noise) Policy 2007 Australian Standard AS 2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives (AS 2187.2 – 2006) Management of Noise and Vibration: Construction and Maintenance Activities, Environmental Instruction 21.7 (DPTI, 2017)
Potential Impacts	Increase in noise and vibration causing nuisance to the local community. Changes in the behaviour of fauna, including breeding behaviour and social interactions.
Mitigation and control measures	Design of equipment in accordance with relevant standards and industry guidelines. Regular maintenance of equipment. Consult with landowners if noise generating activities in the vicinity of residences are planned outside normal construction hours. Complaints register and corrective action program. Community consultation process. All civil aircraft comply with the Air Navigation (Aircraft Noise) Regulations 2018. Noise reduction devices such as mufflers will be fitted and operate effectively. Blasting (if required) will be undertaken in accordance with regulatory requirements. Landowners in close proximity to potential blasting events (if required) will be notified. Truck movements limited to designated routes.

4.5 Flora and Fauna

During the construction phase of the Project, activities including (but not limited to) land clearance, saline emissions (for dust suppression and foundation compaction) and placement of powerline infrastructure have the potential to impact the abundance and diversity of native flora. Loss of native vegetation (through clearance), vehicle movements and illumination at night (from accommodation camps and or night works) all have the potential to impact the abundance, diversity and behaviour of native fauna. An increase and spread of weeds and increase in feral animals may also result from construction activities of the Project. The mitigation and management controls for the impacts of construction of the Project on native vegetation clearance (Table 4.5), native fauna (Table 4.6) and weed and feral animals (Table 4.7) are described in their respective tables below.

4.5.1 Native Vegetation Clearance Management

Table 4.5: Native Vegetation Clearance Mitigation and Management Controls

Aspect	Detail
Objectives	Minimise vegetation clearance and ensure it is offset by long-term actions that deliver a significant environmental benefit (SEB).
Legislation and other guidance	*Environment Protection and Biodiversity Conservation Act 1999* (Cth) *National Parks and Wildlife Act 1972* (SA) (Schedules 7, 8 and 9 of the Act) (NPW Act) *Native Vegetation Act 1991* (SA) *Native Vegetation Regulations 2017* (SA) *Natural Resource Management Act 2004* (SA)
Potential Impacts	Habitat fragmentation and reduction in habitat size and quality Loss of native vegetation. Weed infestation. Soil erosion.
Mitigation and control measures	Where practicable, avoid locating transmission towers, access roads and laydown areas in the following habitats: • Minor drainage lines and outwash plains with stony surfaces and loamy sand or clay sand soils which are potentially important for the southern sea-heath and large-flower groundsel. • Taller and denser chenopod shrublands that occur in drainage lines and chenopod shrublands surround drainage lines supporting open woodlands which are potentially important for Western grasswren. • Taller chenopod shrubland and lignum habitat in minor drainage lines which are potentially important for Thick-billed grasswren (eastern) • Inland freshwater wetlands, mudflats and saline lakes which are potentially important for migratory waders including curlew sandpiper. • If present, spinifex (Triodia spp.) hummock grassland on stony plains or chenopod shrublands and adjacent samphire low open shrubland, chenopod shrubland, and areas of mulga which are potentially important for the night parrot. • Low-lying gilgais (i.e., small, depression in the soil surface in expanding clay soils) and watercourses of gibber plains with chenopod shrubland or tussock grassland cracking clay habitat which are potentially important refuge habitat for the plains mouse. Complete targeted pre-construction surveys for important habitats of nationally threatened flora and fauna, including: • Southern sea-heath prior to construction on outwash plains on southern foot-slopes of Arcoona Plateau. • Large-flower groundsel prior to construction on preferred stony slope habitat in the southern portion of alignment. • Thick-billed grasswren (eastern) preferred habitats of taller chenopod shrubland and lignum habitat in minor drainage lines within the northern portion of the alignment. • Western grasswren (Gawler Ranges) preferred habitats of open chenopod shrublands that surrounds minor drainage lines supporting open woodland within the southern portion of the alignment. • Any unknown areas of potential breeding habitat for the night parrot, which consists of spinifex (*Triodia* spp.) hummock grassland. • Plains mouse refuge habitat of deep cracking clay gilgais or broad run-on interdune swales throughout the alignment.

Aspect	Detail
	If important habitats for nationally threatened flora and fauna are detected through pre-construction surveys, demarcate the area and create a 50 m buffer to avoid clearance or disturbance of important habitat, where practicable. If important habitats for nationally threatened flora and fauna cannot be avoided develop site specific mitigation measures in consultation with appropriately experienced ecologist. Restrict the disturbance footprint to the minimum necessary to safely carry out the activities. Utilise existing disturbed or degraded areas where practicable (e.g. for laydown areas). External land disturbance approvals process; appropriate SEB credit to be established (and not exceeded) prior to land disturbance being undertaken. Install bunting around potential preferred habitat identified during targeted surveys or pre-disturbance site clearances, where appropriate, to ensure no disturbance beyond the essential vegetation clearance footprint. Compliance with internal land disturbance approval process. Land disturbance reconciliation during and after construction. GIS system to record / identify clearance areas and status. Area-specific and site inductions and training. Protection of sensitive habitats and species, when encountered, in accordance with work plans and training.

4.5.2 Native Fauna

Table 4.6. Native Fauna Protection Mitigation and Management Controls

Aspect	Detail
Objectives	Minimise impacts to native fauna including via vegetation clearance (see Section 4.5.1) and implement management strategies to avoid damage to protected fauna
Legislation and other guidance	*Environment Protection and Biodiversity Conservation Act 1999* (Cth) *National Parks and Wildlife Act 1972* (SA) (NPW Act) *Native Vegetation Act 1991* (SA) *Native Vegetation Regulations 2017* (SA) *Natural Resource Management Act 2004* (SA)
Potential Impacts	Injury or direct mortality through strike with vehicles or machinery Impacts to breeding regimes as a result of increased disturbance, changes in noise levels and changes in light levels. Vegetation clearance and the introduction and / or spread of weeds or predatory animal pests may indirectly affect fauna values. Illumination at night.
Mitigation and management controls	Line spacing between phase and ground conductors will be greater than 150 cm. Transmission line insulation of phase and/or grounds where necessary and use of perch discouragers where necessary. Attach bird diverters to transmission line conductors and/or the top-most earth/shield wire at regular intervals to increase visibility of the lines on sections of the alignment adjacent to potential water bird foraging habitat where the level of risk increases beyond that already presented by existing transmission lines. Use of ball markers and flappers to reduce bird collisions with the line. Placement of camps near already disturbed areas e.g. highway / substation / pastoral infrastructure and utilising lighting type that limits illumination away from the area required. Traffic Management Plan; including designated speed limits, appropriate constraints on travel at dawn and dusk, vehicles restricted to tracks, and effective signage where potential ecological constraints exist to raise awareness and further control speeds in these areas. Record native fauna interactions. Area-specific site inductions and training. Regularly check any open excavations for trapped fauna or provide measures to allow their escape. Temporary fencing used to prevent stock or large fauna entrapment in excavations where appropriate. Protection of sensitive habitats and species, when encountered, in accordance with work plans and training.

4.6 Weed and Feral Animal Control

Table 4.7: Weed and Feral Animal Mitigation and Management Controls

Aspect	Detail
Objectives	Prevent the increase or movement of weeds and feral animals
Legislation and other guidance	*Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* (Cth) *Native Vegetation Act 1991* (SA) *Native Vegetation Regulations 2017* (SA) *Natural Resource Management Act 2004* (SA)
Potential Impacts	Increase in existing weeds. Establishment of new weeds. Increase in feral animals.
Mitigation and management controls	Weeds
	Minimising ground disturbance; design will consider use of existing tracks wherever possible, minimising new clearance and associated risk of weed incursions. Pre-construction inspection to identify any areas of weed infestation requiring specific management measures. Appropriate disposal of any noxious weeds cleared as part of the project Implement weed hygiene practices such as vehicle wash-downs and inspections during construction as well as post-construction weed surveillance and control programs. Weed Red Alert List for quick identification, provided with induction program where relevant and available on site. Minimising ground disturbance through restriction of vehicle movements and materials to designated construction zones, laydown areas and tracks. Periodic survey (e.g. post completion of construction, after significant rain) to identify and prioritise treatment programs for declared and environmental weeds.
	Feral Animals
	Waste Management Plan; implement protocols for management of waste during construction to avoid attracting feral pest animals. Records of feral animal observations. Feral Animal Eradication Program should an increase in the abundance or diversity of feral animals be observed.

4.7 Protection of Sites of Cultural Heritage

The land traversed by the transmission line is subject to two Native Title Determinations; The southern 32 km is within the determined Barngarla Native Title Claim (National Native Title Tribunal (NTTT) Number SCD2016/001) and the remaining area lies within the determined Kokatha People (Part A) Native Title Determination (NNTT Number SCD2014/004). Although the Project has a relatively small and discrete disturbance footprint, land clearing activities may result in the removal, relocation or damage of artefacts that are of significance to the heritage and culture of the Aboriginal communities (Barngarla and Kokatha People). Areas identified for disturbance are surveyed in accordance with the Land Clearance Approval process as agreed between OZ Minerals the Barngarla Determination Aboriginal Corporation and the Kokatha Aboriginal Corporation. OZ Minerals will continue to work with the Barngarla and Kokatha People to ensure all site selections have been undertaken with their approval. There are no known sites of non-Indigenous historical significance which have been identified within the Project Area. Table 4.8 addresses the mitigation and management controls to be implemented in order to avoid and or minimise impacts to Aboriginal and non-Indigenous cultural heritage sites.

Table 4.8: Protection of Sites of Cultural heritage Mitigation and Management Controls

Aspect	Detail
Objectives	Avoid impacts to Aboriginal and Non-Aboriginal heritage areas.
Legislation and other guidance	*Aboriginal Heritage Act 1988* *Aboriginal and Torres Strait Islander Heritage Protection Act 1994* (Cth) *Development Act 1993* (SA) *Environment Protection Act 1993* (SA) *Heritage Places Act 1993* (SA) *Heritage Places Regulations 2005* (SA) *Native Title Act 1993* (Cth) *Native Title Act 1994* (SA)
Potential Impacts	Disturbance of sites that are of significance to the culture and storylines of Aboriginal communities. Removal, relocation or damage of artefacts that are of significance to the heritage and culture of Aboriginal communities. Disturbance of sites of non-Indigenous heritage (local communities).
Mitigation and management controls	Avoidance of sites of cultural heritage significance as determined in consultation with the Barngarla and Kokatha People. Cultural Heritage Assessment with the Barngarla and Kokatha People. Area-specific site inductions and training. GIS system to record/identify clearance areas and status. Cultural Heritage Management Plan, including new discovery reporting procedures. Identification and fencing of sites of cultural heritage significance. Land disturbance reconciliation during and after construction.

4.8 Waste Management and Chemical Handling and Storage

Construction of the Project will result in waste generation and the requirement for chemicals and hydrocarbons to be stored and used on site. The accidental discharge of chemicals and hydrocarbons may result in contamination of soil or water resources. Mitigation and management controls for waste generation (Table 4.9) and chemical handling and storage (Table 4.10) are described in their respective tables below.

4.8.1 Waste Management

Table 4.9: Waste Generation Mitigation and Management Controls

Aspect	Detail
Objectives	Minimise environmental impacts from wastes and implement reasonable measures to minimise waste generation.
Legislation and other guidance/	*Environment Protection Act 1993* (SA) Environment Protection (Water Quality) Policy 2015 AS 1940-2004: The Storage and Handling of flammable and combustible liquids Bunding and Spill Management Guideline (EPA, 2016b) (SA) Environment Protection (Waste to Resources) Policy 2010 (SA) National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) *Natural Resources Management Act 2004* (SA) *South Australian Public Health Act 2011*(SA) *South Australian Public Health (Wastewater) Regulations 2013* (SA).
Potential Impacts	Contamination of soil and water resources. Reduced amenity. Attraction of pest animal species.
Mitigation and management controls	Appropriate location of camps and mobile facilities away from watercourses. Wastewater managed in accordance with health regulations and Environment Protection (Water Quality) Policy. Identification, separation and provision of adequate waste disposal for all waste streams in accordance with permits and work plans. All commercial or industrial waste is disposed using licensed chemical and waste transporters. Establishment of Chemical Database including copies of SDS and storage, handling and disposal requirements. Liquid waste (including hydrocarbons, paints and solvents) will be stored in sealed drums or containers in a bunded area, or on self-contained bunded pallets, before removal from the site by an EPA licensed contractor for recycling, where possible, or disposal to a licensed facility. Secure lids will be fitted to bins that store food waste to prevent scavenging by birds and animals.

4.8.2 Chemical Handling and Storage

Table 4.10: Chemical and Hydrocarbon handling and Storage Mitigation and Management Controls

Aspect	Detail
Objectives	Avoid/minimise impacts associated with the release of hazardous substances or materials. Implement reasonable measures to minimise the likelihood of chemical and hydrocarbon spills on-site during the Project.
Legislation and other guidance	*Environment Protection Act 1993* (SA) Bunding and Spill Management Guideline (EPA, 2016b) (SA) Environment Protection (Water Quality) Policy 2015 AS 1940-2004: The Storage and Handling of flammable and combustible liquids Environment Protection (Water Quality) Policy 2015 National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) *Natural Resources Management Act 2004* (SA)
Potential Impacts	Contamination of soil or water resources.
Mitigation and management controls	Spill and emergency response procedures. Accidental Spill management controls: • Equipment maintenance. • Spill and emergency response procedures • SA EPA Licensed transporters. • Contaminated land register. • Regular inspection programs of construction sites where bunding either temporary or permanent is installed to ensure appropriate use, placement of spill kits, clean up procedures and handling procedures • Induction contains process for bringing chemicals and hydrocarbons onsite including requirements for storage, handling and disposal. • Contracts contain conditions relevant to design, management of the storage and handling of chemicals and hydrocarbons • All commercial or industrial waste is disposed of in an EPA licensed facility • Establishment of Chemical Database including copies of SDS and storage, handling and disposal requirements. Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards. Equipment maintenance to prevent spills. Licensed chemical and waste transporters. Any potentially disturbed ASS managed in accordance with industry standards based on principals of avoidance, minimisation of disturbance and treatment. • Avoidance - potential areas of ASS will be avoided where practicable when finalising the construction methodology and location of temporary construction areas. • Minimisation of disturbance - when disturbance of potential ASS cannot be avoided, alterations to the design and construction methodology will be investigated to limit the extent of disturbance of potential ASS material. • Treatment – where required, soils will be immediately neutralised and managed, or segregated and isolated from uncontaminated soil and treated at a separate facility.

Aspect	Detail
	Chemical and fuel storage, handling and emergency response procedures will be developed in accordance with AS 1940-2004. The quantity of chemicals stored on site will be kept to a minimum. Designated equipment lay down areas will be established. All vehicle re-fuelling will be undertaken in a designated re-fuelling area and appropriate measures implemented (e.g. drip trays, bunding) to contain refuelling nozzle leakages. Contamination booms, spill kits and absorption materials (as appropriate) will be maintained on site to contain and recover any inadvertent spillage of fuels or chemicals.

4.9 Fire, Risks and Prevention

Accidental fires can eventuate from ignition sources common to a construction zone. Fire may result in the loss of abundance and/or diversity of native vegetation and fauna. Fire may spread causing damage to the ancillary services and structures and smoke may disrupt traffic on adjacent roads. Although occasional bushfires are a natural occurrence, an increased incidence of bushfires as a result of human activity could have a profound impact on the ecology of the arid zone. Implementation of best practice bushfire management strategies, will be undertaken in consultation with the CFS and State Emergency Service (SES). Mitigation and management controls to manage bushfire risk during the construction phase are described in Table 4.11. Once commissioned, there is limited potential for bushfires to be initiated through vegetation making contact with transmission lines in an environment dominated by sparse, low vegetation communities.

Table 4.11: Fire, Risk and Prevention Mitigation and Management Controls

Aspect	Detail
Objectives	Minimise the risk of fire resulting from the construction of the Project
Legislation and other guidance	*Fire and Emergency Services Act 2005* (SA) *National Parks and Wildlife Act 1972* (NPW Act) (SA) *Native Vegetation Act 1991* (SA) *Native Vegetation Regulations 2017* (SA) *Natural Resource Management Act 2004* (SA) Australian Standard 1940-2004 The storage and handling of flammable and combustible liquids Bushfire Safety and Survival for Businesses and Organisations (CFS, *no date*) Ecological Fire Management Guidelines for Native Vegetation in SA (DEWNR, 2013)
Potential Impacts	Human health and safety Loss of native vegetation and fauna Loss of property, crops, stock Damage to Project infrastructure Smoke may disrupt traffic on nearby roads
Mitigation and management controls	All equipment fitted with appropriate firefighting equipment. Site based emergency response team.

Aspect	Detail
	Minimisation of ignition risk through operation of vehicles and other equipment with ignition sources within designated construction zones, laydown areas and tracks only. Clearance distances between vegetation and powerlines established and maintained in accordance with the Electricity (Principles of Vegetation Clearance) Regulations 2010. Liaise with CFS during the pre-construction stage with regards to requirements surrounding construction during the 'Fire Danger Period'. Maintaining awareness of local seasonal restrictions, particularly regarding hot works during fire ban season. Undertaking welding activities in accordance with Australian safety standards and the safety management plan for the activities. Restriction of high risk fire activities during fire periods. Development and implementation of fire and emergency response strategy. Education of workforce about local bushfire risk (during site inductions). Undertaking training and routine exercises to demonstrate emergency preparedness and effectiveness. Ensure that adequate resources are in place, including communications systems, to enable all fire and emergency response plans to be effectively enacted. Implementing a program to regularly inspect assets.

4.10 Local Community and Third Party Users

The construction of the Project has the potential to impact on residents, communities and stakeholders in a number of ways including increased dust emissions (Section 4.3), noise (Section 4.4), visual amenity, personal safety and the influx of workers into a generally quiet, rural area. Table 4.12 describes the mitigation and management controls that will be implemented to minimise impacts to the local community and third party users not already covered in Section 4.3 and Section 4.4. The construction of the Project also has the potential to impact local community and third party users through increased traffic on local roads, delays to normal travel routes and or damage to access tracks; these potential construction traffic related impacts will be addressed in a specific Traffic Management Plan that will be developed prior to construction.

Table 4.12: Local Community and Third Party Users Mitigation and Management Controls

Aspect	Detail
Objectives	Minimise impacts from construction activities of the Project to landowners, local community and third party users
Legislation and other guidance	*Environment Protection Act 1993* (SA) *Native Vegetation Act 1991* *Natural Resource Management Act 2004* AS 1940-2004: The Storage and Handling of flammable and combustible liquids Bunding and Spill Management Guideline (EPA, 2016b) (SA)
Potential Impacts	Visual amenity. Injury to local community / third party land users. Influx of workers into a generally quiet, rural area.

Aspect	Detail
Mitigation and control measures	Third party infrastructure identified during detailed design and addressed in construction documentation as appropriate. Restrict the Project footprint to the minimum necessary. Distances to sensitive receptors considered during the design of lighting and camp facilities. Placement of camps near already disturbed areas such as highways or pastoral infrastructure. A Right of Way (ROW) will be designed to provide a safety clearance margin between the high voltage transmission lines and surrounding structures and vegetation. Site security and access control measures where appropriate (e.g. signage and/or fencing of high-risk areas). Appropriate signage on infrastructure and key access points. Contractors and employees will complete site specific inductions, follow appropriate construction practices and be held to will be held to performance standards that prevent drug and alcohol abuse and anti-social behaviour, for example: • Health and Wellbeing Performance Standards including • Fitness for Work Standard • Contractor selection • Contractor management. Maintenance of unsealed roads. Traffic Management Plan include traffic management and speed limits. Contractor vehicle maintenance. Ongoing consultation with landowners regarding activities. Complaints register and corrective action program. Community engagement and sponsorship. Tower design and lighting in accordance with Civil Aviation Safety Authority (CASA) requirements. Appropriate construction practices associated with civil works implemented at all times. Timing of construction activities to minimise light disturbance at night. Avoiding light spill by using directional lighting as much as practical.

5 ABBREVIATIONS AND GLOSSARY

Abbreviations and Acronyms

Acronym	Expansion
AHD	Australian Height Datum
ASS	Acid Sulphate Soils
CASA	Civil Aviation Safety Authority
CEMP	Construction Environment Management Plan
CFS	Country Fire Service
Cth	Commonwealth
DA	Development Application
DEWNR	Department of Environment, Water and Natural Resources (now Department for Environment and Water)
DPTI	Government of South Australia, Department of Planning, Transport and Infrastructure
ECMP	Environment and Community Management Plan
EMS	Environmental Management System
EPA	Government of South Australia, Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ERP	Emergency Response Plan
GIS	Geographic Information System
MSDS	Material Safety Data Sheets
NEPM	National Environment Protection Measure
NGER	National Greenhouse and Energy Reporting
NNTT	National Native Title Tribunal
NPW Act	*National Parks and Wildlife Act 1972*
NRM Act	*Natural Resources Management Act 2004*
ISO	International Organization for Standardization
ROW	Right of Way
SA	South Australia
SEB	Significant Environmental Benefit
SEDMP	Soil Erosion and Drainage Management Plan
SES	State Emergency Service
WBCSD	World Business Council for Sustainable Development
WHS	Work Health and Safety
WPA	Woomera Prohibited Area

Units of Measure

Abbreviation	Expansion of Unit
km	kilometre(s)
kV	kilovolt
m	metre(s)
m^2	square metre(s)

6 REFERENCES

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Appendix I. Impact Assessment Framework Tables

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CARRIEWERLOO SUBSTATION TO PROMINENT HILL ELECTRICITY TRANSMISSION LINE

Impact Assessment Framework Tables

July 2018

ACKNOWLEDGEMENTS

OZ Minerals recognises that the sense of place and belonging of the Kokatha People and the Barngarla People is linked to their identity, creation stories, travel, trade, ceremonies, family and places held sacred. We recognise the deep and ongoing feelings of relationship and attachment they hold for their lands.

OZ Minerals acknowledges both the Kokatha and Barngarla connection to 'country', the contribution of Traditional Owners to their region and the enduring importance of values, cultural authority, cultural norms and customary laws.

The Far North region of South Australia also has a long and rich history of pastoralism. The proposed Electricity Transmission Line Project is located on a number of Pastoral Stations. OZ Minerals recognises the importance of the land to its owners and their operations and acknowledges their cooperation in developing the Project.

OZ Minerals places great value on our relationships with all stakeholders and seeks to work in partnership, to create value wherever possible.

DISCLAIMER

This Report has been prepared for submission to the South Australian State Commission Assessment Panel under the *Development Act 1993* (SA). No one other than the South Australian Minister for Planning should rely on the information contained in this Report to make, or refrain from making, any decision.

In preparing this Report, OZ Minerals Prominent Hill Operations Pty Ltd has relied on information provided by specialist consultants, government agencies and other third parties. OZ Minerals Prominent Hill Operations Pty Ltd has not fully verified the accuracy or completeness of that information, except where expressly acknowledged in this Report.

This Report has been prepared for information purposes only and, to the full extent permitted by law, OZ Minerals Prominent Hill Operations Pty Ltd, in respect of all persons other than the South Australian Minister for Planning:

- Makes no representation and gives no warranty or undertaking, express or implied, in respect to the information contained herein; and
- Does not accept responsibility and is not liable for any loss or liability whatsoever arising as a result of any person acting, or refraining from acting, on any information contained in this Report.

NOTE ON CURRENCY

Where possible, the information contained in this Report is up to date as at July 2018. This was not possible where parts of this Report were prepared from information provided by third parties (as discussed in in the second paragraph above) prior to this Report being finalised.

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1 IMPACT ASSESSMENT FRAMEWORK

1.1 Background

OZ Minerals Limited (OZ Minerals) is proposing to construct a 237 km transmission line (the Project) from 20 km northwest of Port Augusta to 10 km west of Olympic Dam as discussed in the Development Application to which this report is appended.

This Impact Assessment Framework Summary Report provides the outputs of the environmental and social impact and risk assessments undertaken for the purpose of the Development Application. The report provides a complete set of assessment tables grouped by pathway, based on the assessment framework developed for the project and as described in this document. The information presented in the assessment tables draws on information from the following chapters of the Development Application:

- Chapter 5: Project Description (Source)
- Chapters 6 – 16: Aspects of the Environment
  - Existing Environment
  - Impact Assessment (Description of Effects, Identified Source-Pathway-Receptor Linkages and Assessment of Impact
- Chapter 17: Project Engagement.

1.2 Assessment Framework Development

OZ Minerals has developed an assessment framework that supports a project throughout its lifecycle to manage environmental and social impacts and risks in a transparent and repeatable manner. OZ Minerals uses the framework to assess all its proposed mining operations and related infrastructure.

The assessment framework draws on the requirements of ISO 14001, State and Commonwealth regulation and internationally recognised frameworks such as those established by the International Finance Corporation of the World Bank Group.

The following sections provide an overview of key components of the OZ Minerals assessment framework and how they relate to this document, and include:

- Source-pathway-receptor model
- Effect and impact
- Unplanned events (Risk)
- Design controls and management controls
- Assessment framework outputs.

The S-P-R (Source-pathway-receptor) model is used to identify credible potential impacts of the Project. If an impact is identified then an assessment of the significance of that impact is undertaken to ensure that adequate controls have been applied, and that the impact is managed to a justifiable level.

The OZ Minerals impact assessment framework approach has been applied and presented in this document to suit the requirements of the Development Act as well as the requirements of the Department of Planning, Transport and Infrastructure and referral agencies. Consequently, the assessment for each aspect of the environment has been presented independently from Chapter 6 to Chapter 16 of the Development Application (DA), and below.

1.2.1 Source-Pathway-Receptor Model

The framework builds upon the foundation of a source-pathway-receptor (S-P-R) model, adjusted to articulate the effect to pathways, and impacts on receptors. An S-P-R linkage assessment subsequently identifies when an impact significance assessment is required to be undertaken (i.e. when an S-P-R linkage is confirmed) for a receptor. OZ Minerals defines source, pathways and receptors as:

Source: A project element that can interact with the environment.

Pathway: The medium by which the effect originating from the source reaches a receptor.

Receptor: A discrete, identifiable attribute or associated entity that is measurably impacted by an effect to a pathway.

Sources, pathways and receptors for the Project were initially identified at a workshop which generated a broad range of possible S-P-R's. These were subsequently refined into a list of credible and realistic S-P-R's as Project detail was developed and detailed investigations and stakeholder consultation were undertaken. These are presented in Chapters 6 to 16 of the Development Application and summarised below.

1.2.2 Effect and Impact

OZ Minerals has taken the approach to pathways and receptors as per the definitions above. The definitions of effect and impact are as follows:

Effect: An effect can occur on a pathway as a result of a source. It is a deviation from the expected and can be positive and/or negative.

Impact: Any certain and defined change to a receptor, whether adverse or beneficial, wholly or partially resulting from a source affecting a pathway.

For an impact to occur there needs to be a linkage between the source, pathway and receptor. Whilst an effect on a pathway may occur and not result in an impact (i.e. no link to the receptor), there may

remain a perceived link (or assigned value) from the perspective of stakeholders. In such circumstances, the S-P-R linkage is assessed as material and an impact assessment is carried out. The materiality of an S-P-R linkage may also be acknowledged in the case of unplanned events, where there would ordinarily not be a linkage unless an unplanned event occurred. In this case a risk assessment is undertaken (see Section 1.2.3).

Materiality: The instance when particular impacts are considered to be significant on the basis of perception or stakeholder consultation.

Pathways identified for the Project include Land (Soil, Habitat, Visual Amenity, Cultural Heritage), Air (Dust, Noise and Light), Groundwater, Surface Water, and Socio-economic (Economy and Social Infrastructure). Impact identification numbers (Impact IDs) used throughout the assessment are grouped by pathway.

Receptors have been grouped into the following key categories:

- Communities – Aboriginal Communities, Local Communities and Third-Party Users (Pastoralists and Businesses)
- State – South Australia
- National – Australia (includes International Obligations that Australia has for matters of national environmental significance)
- Flora – Common, State or Nationally Significant Species
- Fauna – Common, State or Nationally Significant Species.

Once a source-pathway-receptor linkage is confirmed, an Impact Significance assessment is carried out, which examines the receptor resilience, importance and the duration of the impact to derive an impact significance level. Uncertainty that exists through the impact assessment in terms of inputs, methods and the sensitivity of predictions to input variations, is then assessed and given an uncertainty rating. Uncertainties can include:

- Inputs associated with the options that remain as a part of the Project description
- The breadth and scope of the baseline studies; and / or
- The science undertaken in the determination of the magnitude of the effect and / or the impact.

The impact significance level can range from 1-125, and is further elevated if the uncertainty is high. OZ Minerals have adopted the approach that an impact is considered to be significant in those circumstances where the impact rating is greater than or equal to 48.

Final impact ratings that are not significant (<48) have been further categorized as either Very Low (1-4), Low (5-23) or Medium (24-47).

The detailed assessments for all impact events identified for the Project are contained below, and are summarised for each aspect of the environment in Chapters 6 to 16 of the DA.

1.2.3 Unplanned Events (Risk)

The OZ Minerals assessment approach is based upon the distinction between impact (planned event) and risk (unplanned event). Both play an important part in project definition and form a part of this assessment. 1

Risk: The impact of uncertainty on objectives (ISO 31000:2009). It consists of two components—the consequence and its likelihood.

As mentioned in Section 1.2.2, an impact is a certain and defined change to a receptor resulting from a source affecting a pathway.

Importantly, an impact assessment quantifies and allows communication of the impact of a project to all stakeholders if it is constructed and operated in accordance with its scope and design.

Risk emerges when unplanned events that lie outside the previous assessment stages threaten to increase the impact of a project.

The Project risk assessment has been undertaken in accordance with ISO31000. The risk rankings and matrix utilised during the risk assessment process are described in Chapter 2. The process undertaken captures the existing or proposed risk controls and assigns a consequence and likelihood rating to the final risk ranking.

Risk assessments undertaken for unplanned events are contained in Section 2.4, and are summarised for each aspect of the environment in Chapters 6 to 16 of the DA.

1.2.4 Control and Mitigation Strategies

OZ Minerals has considered the role of design controls and management controls in the assessment process. Where possible, a conservative effect assessment has been undertaken to ensure the potential impacts of the Project consider a worst case scenario. Controls for the mitigation of potential impacts and unplanned events associated with the Project have been categorised for each pathway as either design controls or mitigation strategies.

The transmission line alignment, access track alignment and transmission structure placement are principal design controls. They have been selected to follow existing infrastructure corridors, avoiding areas of high cultural significance and important habitat for threatened species, to minimise the potential for disturbance. Specific design controls for each aspect are detailed in each chapter of this report, together with management controls and mitigation strategies to further reduce the potential for impact as a result of Project activities. Controls are also collated in the Draft Construction Environmental Management Plan (CEMP) which is Appendix H to the Development Application (DA).

1.2.5 Assessment Framework Outputs

OZ Minerals has applied the impact assessment framework to assess information associated with the credible potential impacts originating from either the construction or operation of the Project.

The key outputs of the assessment framework are summarised as:

- Identification of credible potential Source-Pathway-Receptor linkages (planned events) and providing sufficient justification behind the statement of impact, including an explanation of any uncertainty
- Identification of legislative requirements
- Determination of materiality of any potential impact on the basis of perception or stakeholder consultation
- Assessment of impact significance
- Assessment of impact uncertainty by stating any uncertainty in any element of the assessment to develop a statement of impact
- Assessment of the relevant risks (unplanned events) that may lead to an impact.

The template for the assessment framework output with explanatory text included is shown in Section 4.1.5 of the DA The individual potential impact assessments are contained below.

Potential Impact IDs are referenced throughout the DA. It is recommended that a copy of the Impact Assessment Framework Tables be readily available to assist the reader to be able to quickly access these and understand the potential impacts.

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2 IAF RANKING TABLES

2.1 Impact Significance

The impact assessment evaluates the significance of the impact on the basis of resilience, receptor importance and duration.

Resilience: The inherent susceptibility of the receptor to the source and its ability to adapt to the effect. It does not refer to the status of the population, for example, endangered, not endangered.

Importance: The relevance of the exposed population. For example, the exposed population may be critically endangered, in which case the Receptor Importance will be ranked as 'high'. Receptor Importance is interpreted differently for receptors such as pastoralists and local community. In this case, it is more closely associated with geographical extent of impact and number of persons/locations impacted. For example, an impact on an individual will be ranked as having less importance than an impact on persons nationwide.

Duration: The duration of the impact from the time of its commencement.

The ranking of the impact significance is calculated by multiplying the resilience, receptor importance and duration ranking values provided in Table 2.1, Table 2.2 and Table 2.3. Given that each of these factors can range from a value of 1 to 5, the total impact significance level can range from 1 to 125.

OZ Minerals have adopted the approach that an impact is considered to be significant in those circumstances where the impact ranking is greater than or equal to 48. Impacts with rankings below 48 are considered on a case-by-case basis to determine whether particular impacts are considered to be significant on the basis of perception or stakeholder consultation (this is referred to as materiality).

Note that "48" is a trigger level only, and impacts with rankings below 48 can be considered on a case-by-case basis to determine whether particular impacts are considered to be material on the basis of perception or through stakeholder consultation.

Table 2.1: Resilience Ranking

Ranking	Description
1	Exposed receptor population is adaptable to the effect/change
2	Not used
3	Exposed receptor population has moderate adaptability to the effect/change
4	Not used
5	Exposed receptor population has very limited adaptability to the effect/change

Table 2.2: Receptor Importance Ranking

Ranking	Description
1	Abundant/ Individual/Personal
2	Conservation dependent/ Local
3	Vulnerable/ Regional
4	Endangered/ State
5	Critically endangered/ National

Table 2.3: Duration Ranking

Ranking	Description
1	One year from commencement of impact
2	Ten years from commencement of impact
3	One hundred years from commencement of impact
4	One thousand years from commencement of impact
5	Greater than one thousand years from commencement of impact

2.2 Uncertainty Assessment

2.2.1 Inputs

Inputs refer to the nature of any assumptions made and the quality of the data that were used in predicting the effect on the pathway, and is to be ranked in accordance with Table 2.4.

Table 2.4: Input Uncertainty Ranking

Ranking Value	Description
A	Extensive data; field verified; limited use of assumptions.
B	Limited data; use of industry recognised or benchmarked data; some assumptions.
C	Plugged data; limited (if any) verification; numerous assumptions.

2.2.2 Method/Model

Method refers to the quality of methods and models that were used in the pathway, effect or impact assessment, and is to be ranked in accordance with Table 2.5.

Table 2.5: Model and/or Methodology Uncertainty Ranking

Ranking Value	Description
A	Recognised method and its application; industry standard approach.
B	New method or application of existing method; not industry recognised.
C	Ad hoc methodology; informal approach.

2.2.3 Sensitivity

Sensitivity refers to the fact that assessments may vary significantly with changes to data and assumptions, irrespective of the quality of inputs and methods used, and is to be ranked in accordance with Table 2.6.

Table 2.6: Sensitivity Ranking

Ranking Value	Description
A	Predictions not sensitive to input variation.
B	Some sensitivity of predictions to input variations.
C	Predictions highly sensitive to input variations; sensitivity not studied/known.

2.3 Monte Carlo Analysis

To account for uncertainty, OZ Minerals have applied a Monte Carlo technique which is a mathematical method in which a distribution can be applied to the various numerical input factors that contribute to a predicted outcome. It is considered appropriate to report the 50% and 95% percentile values (P50, P95).

These two parameters (P50, P95) are important because they provide an indication of statistical certainty in relation to the impact rating. These outputs do not have to be treated absolutely but can be the basis for the discussion of uncertainty with stakeholders. Use of the P95 value provides the most conservative approach, i.e. there is a 0.95 probability that the value will be equal to or less than the P95 value.

2.4 Risk Assessment

The Carrapateena Project risk assessment was undertaken in accordance with ISO31000. Risks are those unplanned events that lie outside the previous assessment stages.

Table 2.7: Likelihood Scale

Likelihood Scale		
Level	Description	Criteria (read as either/or)
A	Almost Certain	Consequence is likely to be of a high frequency; >> 50% chance.
B	Likely	Likely consequence within a six month period; approx. 0.5% probability of occurrence in period of interest.
C	Possible	Likely occurrence/consequence within a 12 month period; approx. 0.1% probability of occurrence in period of interest.
D	Unlikely	Consequence could occur within a one to five year timeframe; 0.01% probability of occurrence in period of interest.
E	Rare	Consequence may occur in exceptional circumstances. Consequence has rarely occurred in the industry and is not expected in the life of the mine; << 0.01% probability of occurrence in period of interest.

Table 2.8: Risk Consequence Scale

Rating	Description	Ecological	Cultural	Social
1	Insignificant	Insignificant impact to flora and fauna. Minor local habitat modification and/or lifecycle disruption for a listed species. No loss of individual or listed species.	Reparable damage to site or item of low-moderate cultural significance.	No or very low impact on community.
2	Minor	Local short-term decrease in abundance of some species with no lasting impacts on local population. Moderate local habitat modification and/or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species.	Irreparable damage to site or item of low-moderate cultural significance.	Minor impact on community. Impact confined to a very small area.
3	Moderate	Local long-term decrease in abundance of some species resulting in some change to ecological community structure. Substantial local habitat modification and/or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species.	Reparable damage to heritage site or item of national significance.	Moderate impact on community. Impact confined to the local area.
4	Major	Regional decrease in abundance of some species resulting in some changes to ecological community structure. Moderate regional habitat modification and/or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species.	Irreparable damage to heritage site or item of national significance.	Serious impact on community. Impact over a regional scale.
5	Catastrophic	Regional loss of numerous species resulting in dominance of only a few species. Substantial regional habitat modification and/or lifecycle disruption for a listed species. Moderate or substantial regional decrease in size of population(s) of listed species.	Irreparable damage to heritage site or item of international significance.	Severe long-term social impact on community. Impact unconfined and/or over a large area.

Table 2.9: Risk Matrix

Likelihood	Consequence				
	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
A Almost Certain	11 High	16 High	20 Very High	23 Very High	25 Very High
B Likely	7 Moderate	12 High	17 High	21 Very High	24 Very High
C Possible	4 Low	8 Moderate	13 High	18 Very High	22 Very High
D Unlikely	2 Low	5 Low	9 Moderate	14 High	19 Very High
E Rare	1 Low	3 Low	6 Moderate	10 Moderate	15 High

3 AIR QUALITY IMPACT ASSESSMENT

IMPACT ID AQ01 Greenhouse Gas Emissions (Australia – South Australia)

IMPACT ID AQ01 Greenhouse Gas Emissions (Australia – South Australia)							
Planned Event	**Potential Impact**	Combustion of fossil fuels (i.e. diesel) releases greenhouse gas (GHG) to the atmosphere impacting on the ability to achieve State and National greenhouse gas reduction targets.			**Phase**	All	
	Source	Project	Construction activities (i.e., land clearing, civil works, tower assembly and installation and cable stringing) will require the use of earthmoving equipment, mobile fleet (including helicopters) and generators. The combustion of diesel will result in GHG emissions less than 0.004 tCO_2-e/annum.				
	Pathway	Air	The air environment along the corridor is characterised by clean air, typical of the remote, rural setting within South Australia.				
	Receptor	National	Annual Australian and South Australian GHG emissions are currently 533 Mt CO2-e/annum and 26.4 Mt CO2-e/annum respectively report for 2016 (DEE, 2018). Results for 2017 at not available at the time of submission.				
	Design Controls	Use of emissions control equipment on fixed and mobile plant and equipment.					
	Is the Linkage Confirmed	No	The emissions contribution is considered not material due to the negligible contribution to State (0.03%) and National (0.002%) levels.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with increased GHG emissions has been assessed and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The emissions contribution is considered not material due to the negligible contribution to State (0.03%) and National (0.002%) levels.	**Legislative Requirements**	*National Greenhouse and Energy Reporting Act 2007* (Cth)	

IMPACT ID AQ02 Dust Emissions and Deposition (Terrestrial Ecology – Vegetation Condition / Loss of Habitat)

IMPACT ID AQ02 Dust Deposition (Terrestrial Ecology - Loss of vegetation condition and fauna habitat)					Applicable Alignment Section -ALL
Potential Impact	Activities including land clearing, material movement and vehicles on unpaved roads / generate dust emissions that deposit on vegetation and reduce vegetation health impacting on the abundance and/or diversity of native vegetation and fauna.			**Phase**	Construction
Source	Project	Project activities including land clearing and material movements, may, in certain meteorological conditions, result in the generation of dust.			
Pathway	Air	The proposed route alignment is generally dominated by light to moderate southerly winds. Winds from the south and south east tend to dominate in summer and autumn while in winter, northerly winds often prevail. Emissions are anticipated to be restricted to the areas immediately surrounding Project infrastructure footprint.			
Receptor	Native Vegetation and Fauna (including NPW and EPBC-listed species)	Review of the Biological Database of South Australia (BDBSA) records indicate that a total of 469 flora species (consisting of 413 native species and 56 exotic species) have been recorded on or around the Study Area (5 km buffer). Species were largely represented by individuals from the *Chenopodiaceae* (Chenopod) family with other dominant representation provided by *Gramineae* (Grass) species, *Compositae* (Daisies), *Leguminosae* (Peas, Wattles) and *Malvaceae* (Refer Appendix D1 of the DA: Ecological Baseline Assessment). Eight species of state threatened flora but no nationally threatened species have previously been recorded by BDBSA within the study area. BDBSA records indicate the potential presence of up to 268 native fauna species, including 18 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events. Three threatened species have been recorded in the study area; Plains Mouse (*Pseudomys australis*), Common Sandpiper (*Actitis hypoleucos*) and Lathams Snipe (*Gallinago hardwickii*).			
Design Controls	Existing tracks will be incorporated into the design where possible to avoid construction of new access tracks, and reduce clearance footprint. Progressive rehabilitation of disturbed areas (primary, secondary rehabilitation and/or revegetation).				
Is the Linkage Confirmed	Yes	Potential increase in dust deposition onto vegetation in the vicinity of construction activities may occur. However, the impact is expected to be small scale, transient and confined to the immediate vicinity of the disturbance footprint.	**Uncertainty: S-P-R, impact statement**	Effects from dust deposition associated with the project construction have been assessed and considered appropriate.	

	Is the S-P-R Material?	Yes	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.	**Legislative Requirements**	*Native Vegetation Act 1991* (SA)
	Impact Significance	**Resilience**		1 - Adaptable	Vegetation typical of desert and arid areas are more tolerant of higher dust concentrations than vegetation in other, more temperate climates. Effects will also be minor, localised and short term.	
		Importance		5- National	Native vegetation communities and habitats supporting native fauna are well represented within the Project footprint and broader Study Area. No EPBC Act flora species are known (or expected) from the Project Area, however a conservative assessment assuming they may be present has been undertaken.	
		Duration		3 – 100 years	The recovery times for these communities are on the longer term scale due to the perennial nature of the dominant overstorey.	
		Significance Rating		15	Not Significant (<48)	
	Impact Uncertainty	**Inputs**		A	Initial baseline assessment employed rapid but recognised field survey methods across a broad study area, which has been coupled with a review of historic databases (BDBSA, PMST) and historic technical studies (BHP Billiton, 2009). Informed assumptions on the likelihood of presence / absence of species have been made on this basis (Appendix D1 of the DA: Ecological Baseline Assessment). Impacts of dust in similar environment are well understood through industry experience.	
		Method		A	Native vegetation survey was undertaken in accordance with relevant industry standards and guidelines (Appendix D1 of the DA: Ecological Baseline Assessment).	
		Sensitivity		B	Some sensitivity of predictions to input variations.	
		Uncertainty Rating		19	Not Significant (<48)	
	Final Impact Rating	19		**Final Impact Category**	Low	

IMPACT ID AQ03 Dust emissions (Local Community-Health)

IMPACT ID AQ03 Dust emissions (Local Community-Health)							
Applicable Alignment Section -ALL							
Planned Event	**Potential Impact**	Activities including land clearing and material movement and vehicles on unpaved roads generate particulate emissions ($PM_{2.5}$ and PM_{10}) that result in health impacts to the local community.			**Phase**	Construction	
	Source	Project	Project activities including land clearing and material movements, may, in certain meteorological conditions, result in the generation of wind-blown particulate matter ($PM_{2.5}$ and PM_{10}).				
	Pathway	Air	The proposed route alignment is generally dominated by light to moderate southerly winds. Winds from the south and south east tend to dominate in summer and autumn while in winter, northerly winds often prevail. Dust Emissions are anticipated to be restricted to the areas immediately surrounding Project infrastructure footprint. EPA guidelines for evaluation of distances for effective air quality management indicate no recommended distance from the proposed activity to assess potential effects; however, as a minimum standard, 1000 m distance from source to sensitive receptor is recommended for heavy industries (EPA,2016). On this assumption, a conservative 1.5 km was used as a buffer along the transmission line to evaluate the presence of any potential sensitive receptors that could be affected by dust emissions. There are no residences within 1.5 km of proposed project activities, therefore any wind-blown particulate matter resulting from construction activities is unlikely to cause any amenity or health impacts to the local community.				
	Receptor	Local community (health)	There are 6 potential dwellings within 5 km of the proposed transmission line, however at the time of submission, only one of these is known to be occupied. The nearest occupied residence is 1.8 km (Kootaberra) from the transmission line.				
	Design Controls	Existing tracks will be incorporated into the design where possible to avoid construction of new access tracks, and reduce clearance footprint.					
	Is the Linkage Confirmed	No	Construction activities may result in wind-blown particulate matter. However, there are no sensitive receptors within 1.5 km of the proposed alignment.	**Uncertainty: S-P-R, impact statement**	Dust disturbance associated with the project infrastructure has been assessed and considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	There are no residences within 1.5 km of proposed project activities, therefore any wind-blown particulate matter resulting from construction activities is unlikely to cause any amenity or health impacts to the local community.	**Legislative Requirements**	*Environment Protection Act 1993* Environment Protection (Air Quality) Policy 2016 (SA	

IMPACT ID AQ04 Noise Emissions (Common, NPW Act and EPBC Act Fauna)

IMPACT ID AQ04 Noise Emissions (Common, NPW Act and EPBC Act Fauna)				**Applicable Alignment Section -ALL**	
Potential Impact	Noise generated by surface plant and mobile fleet (including helicopters) during construction and operation activities displaces nearby fauna impacting on the abundance and/or diversity of native fauna.			**Phase**	Construction/Operation
Source	Project	Construction activities (i.e., land clearing, civil works and cable stringing) will require the use of earthmoving equipment, mobile fleet (including helicopters) and generators which will result in noise emissions. There will be temporary disturbance for 12 to 18 months during construction however the duration of disturbance at any given location on the alignment will be shorter than this). Project activities will generate limited noise emissions from surface plant and mobile fleet during maintenance activities and twice yearly inspections.			
Pathway	Air	The main existing noise sources within the study area include traffic along the Stuart Highway and Olympic Dam Highway, mining exploration and production activities, generators at some station homesteads and outstations and, aerial mustering of livestock. In the absence of road traffic noise and other localised noise sources mentioned, historical baseline noise surveys at other similar remote locations indicate that ambient daytime noise levels are typical of the remote, rural setting within South Australia.			
Receptor	Native Fauna (including NPW and EPBC-listed species)	BDBSA records indicate the potential presence of up to 268 native fauna species, including 18 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events. Of the eight nationally threatened EPBC Act fauna identified in desktop studies, five were assessed as possibly occurring in the Study Area ranging from vulnerable to critically endangered (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall;* Curlew Sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis*; Plains Mouse, *Pseudomys australis*). Twelve EPBC-listed migratory species were assessed as having the potential to occur in the Study Area. Of the 27 state threatened fauna within the Study Area, four state only listed species were considered likely to occur in the Project Area ranging from vulnerable to rare; the Musk Duck, Blue-billed Duck, Freckled Duck and Pernatty Knob-tailed Gecko and one species possibly occurs; Australian Bustard. None of these species were observed during the baseline survey (EBS 2018).			
Design Controls	No design controls are proposed.				
Is the Linkage Confirmed	Yes	Project activities will generate short term and transient noise emission effects from surface plant and mobile fleet during construction		**Uncertainty: S-P-R, impact statement**	Noise disturbance associated with the construction and operation of the project has been assessed and considered appropriate.

			which may affect fauna in the immediate vicinity.			
Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material due to the low significance of the impact, which is supported by the impact significance and uncertainty assessment detailed below.	**Legislative Requirements**	*Environment Protection Act 1993* Environment Protection (Noise) Policy 2007 (SA) *National Parks and Wildlife Act 1972* (SA)	
Impact Significance	**Resilience**		1 - Adaptable to effect / change	Any potential displacement will be short term. Habitat will remain, any displaced individuals will return to the area.		
	Importance		5 - National	Species regularly utilising the area (that may be displaced by construction noise) are locally abundant. This has been assessed as a worst-case scenario as there is the potential for EPBC-listed species to occur		
	Duration		2 – Ten years from commencement of impact	There will be temporary disturbance for 12 to 18 months during construction		
	Significance Rating		10	Not Significant (<48)		
Impact Uncertainty	**Inputs**		B – Limited data; use of industry recognised or benchmarked; some assumptions	Previous noise monitoring in the regional area has been used to inform background noise levels expected in the wider area. Assumptions include the transient nature of the construction works. Initial ecology baseline assessment employed rapid but recognised field survey methods across a broad study area, which has been coupled with a review of historic databases (BDBSA, PMST) and historic technical studies (BHP Billiton, 2009). Informed assumptions on the likelihood of presence / absence of species have been made on this basis.		
	Method		C – Ad hoc- informal	An desktop informal noise assessment was undertaken based on information available at the time of writing. Recognised ecological survey methods were utilised during rapid baseline assessment and in the assimilation of historic records (Appendix D1 of the DA: Ecological Baseline Assessment).		
	Sensitivity		B – Some sensitivity of predictions to input variations	Predictions may be sensitive to change with more detailed input (i.e. detailed baseline assessment will be completed).		
	Uncertainty Rating		17	Not Significant (<48)		
Final Impact Rating	17		**Final Impact Category**	Low		

IMPACT ID AQ05 Noise Emissions (Local Community - Amenity)

IMPACT ID AQ05 Noise Emissions (Local Community)							**Applicable Alignment Section -ALL**
Planned Event	**Potential Impact**	Noise generated by surface plant and mobile fleet (including helicopters) during construction and operation activities results in nuisance impacts to the local community.				**Phase**	Construction/Operation
	Source	Project	Construction activities (i.e., land clearing, civil works and cable stringing) will require the use of earthmoving equipment, mobile fleet (including helicopters) and generators which will result in noise emissions. Very little ongoing maintenance is likely to be required for the transmission line.				
	Pathway	Air	The main identified noise sources within the study area include traffic along the Stuart Highway and Olympic Dam Highway, mining exploration and production activities, generators at some station homesteads and outstations and, aerial mustering of livestock. In the absence of road traffic noise and other localised noise sources mentioned, historical baseline noise surveys at other similar remote locations indicate that ambient daytime noise levels are approximately 43 dBLAeq with night time noise levels of approximately 25–30 dBLAeq.				
	Receptor	Local community (amenity)	Sensitive receivers for potential noise impacts related to the Project include pastoral stations. There are 6 potential dwellings within 5 km of the proposed transmission line, however at the time of submission, only one of these is known to be occupied. The nearest occupied residence is 1.8 km (Kootaberra) from the transmission line.				
	Design Controls	There are no elimination or substitution design control measures considered .					
	Is the Linkage Confirmed	Yes	The nearest receptor is 1.8 km of the Project Area. The Project will introduce a number of mobile noise sources associated with construction and operational activities. There is predicted to be a localised and temporal increase in noise in the vicinity of the Project.	**Uncertainty: S-P-R, impact statement**	Noise disturbance associated with the project construction and operation has been assessed and considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.		**Legislative Requirements**	*Environment Protection Act 1993* Environment Protection (Noise) Policy 2007 (SA)
	Impact Significance	**Resilience**	1 - Adaptable	The transient nature of construction activities (i.e. once each transmission pole is erected, construction activities will move on to a new site), the exposure of sensitive receptors to fixed point source noise emissions will be short term and isolated.			

		Importance	1 - Individual	Given the remote location of the Project area, and short term duration of construction / maintenance at each site, the exposure of individual sensitive receptors to fixed point source noise emissions will be short term and isolated
		Duration	2 – Ten years from commencement of impact	The transient nature of construction and maintenance activities the exposure of sensitive receptors to fixed point source noise emissions will be short term and isolated.
		Significance Rating	2	Not significant (< 48)
	Impact Uncertainty	**Inputs**	B – Limited data; use of industry recognised or benchmarked; some assumptions	Previous noise monitoring in the regional area has been used to inform background noise levels expected in the wider area. Assumptions include the transient nature of the construction works and isolation of general public from Project Area
		Method	C – Informal approach	An desktop informal assessment was undertaken based on information available at the time of writing
		Sensitivity	B – Some sensitivity of predictions to input variations	Formal noise assessment along the Project area may provide further input to the baseline conditions, however based of the slow rate of change and development of the area, there is unlikely to be much variation to the outcome.
		Uncertainty Rating	3	Not significant (< 48)
	Final Impact Rating	3	**Final Impact Category**	Very Low

IMPACT ID AQ06 Light Emissions (Common, NPW Act and EPBC Act Fauna)

IMPACT ID AQ06 Light Emissions (Common, NPW Act and EPBC Act Fauna)	Applicable Alignment Section -ALL			
Potential Impact	Illumination at night from camp and construction areas displaces nearby fauna impacting on the abundance and/or diversity of native fauna.		**Phase**	Construction
Source	Project	The Project will introduce temporary artificial sources of light to the environment, predominantly at construction camps. Nightworks at construction sites are not expected to occur. Construction activities are anticipated to run seven days a week (including on Sundays and public holidays) and night-time construction works only occurring in exceptional circumstances. There will be temporary disturbance for 12 to 18 months during construction.		
Pathway	Air	Night-time light levels along the proposed alignment are very low and typical of the remote, rural setting within South Australia.		
Receptor	Native Fauna (including NPW and EPBC-listed species)	BDBSA records indicate the potential presence of up to 268 native fauna species, including 18 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events. Of the eight nationally threatened EPBC Act fauna identified in desktop studies, five were assessed as possibly occurring in the Study Area ranging from vulnerable to critically endangered (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall;* Curlew Sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis*; Plains Mouse, *Pseudomys australis*). Twelve EPBC-listed migratory species were assessed as having the potential to occur in the Study Area. Of the 27 state threatened fauna within the Study Area, four state only listed species were considered likely to occur in the Project Area ranging from vulnerable to rare; the Musk Duck, Blue-billed Duck, Freckled Duck and Pernatty Knob-tailed Gecko and one species possibly occurs; Australian Bustard. None of these species were observed during the baseline survey (EBS 2018).		
Design Controls	Distances to sensitive receptors considered during the design of lighting and camp facilities. Placement of camps near already disturbed areas where practicable e.g. highway / substation / pastoral infrastructure and utilising lighting type that limits illumination away from the area. Avoiding light spill through the use of directional lighting where practical			
Is the Linkage Confirmed	No	Construction camps are expected to be a localised and temporary source of light. It is expected that other than in close proximity to the Olympic Dam airport, where aviation warning lights may be required, the project infrastructure will not be illuminated.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential impacts from illumination from the project construction has been assessed has been considered appropriate.

	Is the S-P-R Material?	No	**Justification**	The limited illumination associated with the Project will only bring about a minor and localised change to existing conditions, and is not anticipated to have any material effects to fauna	**Legislative Requirements**	*National Parks and Wildlife Act 1972* (SA)

IMPACT ID AQ07 Light Emissions (Local Community)

IMPACT ID AQ07 Light Emissions (Local Community)							
Applicable Alignment Section -ALL							
Planned Event	**Potential Impact**	Illumination at night from camp areas impacts on the amenity of the local community.			**Phase**	All	
	Source	Project	Construction activities are anticipated to run seven days a week (including on Sundays and public holidays) with night time construction works not expected to occur. Construction camps are expected to be on location for 12 to 18 months during construction period.				
	Pathway	Air	The nearest occupied residence is 1.8 km (Kootaberra) from the transmission line. Construction camps are expected to be set up in remote locations, distant from sensitive receptors.				
	Receptor	Local community (amenity)	Night-time artificial light sources along the proposed alignment are very low and typical of the remote, rural setting within South Australia. Away from the townships of Olympic Dam, Woomera and the settlement of Pimba, the night time setting is that of an intrinsically dark landscape. There are 6 potential dwellings within 5 km of the proposed transmission line, however at the time of submission, only one of these is known to be occupied. A dwelling is also located in the vicinity of the potential laydown and camp area at the southern end of the transmission line, but it is expected to be a significant distance from the dwelling (in the order of 2km).				
	Design Controls	Distances to sensitive receptors considered during the design of lighting and camp facilities. Placement of camps near already disturbed areas such as highways or pastoral infrastructure Avoiding light spill through the use of directional lighting where practical					
	Is the Linkage Confirmed	No	Construction camps are expected to be set up in remote locations distant from sensitive receptors. It is expected that other than in close proximity to the Olympic Dam airport, where aviation warning lights may be required, the project infrastructure will not be illuminated. As a result, there will be no night time lighting effects from the operation of the project.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential impacts from illumination from the project construction has been assessed has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	There is no effect on the amenity of the local communities predicted and therefore no S-P-R linkage exists.	**Legislative Requirements**	N/A	

IMPACT ID AQ08 Noise from Blasting (Local Community)

IMPACT ID AQ08 Noise and Over blast Pressures (Local Community)							**Applicable Alignment Section -ALL**
Planned Event	**Potential Impact**	Noise from blasting during construction activities results in nuisance impacts to the local community.				**Phase**	Construction
	Source	Project	Blasting or pile driving is unlikely to be required based on previous transmission lines and geology of area, however may sometimes be used in areas where it is dictated by the geology.				
	Pathway	Air	The main identified noise sources within the study area include traffic along the Stuart Highway and Olympic Dam Highway, mining exploration and production activities, generators at some station homesteads and outstations and, aerial mustering of livestock. In the absence of road traffic noise and other localised noise sources mentioned, historical baseline noise surveys at other similar remote locations indicate that ambient daytime noise levels are approximately 43 dBLAeq with night time noise levels of approximately 25–30 dBLAeq.				
	Receptor	Local community (amenity)	Sensitive receivers for potential noise impacts related to the Project include pastoral stations. There are 6 potential dwellings within 5 km of the proposed transmission line, however at the time of submission, only one of these is known to be occupied. The nearest occupied residence is 1.8 km (Kootaberra) from the transmission line.				
	Design Controls	There are no elimination or substitution design control measures considered.					
	Is the Linkage Confirmed	Yes	The nearest receptor is 1.8 km from the Project Area. Although blasting is unlikely to be required, there is a potential linkage.	**Uncertainty: S-P-R, impact statement**	Noise disturbance associated with blasting (if required) has been assessed and considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.		**Legislative Requirements**	*Environment Protection Act 1993* Environment Protection (Noise) Policy 2007 (SA)
	Impact Significance	**Resilience**		1 - Adaptable	The transient nature of construction activities (i.e. once each transmission pole is erected, construction activities will move on to a new site), the exposure of sensitive receptors to fixed point noise emissions will be small scale, short term and isolated.		
		Importance		1 - Individual	Given the remote location of the Project area, and short term duration of construction / maintenance at each site, the exposure of individual sensitive receptors to fixed point source noise emissions will be small scale, short term and isolated		
		Duration		1 – One year from commencement of impact	The transient nature of construction, isolated and unlikely requirement for blasting activities limits exposure of sensitive receptors to fixed point noise emissions.		
		Significance Rating		1	Not significant (< 48)		

	Impact Uncertainty	**Inputs**	B – Limited data; use of industry recognised or benchmarked; some assumptions	Previous noise monitoring in the regional area has been used to inform background noise levels expected in the wider area. Assumptions include the transient nature of the construction works and isolation of general public from Project construction area
		Method	C – Informal approach	An desktop informal assessment was undertaken based on information available at the time of writing
		Sensitivity	B – Some sensitivity of predictions to input variations	Formal noise assessment along the Project area may provide further input to the baseline conditions, however based of the slow rate of change, isolated use of blasting at construction sites and the regional development of the area, there is unlikely to be much variation to the outcome.
		Uncertainty Rating	2	Not significant (< 48)
	Final Impact Rating	2	**Final Impact Category**	Very Low

IMPACT ID AQ09 Noise - Presence of Infrastructure (Common, NPW Act and EPBC Act Fauna)

IMPACT ID AQ09 Noise - Presence of Infrastructure (Common, NPW Act and EPBC Act Fauna)	Applicable Alignment Section -ALL				
Potential Impact	Generation of noise from interaction of wind, powerlines and towers displaces native fauna and impacts on the abundance and/or diversity of native fauna.			**Phase**	Operations
Source	Project	Aeolian noise caused by wind passing through the transmission lines is uncommon and requires steady winds blowing perpendicular to the lines.			
Pathway	Air	Prevailing winds run parallel rather than perpendicular to the transmission line.			
Receptor	Native Fauna (including NPW and EPBC-listed species)	BDBSA records indicate the potential presence of up to 268 native fauna species, including 18 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events. Of the eight nationally threatened EPBC Act fauna identified in desktop studies, five were assessed as possibly occurring in the Study Area ranging from vulnerable to critically endangered (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall;* Curlew Sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis*; Plains Mouse, *Pseudomys australis*). Twelve EPBC-listed migratory species were assessed as having the potential to occur in the Study Area. Of the 27 state threatened fauna within the Study Area, four state only listed species were considered likely to occur in the Project Area ranging from vulnerable to rare; the Musk Duck, Blue-billed Duck, Freckled Duck and Pernatty Knob-tailed Gecko and one species possibly occurs; Australian Bustard. None of these species were observed during the baseline survey (EBS 2018).			
Design Controls	Design of equipment in accordance with relevant standards and industry guidelines.				
Is the Linkage Confirmed	No	Prevailing winds run parallel rather than perpendicular to the line, therefore the effect is unlikely to occur. Potential effect is very localised and fauna in immediate vicinity will not be negatively affected.	**Uncertainty: S-P-R, impact statement**	Noise disturbance associated with the project has been assessed and considered appropriate.	
Is the S-P-R Material?	No	**Justification**	The localised nature of the effect associated with the Project will only bring about a minor change to existing conditions, and is not anticipated to have any material effects to fauna.	**Legislative Requirements**	*National Parks and Wildlife Act 1972* (SA)

IMPACT ID AQ10 Noise - Presence of Infrastructure (Local Community - Amenity)

IMPACT ID AQ10 Noise - Presence of Infrastructure (Local Community - Amenity)							
Applicable Alignment Section -ALL							
Planned Event	**Potential Impact**	Generation of noise from interaction of wind, powerlines and towers results in amenity impacts to the local community.				**Phase**	Operations
	Source	Project	Aeolian noise caused by wind passing through the transmission lines is uncommon and requires steady winds blowing perpendicular to the lines (DA Section 10.2.1). Corona noise from the transmission lines is a cracking, hissing or buzzing sound associated with the leakage of electricity into the air, which is usually only audible in humid weather, or during heavy rains.				
	Pathway	Air	Prevailing winds run parallel rather than perpendicular to the transmission line. The generally dry conditions that prevail across the alignment would maintain any potential corona effects to a minimum.				
	Receptor	Local community (amenity)	Sensitive receivers for potential noise impacts related to the Project include pastoral stations. There are 6 potential dwellings within 5 km of the proposed transmission line, however at the time of submission, only one of these is known to be occupied. The nearest occupied residence is 1.8 km (Kootaberra) from the transmission line.				
	Design Controls	Design of equipment in accordance with relevant standards and industry guidelines.					
	Is the Linkage Confirmed	No	Consolidation design of the Project with the existing powerline will not increase the noise above existing background levels.	**Uncertainty: S-P-R, impact statement**	Noise disturbance associated with the project infrastructure has been assessed and considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	Noise generation during operations is expected to be minimal above background levels.		**Legislative Requirements**	*Environment Protection Act 1993* Environment Protection (Noise) Policy 2007 (SA)

IMPACT ID AQ11 Nuisance Dust (Local Community-Amenity)

IMPACT ID AQ11 Nuisance Dust (Local Community-Amenity)						
Applicable Alignment Section -ALL						
Planned Event	**Potential Impact**	Activities including land clearing and material movement and vehicles on unpaved roads generate dust emissions that result in amenity impacts to the local community.			**Phase**	Construction
	Source	Project	Project activities including land clearing and material movements, may, in certain meteorological conditions, result in the generation of wind-blown dust.			
	Pathway	Air	The proposed route alignment is generally dominated by light to moderate southerly winds. Winds from the south and south east tend to dominate in summer and autumn while in winter, northerly winds often prevail. Dust Emissions are anticipated to be restricted to the areas immediately surrounding Project infrastructure footprint.			
	Receptor	Local community (health)	The proposed route alignment is generally dominated by light to moderate southerly winds. Winds from the south and south east tend to dominate in summer and autumn while in winter, northerly winds often prevail. Dust Emissions are anticipated to be restricted to the areas immediately surrounding Project infrastructure footprint. EPA guidelines for evaluation of distances for effective air quality management indicate no recommended distance from the proposed activity to assess potential effects; however, as a minimum standard, 1000 m distance from source to sensitive receptor is recommended for heavy industries. On this assumption, a conservative 1.5 km was used as a buffer along the transmission line to evaluate the presence of any potential sensitive receptors that could be affected by dust emissions. There are no residences within 1.5 km of proposed project activities, therefore any wind-blown particulate matter resulting from construction activities is unlikely to cause any amenity or health impacts to the local community.			
	Design Controls	Existing tracks will be incorporated into the design where possible to avoid construction of new access tracks, and reduce clearance footprint.				
	Is the Linkage Confirmed	No	Dust will be generated and may affect receptors in close proximity to the proposed corridor. However, there are no sensitive receptors within 1.5 km of the proposed alignment.	**Uncertainty: S-P-R, impact statement**	Dust disturbance associated with the project infrastructure has been assessed and considered appropriate.	
	Is the S-P-R Material?	No	**Justification**	There are no residences within 1.5 km of proposed project activities, therefore any wind-blown particulate matter resulting from construction activities is unlikely to cause any amenity or health impacts to the local community	**Legislative Requirements**	*Environment Protection Act 1993* Environment Protection (Air Quality) Policy 2016 (SA

4 SURFACE WATER IMPACT ASSESSMENT

IMPACT ID SW01 Placement of Infrastructure (Aquatic Ecology)

IMPACT ID SW01 Placement of Infrastructure (Aquatic Ecology)				Applicable Alignment Section -ALL	
Planned Event	**Potential Impact**	Placement of powerline infrastructure alters surface water flows impacting on the abundance and/or diversity of aquatic ecology		**Phase**	Construction
	Source	Project	The presence of transmission structures and the access track has the potential to alter surface water flows during rainfall events. Total disturbance is conservatively estimated to be approximately 470 ha in total, distributed along the entire length of the line. Existing tracks will be used as far as possible which will significantly reduce this disturbance. Access tracks will be established at natural surface level. Tower structures will not be provide any significant impediment to surface water flows and will not be located in watercourses.		
	Pathway	Surface Water	The Project is located in an arid to semi-arid environment. Surface waters in the region are scarce, with flow occurring for short periods following only significant rainfall events. Rainfall in the region is low, with no clear seasonal pattern. Rainfall is unpredictable and sporadic throughout the year, often occurring in intense short bursts. Construction and operating of the transmission line would have negligible effects on catchments and flow paths. Any changes to flow paths during the construction period would be very minor, localised and short term. There will not be a significant change in runoff from the Project Area as impervious surfaces are not proposed to be introduced and the contribution from any less permeable areas (e.g. capped or compacted areas of access tracks) will be negligible. The Project Area also represents a very small proportion of the catchment of surface water features in the area.		
	Receptor	Aquatic Ecology	There are no surface water features of conservation significance (e.g. Great Artesian Basin (GAB) springs, Ramsar listed wetlands) within the Project Area and the ephemeral drainage lines near the proposed transmission line do not contain waterholes. The alignment is in close proximity (approx. 300 m at the closest point) to several ephemeral lakes including Pernatty Lagoon, Lake Mary and Coorlay Lagoon and it crosses Lake Windabout (however the access track does not cross the lake surface). Ephemeral lakes support aquatic invertebrates such as Brine Shrimp which lay dormant as eggs until rainfall events stimulate their life cycle. Following significant rainfall, these species can provide food resources for water birds (EBS 2018). Of the 171 avian species identified in BDBSA records , 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events.		

	Design Controls	Siting of Project infrastructure to minimise disturbance to ephemeral drainage lines.				
	Is the Linkage Confirmed	No	The Project will have a negligible effect on surface water flows as it will not provide any significant impediment to surface water flows, or alter catchment areas.	**Uncertainty: S-P-R, impact statement**	Effects of infrastructure placement on surface water flows is conceptual.	
	Is the S-P-R Material?	No	**Justification**	The impact is not considered material based on the negligible effect on surface water flows..	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA) *Environment Protection Act 1993* Environment Protection (Water Quality) Policy 2015 (SA)

IMPACT ID SW02 Placement of Infrastructure (Terrestrial Ecology)

IMPACT ID SW02 Placement of Infrastructure (Terrestrial Ecology)				Applicable Alignment Section -ALL	
Planned Event	**Potential Impact**	Placement of powerline infrastructure alters surface water flows impacting on the abundance and/or diversity of terrestrial ecology		**Phase**	Construction
	Source	Project	The presence of transmission structures and the access track has the potential to alter surface water flows during rainfall events. Total disturbance is conservatively estimated to be approximately 470 ha in total, distributed along the entire length of the line. Existing tracks will be used as far as possible which will significantly reduce this disturbance. Access tracks will be established at natural surface level. Tower structures will not be provide any significant impediment to surface water flows and will not be located in watercourses.		
	Pathway	Surface Water	The Project is located in an arid to semi-arid environment. Surface waters in the region are scarce, with flow occurring for short periods following only significant rainfall events. Rainfall in the region is low, with no clear seasonal pattern. Rainfall is unpredictable and sporadic throughout the year, often occurring in intense short bursts.. Construction and operating of the transmission line would have negligible effects on catchments and flow paths. Any changes to flow paths during the construction period would be very minor, localised and short term. There will not be a significant change in runoff from the Project Area as impervious surfaces are not proposed to be introduced and the contribution from any less permeable areas (e.g. capped or compacted areas of access tracks) will be negligible.		
	Receptor	Terrestrial Ecology (including NPW and EPBC-listed species)	There are no surface water features of conservation significance (e.g., Great Artesian Basin (GAB) springs, Ramsar listed wetlands) within the Project Area. A total of 413 native flora species were identified for the Study Area from historical floristic records within the BDBSA. Two nationally threatened flora species have the potential to occur within the Study Area.; *Frankenia plicata* (Braided Sea-heath)(EN) and *Senecio megaglossus* (Large-flower Groundsel) (V). One state-threatened flora species is known to occur within the broader Study Area *Santalum spicatum* (Sandalwood) (V), and five species listed as vulnerable to rare possibly occur within the Study Area (Desert Lime, Large Adders Tongue; Australian Broomrape, One-bristle Everlasting and Wild Violet). With the exception of Sandalwood, none of these species were observed during the baseline survey (EBS 2018). BDBSA records indicate the potential presence of up to 268 native fauna species, including 10 mammals, 77 reptiles, and 171 bird (. Of the eight nationally threatened EPBC Act fauna identified in desktop studies, five were assessed as possibly occurring in the Study Area ranging from vulnerable to critically endangered (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall*; Curlew Sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis*; Plains Mouse, *Pseudomys australis*). Twelve EPBC-listed migratory species were assessed as having the potential to occur in the Study Area. Of the 27 state threatened fauna within the Study Area, four state only listed species were considered likely to occur in the Project Area ranging from vulnerable to rare; the Musk Duck, Blue-billed Duck, Freckled Duck and Pernatty Knob-tailed Gecko and one species possibly occurs; Australian Bustard. None of these species were observed during the baseline survey (EBS 2018).		

	Design Controls	Siting of Project infrastructure to minimise disturbance to ephemeral drainage lines.					
	Is the Linkage Confirmed	No	The Project will have a negligible effect on surface water flows as it will not provide any significant impediment to surface water flows, or alter catchment areas.	**Uncertainty: S-P-R, impact statement**	Effects of infrastructure placement on surface water flows is conceptual.		
	Is the S-P-R Material?	No	**Justification**	The impact is not considered material based on the negligible effect on surface water flows..	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA) *Environment Protection Act 1993* Environment Protection (Water Quality) Policy 2015 (SA)	

				Residual Risk (Post Controls)		
Unplanned Event	**Risk Assessment**	**Risk Event**	**Management Controls**	**Consequence**	**Likelihood**	**Risk**
		Construction / placement of infrastructure outside of design parameters and/or inappropriate application of construction methodologies alters surface water flows and leads to unplanned indirect impacts to terrestrial ecology	Land disturbance approval process. Locate soil stockpiles out of potential flow paths. Access tracks will be constructed in accordance with industry standards.	1 - Insignificant	D - Unlikely	2 - Low

IMPACT ID SW03 Placement of Infrastructure (Local Communities)

IMPACT ID SW03 Placement of Infrastructure (Local Communities)						
Applicable Alignment Section -ALL						
Planned Event	**Potential Impact**	Placement of powerline infrastructure alters surface water flows impacting on local communities		**Phase**	Construction	
	Source	Project	The presence of transmission structures and the access track has the potential to alter surface water flows during rainfall events. Total disturbance is conservatively estimated to be approximately 470 ha in total, distributed along the entire length of the line. Existing tracks will be used as far as possible which will significantly reduce this disturbance. Access tracks will be established at natural surface level. Tower structures will not be provide any significant impediment to surface water flows and will not be located in watercourses.			
	Pathway	Surface Water	The Project is located in an arid to semi-arid environment. Surface waters in the region are scarce, with flow occurring for short periods following only significant rainfall events. Rainfall in the region is low, with no clear seasonal pattern. Rainfall is unpredictable and sporadic throughout the year, often occurring in intense short bursts. Construction and operating of the transmission line would have negligible effects on catchments and flow paths. Any changes to flow paths during the construction period would be very minor, localised and short term. There will not be a significant change in runoff from the Project Area as impervious surfaces are not proposed to be introduced and the contribution from any less permeable areas (e.g. capped or compacted areas of access tracks) will be negligible.			
	Receptor	Local Communities: Aboriginal Communities Third-party Users Future Users	There are no surface water features of conservation significance (e.g., Great Artesian Basin (GAB) springs, Ramsar listed wetlands) within the Project Area. The Project Area is not located within an area where the water resource is prescribed under the NRM Act, and is not within a water protection area. Although scarce, surface waters in the region are of value to pastoralists. Following rainfall events, pastoralists may utilise surface waters from dams providing supply for up to two years. However, the high evaporation rates and sporadic nature of rainfall in the region mean that surface water is only used opportunistically in the region.			
	Design Controls	Design drainage features or structures to appropriate standards where considered necessary. Siting of Project infrastructure to minimise disturbance to ephemeral drainage lines. Locate soil stockpiles out of potential flow paths. Access tracks will be constructed in accordance with industry standards.				
	Is the Linkage Confirmed	No	The Project will have a negligible effect on surface water flows as it will not provide any significant impediment to surface water flows, or alter catchment areas.	**Uncertainty: S-P-R, impact statement**	Effects of infrastructure placement on surface water flows is conceptual.	

	Is the S-P-R Material?	No	**Justification**	The impact is not considered material based on the negligible effect on surface water flows.	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA) *Environment Protection Act 1993* Environment Protection (Water Quality) Policy 2015 (SA)

IMPACT ID SW04 Erosion and Sedimentation (Aquatic Ecology)

IMPACT ID SW04 Erosion and Sedimentation (Aquatic Ecology)				Applicable Alignment Section -ALL	
Planned Event	**Potential Impact**	Erosion of soils and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water impacting on the abundance and/or diversity of aquatic ecology.		**Phase**	Construction/Operations
	Source	Runoff from stockpiles and disturbed surfaces	Construction activities such as vegetation clearance, excavation and earthworks have the potential to generate suspended solids in surface water run-off during rainfall events. Total disturbance is conservatively estimated to be approximately 470 ha in total, distributed along the entire length of the line. Existing tracks will be used as far as possible which will significantly reduce this disturbance. Areas of disturbance have a relatively small and discrete footprint and are sparsely distributed, and groundcover will be retained as far as possible. The most continuous disturbance will be the access track along the length of the transmission line which will run through some areas more susceptible to erosion. Sediment and erosion control measures will be installed during construction where appropriate (e.g. where earthworks are being undertaken in close proximity to watercourses or ephemeral lakes). Drainage features or structures will be installed on the access track where appropriate to prevent erosion during operations and remedial action will be implemented where required.		
	Pathway	Surface Water	The soils and drainage conditions vary along the alignment. The, majority of soils across the alignment have low or medium erosion potential. Rainfall is low, unpredictable and sporadic throughout the year, often occurring in intense short bursts. Surface waters in the region are generally scarce, with flow occurring for short periods following only significant rainfall events, however ephemeral lakes can hold water for long periods following significant rainfall. During flow events, surface water is typically characterised by high total suspended solids. The ephemeral lakes are fed by large catchments and are generally significant distances from the proposed transmission line, with low contribution to flow and sediment load from the Project Area. Sediment transport from disturbed areas could have a small and localised effect on total sediment loads during flow events. Any effect on turbidity in ephemeral lakes, where inflows following rainfall are naturally highly turbid, would also be small, localised and short term.		
	Receptor	Aquatic Ecology.	There are no surface water features of conservation significance (e.g. Great Artesian Basin (GAB) springs, Ramsar listed wetlands) within the Project Area and the ephemeral drainage lines near the proposed transmission line do not contain waterholes. The alignment is in close proximity (approx. 300 m at the closest point) to several ephemeral lakes including Pernatty Lagoon, Lake Mary and Coorlay Lagoon and it crosses Lake Windabout (however the access track does not cross the lake surface). Ephemeral lakes support aquatic invertebrates such as Brine Shrimp which lay dormant as eggs until rainfall events stimulate their life cycle. Following significant rainfall, these species can provide food resources for water birds (EBS 2018). Of the 171 avian species identified in BDBSA records , 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events.		

	Design Controls	Installation of drainage features or structures where appropriate. Siting of Project infrastructure to minimise disturbance to ephemeral drainage lines Restricting area of disturbance to the minimum necessary. Locate soil stockpiles out of potential flow paths. Existing tracks incorporated into the design as far as possible. Design drainage features or structures to appropriate standards where considered necessary. Access tracks will be constructed in accordance with industry standards.					
	Is the Linkage Confirmed	Yes	Significant rainfall events may erode disturbed areas and stockpiles resulting in an increase in sediment loads entering local surface water catchments. This could possibly result in a small and localised increase above high background levels and result in very localised change in the abundance and diversity of aquatic invertebrates in ephemeral lakes.	**Uncertainty: S-P-R, impact statement**	Effects of erosion and sedimentation to aquatic ecology is conceptual based on the arid environment and rarity of rainfall events leading to water flow across the region.		
	Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.	**Legislative Requirements**	Natural Resources Management Act 2004 (SA) *Environment Protection Act 1993* Environment Protection (Water Quality) Policy 2015 (SA)	
	Impact Significance	**Resilience**		1-Adaptable	Any effects on turbidity will be small and localised and species such as Brine Shrimp are adapted to such conditions and able to rapidly reproduce in large numbers.		
		Importance		1 – Abundant	Irruptive aquatic species such as Brine shrimp reproduce in large numbers following substantial rainfall.		
		Duration		3 – One hundred years from commencement of impact	The impact may occur occasionally during construction and operation of the transmission line.		
		Significance Rating		3	Not significant (<48)		
		Inputs		B -Limited Data	Australian Bureau of Meteorology data are used for climate characteristics		

	Impact Uncertainty	**Method**	B- Application of existing method	Approach based on literature rather than on field sampling.
		Sensitivity	B – Some sensitivity of predictions	Predictions will have some sensitivity to input variations.
		Uncertainty Rating	5	Not significant (<48)
	Final Impact Rating	5	**Final Impact Category**	Low

IMPACT ID SW05 Erosion and Sedimentation (Terrestrial Ecology)

IMPACT ID SW05 Erosion and Sedimentation (Terrestrial Ecology)				Applicable Alignment Section -ALL	
Planned Event	**Potential Impact**	Erosion of soils and runoff from stockpiles and disturbed surfaces leads to alteration of land surface and increased sedimentation impacting on the abundance and/or diversity of terrestrial ecology		**Phase**	Construction/Operation
	Source	Runoff from stockpiles and disturbed surfaces	Construction activities such as vegetation clearance, excavation and earthworks of stockpiles have the potential to lead to erosion of land surfaces, and the off-site transport of sediment in run-off during rainfall events. Total disturbance is conservatively estimated to be approximately 470 ha in total, distributed along the entire length of the line. Existing tracks will be used as far as possible which will significantly reduce this disturbance. Areas of disturbance have a relatively small and discrete footprint and are sparsely distributed, and groundcover will be retained as far as possible. The most continuous disturbance will be the access track along the length of the transmission line which will run through some areas more susceptible to erosion. Sediment and erosion control measures will be installed during construction where appropriate (e.g. where earthworks are being undertaken in close proximity to watercourses or ephemeral lakes). Drainage features or structures will be installed on the access track where appropriate to prevent erosion during operations and remedial action will be implemented where required.	
	Pathway	Surface Water	The soils and drainage conditions vary along the alignment. The, majority of soils across the alignment have low or medium erosion potential. Rainfall is low, unpredictable and sporadic throughout the year, often occurring in intense short bursts. Surface waters in the region are generally scarce, with flow occurring for short periods following only significant rainfall events, however ephemeral lakes can hold water for long periods following significant rainfall. During flow events, surface water is typically characterised by high total suspended solids. Sediment transport from disturbed areas could have a small and localised effect on total sediment loads during flow events and potentially have a small and localised effect in areas of predominantly terrestrial vegetation that receive runoff (e.g. claypans, swamps or riparian vegetation). Erosion of disturbed areas can alter suitability of habitats for native vegetation and fauna through loss of topsoil and creation of scalds or erosion gullies. This effect would generally be localised to the disturbed area, however in some areas such as gibber soils, can affect adjacent areas if not managed appropriately.	
	Receptor	Terrestrial Ecology (including NPW and EPBC-listed species)	A total of 413 native flora species were identified for the Study Area from historical floristic records within the BDBSA. Two nationally threatened flora species have the potential to occur within the Study Area.; *Frankenia plicata* (Braided Sea-heath)(EN) and *Senecio megaglossus* (Large-flower Groundsel) (V). One state-threatened flora species is known to occur within the broader Study Area *Santalum spicatum* (Sandalwood) (V), and five species listed as vulnerable to rare possibly occur within the Study Area (Desert Lime, Large Adders Tongue; Australian Broomrape, One-bristle Everlasting and Wild Violet). With the exception of Sandalwood, none of these species were observed during the baseline survey (EBS 2018).	

			BDBSA records indicate the potential presence of up to 268 native fauna species, including 10 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). Of the eight nationally threatened EPBC Act fauna identified in desktop studies, five were assessed as possibly occurring in the Study Area ranging from vulnerable to critically endangered (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall*; Curlew Sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis;* Plains Mouse, *Pseudomys australis*). Twelve EPBC-listed migratory species were assessed as having the potential to occur in the Study Area. Of the 27 state threatened fauna within the Study Area, four state only listed species were considered likely to occur in the Project Area ranging from vulnerable to rare; the Musk Duck, Blue-billed Duck, Freckled Duck and Pernatty Knob-tailed Gecko and one species possibly occurs; Australian Bustard. None of these species were observed during the baseline survey (EBS 2018).				
	Design Controls	Siting of tracks and transmission structures to minimise erosion potential. Restricting area of disturbance to the minimum necessary. Existing tracks incorporated into the design as far as possible. Installation of drainage features or structures where appropriate. Siting of Project infrastructure to minimise disturbance to ephemeral drainage lines. Design drainage features or structures to appropriate standards where considered necessary.					
	Is the Linkage Confirmed	Yes	Significant rainfall events may erode disturbed areas and stockpiles resulting in altered land surfaces and increased sediment loads. This could possibly result in minor localised alterations to habitat suitability for terrestrial flora and fauna, and a small, localised increase in sediment loads above high background levels and potentially result in very localised changes in the abundance and diversity of terrestrial species.	**Uncertainty: S-P-R, impact statement**	Effects of erosion and sedimentation is conceptual based on the arid environment and rarity of rainfall events leading to water flow across the region.	
	Is the S-P-R Material?	Yes	**Justification**	The potential for erosion of disturbed areas, while generally minor and localised, is perceived by some stakeholders as a material issue.	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA) *Environment Protection Act 1993* Environment Protection (Water Quality) Policy 2015 (SA)

	Impact Significance	**Resilience**	1- Adaptable	The potential for significant sedimentation occurring in watercourses as a result of project construction activities is low given the nature of the arid-zone, the infrequent nature of run-off events and the design controls implemented to minimise disturbance and mobilisation of sediments. The potential for sedimentation of watercourses or other surface water features during operation is low as cleared areas will be rehabilitated providing stabilisation by vegetation to remain (or regenerate) across the site.
		Importance	5 – National	Of the eight nationally threatened EPBC Act fauna identified in desktop studies, five were assessed as possibly occurring in the Study Area ranging from vulnerable to critically endangered, however, it is worth nothing that there are no surface water features of conservation significance (e.g., Great Artesian Basin (GAB) springs, Ramsar listed wetlands) within the Project Area and no threatened flora or fauna species were identified within the Project Area in the field survey (EBS 2018).
		Duration	3 – One hundred years from commencement of impact	The impact my occur during construction and operation of the transmission line.
		Significance Rating	15	Not significant (<48)
	Impact Uncertainty	**Inputs**	B – Limited data	Initial baseline assessment employed rapid but recognised field survey methods across a broad study area, which has been coupled with a review of historic databases (BDBSA, PMST) and historic technical studies (BHP Billiton, 2009). Informed assumptions on the likelihood of presence / absence of species have been made on this basis.
		Method	A – Recognised method	Recognised survey methods were utilised during rapid baseline assessment and in the assimilation of historic records (Appendix D1 of the DA: Ecological Baseline Assessment)
		Sensitivity	A – Predictions not sensitive	Predictions not sensitive to change even with more detailed input (i.e. detailed baseline assessment will be completed and will inform micro siting of poles and towers)
		Uncertainty Rating	19	Not significant (<48)
	Final Impact Rating	19	**Final Impact Category**	Low

		Risk Event	Management Controls	Residual Risk (Post Controls)		
				Consequence	Likelihood	Risk
Unplanned Event	**Risk Assessment**	Construction outside of design parameters and/or inappropriate application of construction methodologies may lead to potential increase in erosion and sedimentation effects and unplanned indirect impacts to terrestrial ecology	Access tracks constructed in accordance with industry standards. Land disturbance approval process. Temporary sediment and erosion controls (e.g. berms, drainage controls, sediment fencing). Land system and site-specific soil management measures detailed in CEMP. Stockpiling of topsoil and cleared vegetation for re-spreading over areas of temporary disturbance. Rehabilitation procedures. Locate soil stockpiles out of potential flow paths.	1 - Insignificant	D - Unlikely	2 - Low

IMPACT ID SW06 Erosion and Sedimentation (Local Communities)

IMPACT ID SW06 Erosion and Sedimentation (Local Communities)				Applicable Alignment Section -ALL	
Planned Event	**Potential Impact**	Erosion of soils and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water impacting on the local community		**Phase**	All
	Source	Runoff from stockpiles and disturbed surfaces	Construction activities such as vegetation clearance, excavation and earthworks have the potential to generate suspended solids in surface water run-off during rainfall events. Total disturbance is conservatively estimated to be approximately 470 ha in total, distributed along the entire length of the line. Existing tracks will be used as far as possible which will significantly reduce this disturbance. Areas of disturbance have a relatively small and discrete footprint and are sparsely distributed, and groundcover will be retained as far as possible. Sediment and erosion control measures will be installed during construction where appropriate (e.g. where earthworks are being undertaken in close proximity to watercourses or ephemeral lakes). Drainage features or structures will be installed on the access track where appropriate to prevent erosion during operations and remedial action will be implemented where required.		
	Pathway	Surface Water	The soils and drainage conditions vary along the alignment. The, majority of soils across the alignment have low or medium erosion potential. Rainfall is low, unpredictable and sporadic throughout the year, often occurring in intense short bursts. Surface waters in the region are generally scarce, with flow occurring for short periods following only significant rainfall events, however ephemeral lakes can hold water for long periods following significant rainfall. During flow events, surface water is typically characterised by high total suspended solids. The ephemeral lakes are fed by large catchments and are generally significant distances from the proposed transmission line, with low contribution to flow and sediment load from the Project Area. Sediment transport from disturbed areas could have a small and localised effect on total sediment loads during flow events. Any effect on turbidity in ephemeral lakes, where inflows following rainfall are naturally highly turbid, would also be small, localised and short term. There is one pastoral dam in close proximity to the alignment and the next closest is more than 1 km distant. Both dams receive inflow from a large catchment; runoff from disturbed areas for the Project would constitute a very small proportion of the dam catchment.		
	Receptor	<u>Local Communities:</u> Third-party Users – Pastoral Leases Aboriginal Communities Future Users	Although scarce, surface waters in the region are of value to pastoralists. Following rainfall events, pastoralists may utilise surface waters from dams providing supply for up to two years. Water ponded in clay pans following storm events provide an important source of water for sheep, cattle and native fauna. However, the high evaporation rates and sporadic nature of rainfall in the region mean that surface water is only used opportunistically in the region. Domestic water supplies may be sourced from either rainfall capture, groundwater or the SA Water potable water supply network.		
	Design Controls	Infrastructure will be sited to minimise disturbance to any ephemeral drainage lines			

		Siting of tracks and transmission structures to minimise erosion potential. Restricting area of disturbance to the minimum necessary. Existing tracks incorporated into the design as far as possible. Installation of drainage features or structures where appropriate. Design drainage features or structures to appropriate standards where considered necessary.					
	Is the Linkage Confirmed	No	During construction (and to a lesser extent operation) the disturbance of land will result in the potential for discharge of sediments during rainfall events. Given the high natural turbidity, small contribution from the Project Area to surface water catchments, distance to dams or other surface water features used by the community (in addition to the short construction period and the rare occurrence of water volumes suitable for use) the Project is not anticipated to impact surface water used by the local community.	**Uncertainty: S-P-R, impact statement**	Effects of erosion and sedimentation to surface water channels is conceptual based on the arid environment and rarity of rainfall events leading to water flow across the region.		
	Is the S-P-R Material?	No	**Justification**	The impact is not considered material based on distance to surface water features important to the community and negligible contribution of sediment from the Project Area.		**Legislative Requirements**	*Environment Protection Act 1993* Environment Protection (Water Quality) Policy 2015 (SA)

IMPACT ID SW07 Generation of Acid Sulphate Soils (Aquatic Ecology)

IMPACT ID SW07 Generation of Acid Sulphate Soils (Aquatic Ecology)						
	Applicable Alignment Section -ALL					
Planned Event	**Potential Impact**	Excavation and earthworks disturb acid sulphate soils (ASS) leading to generation of acid leachate impacting on the abundance and/or diversity of aquatic ecology.		**Phase**	Construction/	
	Source	Project	Clearance, excavation and earthworks undertaken during construction have the potential to disturb acid sulphate soils. There are several salt lakes adjacent to the route alignment, and the route traverses low lying areas around Lake Windabout and Pernatty Lagoon, which may have sediments that could form acid sulphate soils. Previous investigations undertaken at sites across the Project Area, identified the inlet to Lake Windabout as having very thin monosulfide layers within the top 5 cm of surficial sediments (BHP Billiton, 2009). The access track does not cross the lake surface.				
	Pathway	Surface water	Inland acid sulphate soils (ASS) form in instances where there is a source of sulphate, iron and organic matter, all of which occur in inland salt lakes. They occur in the form of monosulphides (black ooze) in near-surface sediments (<10 m) of salt lakes, which if disturbed, can react rapidly to form acid. If disturbed, the amount of acid produced by oxidation from the small amount of monosulphides would be negligible, and have negligible effects on aquatic ecology as surface waters in the region are scarce, with flow occurring for short periods following only significant rainfall events. Rainfall in the region is low, with no clear seasonal pattern. Rainfall is unpredictable and sporadic throughout the year, reducing the likelihood of mobilisation of acid leachate if generated by construction works. Standard practices such as minimising disturbances and lime dosing if required would further limit the potential effect.				
	Receptor	Aquatic ecology	There are no surface water features of conservation significance (e.g. Great Artesian Basin (GAB) springs, Ramsar listed wetlands) within the Project Area and the ephemeral drainage lines near the proposed transmission line do not contain waterholes. The alignment is in close proximity (approx. 300 m at the closest point) to several ephemeral lakes including Pernatty Lagoon, Lake Mary and Coorlay Lagoon and it crosses Lake Windabout (however the access track does not cross the lake surface). Ephemeral lakes support aquatic invertebrates such as Brine Shrimp which lay dormant as eggs until rainfall events stimulate their life cycle. Following significant rainfall, these species can provide food resources for water birds (EBS 2018). Of the 171 avian species identified in BDBSA records , 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events.				
	Design Controls	Geotechnical investigations will be undertaken as part of structure foundation design Siting of the transmission structures and access track to avoid disturbing identified areas of potential acid sulphate soils as far as possible e.g. Lake Windabout inlet.				
	Is the Linkage Confirmed	No	Detailed design will ensure that areas of PASS will be avoided. Even if disturbed, the amount of acid produced by oxidation from the small amount of	**Uncertainty: S-P-R, impact statement**	Disturbance of potential acid sulphate soils is conceptual based.	

			monosulphides would be minimal, with negligible potential for off-site effects, particularly given that lakes such as Lake Windabout also form a sink for surface water and groundwater flows.			
	Is the S-P-R Material?	No	**Justification**	The impact is not considered material as even if disturbed, the amount of acid produced by oxidation from the small amount of monosulphides would be minimal with negligible potential for off-site effects.	**Legislative Requirements**	*National Parks and Wildlife Act 1972 (SA)* *Environment Protection Act 1993* *Environment Protection (Water Quality) Policy 2015 (SA)*

IMPACT ID SW08 Generation of Acid Sulphate Soils (Terrestrial ecology)

IMPACT ID SW08 Generation of Acid Sulphate Soils (Terrestrial ecology)			Applicable Alignment Section -ALL		
Planned Event	**Potential Impact**	Excavation and earthworks disturb acid sulphate soils (ASS) leading to generation of acid leachate impacting on the abundance and/or diversity of terrestrial ecology		**Phase**	Construction/Operation
	Source	Project	Clearance, excavation and earthworks undertaken during construction have the potential to disturb acid sulphate soils. There are several salt lakes adjacent to the route alignment, and the route traverses low lying areas around Lake Windabout and Pernatty Lagoon, which may have sediments that could form acid sulphate soils. Previous investigations undertaken at sites across the Project Area, identified the inlet to Lake Windabout as having very thin monosulfide layers within the top 5 cm of surficial sediments (BHP Billiton, 2009).		
	Pathway	Surface water	Inland acid sulphate soils (ASS) form in instances where there is a source of sulphate, iron and organic matter, all of which occur in inland salt lakes. They occur in the form of monosulphides (black ooze) in near-surface sediments (<10 m) of salt lakes, which if disturbed, can react rapidly to form acid. Even if disturbed, the amount of acid produced by oxidation from the small amount of monosulphides would be minimal (BHP Billiton, 2009), with negligible potential for off-site effects, particularly given that lakes such as Lake Windabout also form a sink for surface water and groundwater flows (BHP Billiton, 2009). Standard practices such as minimising disturbances and lime dosing if required would further limit the potential effect.		
	Receptor	Terrestrial ecology (including NPW and EPBC-listed species)	There are no surface water features of conservation significance (e.g., Great Artesian Basin (GAB) springs, Ramsar listed wetlands) within the Project Area. A total of 413 native flora species were identified for the Study Area from historical floristic records within the BDBSA. Two nationally threatened flora species have the potential to occur within the Study Area.; Frankenia plicata (Braided Sea-heath)(EN) and Senecio megaglossus (Large-flower Groundsel) (V). One state-threatened flora species is known to occur within the broader Study Area Santalum spicatum (Sandalwood) (V), and five species listed as vulnerable to rare possibly occur within the Study Area (Desert Lime, Large Adders Tongue; Australian Broomrape, One-bristle Everlasting and Wild Violet). With the exception of Sandalwood, ,one of these species were observed during the baseline survey (EBS 2018). BDBSA records indicate the potential presence of up to 268 native fauna species, including 10 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). Of the eight nationally threatened EPBC Act fauna identified in desktop studies, five were assessed as possibly occurring in the Study Area ranging from vulnerable to critically endangered (Thick-billed Grasswren, Amytornis modestus; Western Grasswren (Gawler Ranges), Amytornis textilis myall; Curlew Sandpiper, Calidris ferruginea; Night Parrot, Pezoporus occidentalis; Plains Mouse, Pseudomys australis). Twelve EPBC-listed migratory species were assessed as having the potential to occur in the Study Area. Of the 27 state threatened fauna within the Study Area, four state only listed species were considered likely to occur in the Project Area ranging from vulnerable to rare; the Musk Duck, Blue-billed Duck, Freckled Duck and Pernatty Knob-tailed Gecko and one species possibly occurs; Australian Bustard. None of these species were observed during the baseline survey (EBS 2018).		

	Design Controls	Geotechnical investigations will be undertaken as part of structure foundation design Siting of the transmission structures and access track to avoid disturbing identified areas of potential acid sulphate soils as far as possible e.g. Lake Windabout inlet.					
	Is the Linkage Confirmed	No	Detailed design will ensure that areas of PASS will be avoided. Even if disturbed, the amount of acid produced by oxidation from the small amount of monosulphides would be minimal, with negligible potential for off-site effects, particularly given that lakes such as Lake Windabout also form a sink for surface water and groundwater flows.	**Uncertainty: S-P-R, impact statement**	Disturbance of potential acid sulphate soils is conceptual based.		
	Is the S-P-R Material?	No	**Justification**	The impact is not considered material as even if disturbed, the amount of acid produced by oxidation from the small amount of monosulphides would be minimal with negligible potential for off-site effects.		**Legislative Requirements**	*National Parks and Wildlife Act 1972 (SA)* *Environment Protection Act 1993* *Environment Protection (Water Quality) Policy 2015 (SA)*

IMPACT ID SW09 Generation of Acid Sulphate Soils (Local Communities)

IMPACT ID SW09 Generation of Acid Sulphate Soils (Local Communities)						
Applicable Alignment Section -ALL						
Planned Event	**Potential Impact**	Excavation and earthworks disturb acid sulphate soils (ASS) leading to generation of acid leachate impacting local communities.		**Phase**	Construction	
	Source	Project	Clearance, excavation and earthworks undertaken during construction have the potential to disturb acid sulphate soils. There are several salt lakes adjacent to the route alignment, and the route traverses low lying areas around Lake Windabout and Pernatty Lagoon, which may have sediments that could form acid sulphate soils. Previous investigations undertaken at sites across the Project Area, identified the inlet to Lake Windabout as having very thin monosulfide layers within the top 5 cm of surficial sediments (BHP Billiton, 2009).				
	Pathway	Surface water	Inland acid sulphate soils (ASS) form in instances where there is a source of sulphate, iron and organic matter, all of which occur in inland salt lakes. If disturbed, the amount of acid produced by oxidation from the small amount of monosulphides would be negligible, and have no off-site effects as surface waters in the region are scarce, with flow occurring for short periods following only significant rainfall events. Rainfall in the region is low, with no clear seasonal pattern. Rainfall is unpredictable and sporadic throughout the year, reducing the likelihood of mobilisation of acid leachate if generated by construction works.			
	Receptor	<u>Local Communities:</u> Aboriginal Communities Third-party Users Future Users	Although scarce, surface waters in the region are of value to pastoralists. Following rainfall events, pastoralists may utilise surface waters from dams providing supply for up to two years. Water ponded in clay pans following storm events provide an important source of water for sheep, cattle and native fauna. However, the high evaporation rates and sporadic nature of rainfall in the region mean that surface water is only used opportunistically in the region.			
	Design Controls	Geotechnical investigations will be undertaken as part of structure foundation design Siting of the transmission structures and access track to avoid disturbing identified areas of potential acid sulphate soils as far as possible e.g. Lake Windabout inlet.				
	Is the Linkage Confirmed	No	Detailed design will ensure that areas of PASS will be avoided. Even if disturbed, the amount of acid produced by oxidation from the small amount of monosulphides would be minimal, with negligible potential for off-site effects, particularly given that lakes such as Lake Windabout also form a sink for surface water and groundwater flows.	**Uncertainty: S-P-R, impact statement**	Disturbance of potential acid sulphate soils is conceptual based.	
	Is the S-P-R Material?	No	**Justification**	The impact is not considered material as even if disturbed, the amount of acid produced by oxidation from the small amount of monosulphides would be minimal with negligible potential for off-site effects.	**Legislative Requirements**	*Environment Protection Act 1993* Environment Protection (Water Quality) Policy 2015 (SA)

5 GROUNDWATER IMPACT ASSESSMENT

IMPACT ID GW01 Groundwater Abstraction (Aquatic Ecology)

IMPACT ID GW01 Groundwater Abstraction (Aquatic Ecology)	Applicable Alignment Section -ALL			
Potential Impact	Abstraction of groundwater during construction activities leads to a reduction of groundwater quantity resulting in an impact to Aquatic Ecology		**Phase**	Construction
Source	Project	Groundwater may be abstracted for compacting foundations at tower sites, dust suppression along the easement, domestic use and concrete manufacture. Approximately 50 ML of water will be obtained from a range of sources, including existing and new groundwater wells and the State potable water network		
Pathway	Ground water quantity	Groundwater is limited in extent and is generally of poor to marginal quality in the region of the Project. Shallow groundwater is highly saline to hypersaline, generally ranging between 14,000 mg/L and 100,000 mg/L along the alignment and up to 200,000 mg/L near ephemeral salt lakes. Groundwater wells in the Study Area groundwater salinities of 6,500 to 42,000 mg/L (WaterConnect, 2018. Groundwater investigations for the Carrapateena mining lease (located to 43 km east) indicated salinity values across the wells tested range from 25,440 mg/l to 166,800 mg/l (OZ Minerals, 2017). Depth to groundwater varies along the alignment. It is shallower in proximity to salt lakes (in the order of 5 m below ground level) however is generally in the order of 10-20m or more, particularly on higher topography (SARIG 2018, OZ Minerals 2017). Limited groundwater discharge may occur to some of the salt lakes in the Study Area.		
Receptor	Aquatic Ecology	Ephemeral lakes support aquatic invertebrates such as Brine Shrimp which lay dormant as eggs until rainfall events stimulate their life cycle. Following significant rainfall, these species can provide food resources for water birds (EBS 2018). Of the 171 avian species identified in BDBSA records , 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events. There are no known groundwater springs or groundwater dependent ecosystems of note recognised in the Study Area (refer Chapter 11) and reliance of flora and fauna on groundwater is likely to be very limited, predominantly due to the depth and salinity.		
Design Controls	Abstraction rates and volumes within limits agreed with well owner. Appropriate permits for the construction of water supply wells obtained where required.			
Is the Linkage Confirmed	No	Limited and short term groundwater use for the transmission line would have negligible effects on the groundwater quantity for aquatic ecosystems.	**Uncertainty: S-P-R, impact statement**	Effects from groundwater abstraction associated with the project construction have been assessed and considered appropriate.

			There are no known groundwater dependent ecosystems of note recognised in the Study Area and reliance of flora and fauna on groundwater is likely to be very limited, predominantly due to the depth and salinity.			
	Is the S-P-R Material?	No	**Justification**	The impact is not material based on the relatively low volumes likely to be extracted, short term nature of the activities and lack of dependence of flora and fauna on groundwater.	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA)

IMPACT ID GW02 Groundwater Abstraction (Terrestrial Ecology)

IMPACT ID GW02 Groundwater Abstraction (Terrestrial Ecology)				
Potential Impact	Abstraction of groundwater during construction activities leads to a reduction of groundwater quantity resulting in an impact to Terrestrial Ecology		**Phase**	Construction
Source	Project	Groundwater may be abstracted for compacting foundations at tower sites, dust suppression along the easement, domestic use and concrete manufacture. Approximately 50 ML of water will be obtained from a range of sources, including existing and new groundwater wells and the State potable water network.		
Pathway	Ground water quantity	Groundwater is limited in extent and is generally of poor to marginal quality in the region of the Project. Shallow groundwater is highly saline to hypersaline, generally ranging between 14,000 mg/L and 100,000 mg/L along the alignment and up to 200,000 mg/L near ephemeral salt lakes. Groundwater wells in the Study Area groundwater salinities of 6,500 to 42,000 mg/L (WaterConnect, 2018. Groundwater investigations for the Carrapateena mining lease (located to 43 km east) indicated salinity values across the wells tested range from 25,440 mg/l to 166,800 mg/l (OZ Minerals, 2017). Depth to groundwater varies along the alignment. It is shallower in proximity to salt lakes (in the order of 5 m below ground level) however is generally in the order of 10-20m or more, particularly on higher topography (SARIG 2018, OZ Minerals 2017). Limited groundwater discharge may occur to some of the salt lakes in the Study Area.		
Receptor	Native Fauna (including NPW and EPBC-listed species)	There are no known springs or groundwater dependent ecosystems of note recognised in the Study Area (refer Chapter 11) and reliance of flora and fauna on groundwater is likely to be very limited, predominantly due to the depth and salinity. Review of the Biological Database of South Australia (BDBSA) records indicate that a total of 469 flora species (consisting of 413 native species and 56 exotic species) have been recorded on or around the Study Area (5 km buffer). Species were largely represented by individuals from the *Chenopodiaceae* (Chenopod) family with other dominant representation provided by *Gramineae* (Grass) species, *Compositae* (Daisies), *Leguminosae* (Peas, Wattles) and *Malvaceae* (Refer Appendix D1 of the DA: Ecological Baseline Assessment). Eight species of state threatened flora but no nationally threatened species have previously been recorded by BDBSA within the study area. BDBSA records indicate the potential presence of up to 268 native fauna species, including 10 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events. Three threatened species have been recorded in the study area; Plains Mouse (*Pseudomys australis*), Common Sandpiper (*Actitis hypoleucos*) and Lathams Snipe (*Gallinago hardwickii*).		
Design Controls	Abstraction rates and volumes within limits agreed with well owner. Appropriate permits for the construction of water supply wells obtained where required.			

	Is the Linkage Confirmed	No	Limited and short term groundwater use for the transmission line would have negligible effects on the groundwater quantity for aquatic ecosystems. There are no known groundwater dependent ecosystems of note recognised in the Study Area and reliance of flora and fauna on groundwater is likely to be very limited, predominantly due to the depth and salinity	**Uncertainty: S-P-R, impact statement**	Effects from groundwater abstraction associated with the project construction have been assessed and considered appropriate.	
	Is the S-P-R Material?	No	**Justification**	The impact is not material based on the relatively low volumes likely to be extracted, short term nature of the activities and lack of dependence of flora and fauna on groundwater	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA)

IMPACT ID GW03 Groundwater Abstraction (Local Communities)

IMPACT ID GW03 Groundwater Abstraction (Local Communities)						
Applicable Alignment Section -ALL						
Planned Event	**Potential Impact**	Abstraction of groundwater during construction activities leads to a reduction of groundwater quantity impacting on the income and business viability of local communities		**Phase**	Construction	
	Source	Project	Groundwater may be abstracted for compacting foundations at tower sites, dust suppression along the easement, domestic use and concrete manufacture. Approximately 50 ML of water will be obtained from a range of sources, including existing and new groundwater wells and the State potable water network.			
	Pathway	Ground water quantity	Groundwater is limited in extent and is generally of poor to marginal quality in the region of the Project. Shallow groundwater is highly saline to hypersaline, generally ranging between 14,000 mg/L and 100,000 mg/L along the alignment and up to 200,000 mg/L near ephemeral salt lakes. Groundwater wells in the Study Area groundwater salinities of 6,500 to 42,000 mg/L (WaterConnect, 2018). Groundwater investigations for the Carrapateena mining lease (located to 43 km east) indicated salinity values across the wells tested range from 25,440 mg/l to 166,800 mg/l (OZ Minerals, 2017). Depth to groundwater varies along the alignment. It is shallower in proximity to salt lakes (in the order of 5 m below ground level) however is generally in the order of 10-20m or more, particularly on higher topography (SARIG 2018, OZ Minerals 2017). The highly saline nature of the groundwater means that it has limited beneficial use without treatment, apart from mining and industrial applications			
	Receptor	Local Communities: Aboriginal Communities Third-party Users Future Users	Woomera sources its water via a pipeline from the SA Water potable water supply network. Roxby Downs sources its water from groundwater wells within the Great Artesian Basin, following treatment at Olympic Dam. Whilst there are some stock water supplies for pastoral stations sourced from localised perched groundwater systems, most supplies are sourced from dams that capture surface water runoff because on a regional scale, groundwater salinities generally exceed what might be tolerated by stock. Domestic water supplies may be sourced from either rainfall capture or low salinity (less than 2,000 mg/L) groundwater supplies that are associated with perched groundwater flow systems.			
	Design Controls	Abstraction rates and volumes within limits agreed with well owner. Appropriate permits for the construction of water supply wells obtained where required.				
	Is the Linkage Confirmed	No	Limited and short term groundwater use for the transmission line would have negligible effects on the groundwater quantity for groundwater users. Groundwater use in the Study Area is relatively limited and existing wells would not be used for water supply without specific agreement from the owner.	**Uncertainty: S-P-R, impact statement**	Effects from groundwater abstraction associated with the project construction have been assessed and considered appropriate.	

	Is the S-P-R Material?	No	**Justification**	The impact is not material based on the relatively low volumes likely to be extracted, short term nature of the activities. Existing bores would not be used for water supply without specific agreement from the owner.	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA)

6 LAND IMPACT ASSESSMENT

IMPACT ID L01 Accidental Spills (Native Vegetation)

IMPACT ID L01 Accidental Spills (Native Vegetation)					Applicable Alignment Section - ALL
Potential Impact	Accidental spills from the transport, storage and handling of hydrocarbons and chemicals contaminates land leading to a decrease in soil quality resulting in a loss of abundance and/or diversity of native vegetation			**Phase**	All
Source	Project	The construction of Project infrastructure and operation of various project activities will require the consumption of chemicals and fuel			
Pathway	Land (Secondary pathways include surface water and groundwater)	Chemicals and hydrocarbons will be stored in accordance with relevant standards and guidelines. This restricts accidental release to land without an unplanned risk event occurring.			
Receptor	Terrestrial Ecology (Native Vegetation including NPW and EPBC-listed species)	A total of 413 native flora species were identified for the Study Area from historical floristic records within the BDBSA. Species were largely represented by individuals from the *Chenopodiaceae* (Chenopod) family with other dominant representation provided by *Gramineae* (Grass) species, *Compositae* (Daisies), *Leguminosae* (Peas, Wattles) and *Malvaceae* (Refer Appendix D1 of the DA: Ecological Baseline Assessment). Two nationally threatened flora species have the potential to occur within the Study Area.; *Frankenia plicata* (Braided Sea-heath)(EN) and *Senecio megaglossus* (Large-flower Groundsel) (V). One state-threatened flora species is known to occur within the broader Study Area *Santalum spicatum* (Sandalwood) (V), and five species listed as vulnerable to rare possibly occur within the Study Area (Desert Lime, Large Adders Tongue; Australian Broomrape, One-bristle Everlasting and Wild Violet). None of these species were observed during the baseline survey (EBS 2018).			
Design Controls	Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards.				
Is the Linkage Confirmed	No	Hydrocarbons and chemicals will be stored within appropriate containers relevant to the material being stored. An impact can only occur as a result of an unplanned event that results in the uncontrolled release of hydrocarbons or chemicals.	**Uncertainty: S-P-R, impact statement**	There is no identified uncertainty based on the planned event	

	Is the S-P-R Material?	Yes	**Justification**	The impact will not occur without an unplanned risk event (assessed below), and has been subject to a risk assessment below.	**Legislative Requirements**	*Dangerous Substances Act 1979* (SA) *Environment Protection Act 1993* (SA)

		Risk Event	**Management Controls**	**Risk (Post Controls)**		
				Consequence	**Likelihood**	**Risk**
Unplanned Event	**Risk Assessment**	The transport, storage and handling of hydrocarbons and chemicals results in an accidental spill that contaminates land and secondary pathways impacting on native vegetation	• Locate camps and mobile facilities away from watercourses and lakes. • Wastewater managed in accordance with health regulations and Environment Protection (Water Quality) Policy. • Spill and emergency response procedures. • Equipment maintenance to prevent spills. • Licensed chemical and waste transporters. • Wastewater managed in accordance with health regulations and Environment Protection (Water Quality) Policy 2015. • Periodic equipment maintenance in accordance with equipment specifications. • Spill and emergency response procedures. • Maintain contaminated land register.	2 – Minor	D – Unlikely	5 -Low

IMPACT ID L02 Land Clearing (Common Native Vegetation and Fauna)

IMPACT ID L02 Land Clearing (Common Native Vegetation and Fauna)	Applicable Alignment Section - ALL				
Potential Impact	Land clearance for the construction of project infrastructure removes vegetation and habitat for fauna, causing a loss of abundance and diversity of common native vegetation and fauna.			**Phase**	Construction
Source	Land Disturbance and Natural Regeneration	Construction of the Project will require worst case clearance of 470 ha of native vegetation and habitat. Cleared areas not housing permanent infrastructure will be allowed to regenerate naturally, restoring landscape function over time.			
Pathway	Land	The disturbance will result in reduction of area of vegetation associations present, with the associations with the highest area of clearance (Section 11.2.1) including Bladder Saltbush / Samphire Shrubland (approx. 80 ha), Mulga Mixed Woodland (approx. 80 ha), Sandhill Wattle / Sticky Hopbush Shrubland (approx. 70 ha), Bladder Saltbush / Swamp Canegrass Low Shrubland (approx. 70 ha) and Western Myall Open Woodland (approx. 55 ha) based on worst-case land disturbance estimates.			
Receptor	Terrestrial Ecology (Common Native vegetation and fauna including NPW and EPBC-listed species)	Review of the Biological Database of South Australia (BDBSA) records indicate that a total of 469 flora species (consisting of 413 native species and 56 exotic species) have been recorded on or around the Study Area (5 km buffer). Species were largely represented by individuals from the *Chenopodiaceae* (Chenopod) family with other dominant representation provided by *Gramineae* (Grass) species, *Compositae* (Daisies), *Leguminosae* (Peas, Wattles) and *Malvaceae* (Refer Appendix D1 of the DA: Ecological Baseline Assessment). BDBSA records indicate the potential presence of up to 268 native fauna species, including 10 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events.			
Design Controls	Incorporate existing tracks into the design where possible to avoid construction of new access tracks. Minimisation of disturbance footprint wherever possible.				
Is the Linkage Confirmed	Yes	The construction of project infrastructure will result in the clearance of native vegetation and habitat.	**Uncertainty: S-P-R, impact statement**	Land disturbance has been assessed against the known vegetation associations in the project area. Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.	
Is the S-P-R Material?	Yes	**Justification**	The clearance of vegetation can only occur under an approval under the *Native Vegetation Act 1991 (SA)* and is considered material due to the need to demonstrate compliance, and to manage and mitigate impacts.	**Legislative Requirements**	*Native Vegetation Act 1991* (SA)

	Impact Significance	**Resilience**	1 – Adaptable to effect / change.	The project will result in the worst-case loss of up to 470 ha of native habitat (actual losses likely to be far less), within a narrow, linear project footprint surrounded by largely continuous native vegetation. Temporary cleared areas naturally regenerate over the longer term. Temporary or permanent losses of vegetation will cause local displacement of fauna to areas of same / similar native habitat potentially within existing home ranges. Significant impacts are not anticipated.
		Importance	1 - Abundant	Native vegetation communities and habitats supporting native fauna are well represented within the Project footprint and broader Study Area.
		Duration	3 – 100 years from commencement	Permanent losses of native vegetation and habitat are associated with permanent infrastructure and will be for a potential duration of up to 100 years as per likely infrastructure lifespan. Temporary cleared areas left to naturally regeneration will likely take >30 years to recover (dominated by slow growing, perennial communities with a reliance on adequate rainfall for germination / recolonisation).
		Significance Rating	3 – Not significant	Not significant (<48)
	Impact Uncertainty	**Inputs**	B – Limited data	Initial baseline assessment employed rapid but recognised field survey methods across a broad study area, which has been coupled with a review of historic databases (BDBSA, PMST) and historic technical studies (BHP Billiton, 2009). Informed assumptions on the likelihood of presence / absence of species have been made on this basis.
		Method	A – Recognised method	Recognised survey methods were utilised during rapid baseline assessment and in the assimilation of historic records (Appendix D1 of the DA: Ecological Baseline Assessment)
		Sensitivity	A – Predictions not sensitive	Predictions not sensitive to change even with more detailed input (i.e. detailed baseline assessment will be completed and will inform micro siting of poles and towers)
		Uncertainty Rating	4	Not Uncertain (No change to Impact Significance <48)
	Final Impact Rating	**4**	**Final Impact Category**	Very Low

Unplanned Event	**Risk Assessment**	**Risk Event**	**Management Controls**	**Risk**		
				Consequence	**Likelihood**	**Risk**
		Land clearance outside the intended disturbance footprint or undertaken without prior approval under the *Native Vegetation Act 1991* (SA) results in the loss of abundance and diversity of common native flora and fauna	External land disturbance approvals process; appropriate SEB credit established prior to clearance being undertaken Area-specific and site inductions and training Install bunting around potential preferred habitat identified during targeted surveys or pre-disturbance site clearances,	2-Minor	D- Unlikely	5-Low

			where appropriate, to ensure no disturbance beyond the essential vegetation clearance footprint. Compliance with the internal land disturbance approval process. Land disturbance reconciliation during and after construction. GIS system to record / identify clearance areas and status. Protection of sensitive habitats and species, when encountered, in accordance with work plans and training.			

IMPACT ID L03 Land Clearing (NPW Act Flora and Fauna)

IMPACT ID L03 Land Clearing (NPW Act Flora and Fauna)	Applicable Alignment Section -ALL			
Potential Impact	Land clearance for the construction of project infrastructure removes vegetation and habitat for fauna, causing a loss of abundance and diversity of NPW Act-listed flora and fauna.		**Phase**	Construction
Source	Land Disturbance and Natural Regeneration	Construction of the Project will require worst case clearance of 470 ha of native vegetation and habitat. Cleared areas not housing permanent infrastructure will be allowed to regenerate naturally, restoring landscape function over time.		
Pathway	Land	The disturbance will result in reduction of area of vegetation associations present, with the associations with the highest area of clearance (Section 11.2.1) including Bladder Saltbush / Samphire Shrubland (approx. 80 ha), Mulga Mixed Woodland (approx. 80 ha), Sandhill Wattle / Sticky Hopbush Shrubland (approx. 70 ha), Bladder Saltbush / Swamp Canegrass Low Shrubland (approx. 70 ha) and Western Myall Open Woodland (approx. 55 ha) based on worst-case land disturbance estimates.		
Receptor	Terrestrial Ecology (NPW Flora and fauna)	A review of BDBSA records identified eight NPW Act threatened flora within the Study Area. One species was confirmed at baseline survey in the Project Area (sandalwood *Santalum spicatum*), and five species are considered to possible and will be actively targeted and voided (if found) when micro-siting towers / poles (Desert Lime, *Citrus glauca*; Large Adders Tongue, *Ophioglossum polyphyllum;* Australian Broomrape, *Orobanche cernua* var. *Australiana*; Wild Violet, *Swainsona microcalyx*; and One-bristle Everlasting *Gratwickia monochaeta*). No vegetation communities identified by the baseline survey are listed as threatened for the relevant sub region on the Provisional List of State Threatened Ecosystems. Twenty-seven (27) state threatened fauna were identified as possible by a BDBSA search, five of which are also protected by the EPBC Act (EPBC Act species discussed in Land Clearing (EPBC Act Flora and Fauna) below). Of the state-only protected species, four are considered likely to occur (musk duck, *Biziura lobata*; blue-billed duck, *Oxyura* australis; freckled duck, *Stictonetta naevosa*; Pernatty knob-tailed gecko, *Nephrurus deleani*) in the Study Area (Appendix D1 of the DA: Ecological Baseline Assessment). The majority of state-threatened species likely and possibly occurring are aquatic avifauna, and would be found in proximity to dams and inland lakes when conditions are suitable. Large rainfall events may attract large numbers of migratory avifauna that stay and breed during the southern hemisphere summer.		
Design Controls	Incorporate existing tracks into the design where possible to avoid construction of new access tracks. Minimisation of disturbance footprint wherever possible. Avoidance of critical habitat when micro-siting poles, tracks and laydown areas.			
Is the Linkage Confirmed	Yes	The construction of project infrastructure will result in the clearance of native vegetation and habitat.	**Uncertainty: S-P-R, impact statement**	Land disturbance has been assessed against the known vegetation associations in the project area. Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.

	Is the S-P-R Material?	Yes	**Justification**	The clearance of native vegetation can only occur with approval under the *Native Vegetation Act 1991* (SA) (which is designed to protect high value habitats) and is considered material due to other legislative requirements and the need to demonstrate compliance.		**Legislative Requirements**	*Native Vegetation Act 1991* (SA) National Parks and Wildlife Act 1972 (SA)
	Impact Significance	**Resilience**		1 - Adaptable to effect / change	The micro-siting of towers / poles will allow habitats of significance to NPW listed flora and fauna present or potentially present to be avoided possibly present (Appendix D1 of the DA: Ecological Baseline Assessment). NPW listed fauna are considered adaptable because of their ability to relocate to areas of similar habitat immediately surrounding the linear infrastructure and the greater region.		
		Importance		4 – State	Of the 18 state threatened flora and fauna species known, likely or possibly occurring in the study area, all are categorised as rare or vulnerable. Only one species, Sandalwood, was observed by the baseline assessment within the Study Area.		
		Duration		3 - 100 years from commencement	Permanent losses of native vegetation and habitat are associated with permanent infrastructure (i.e. towers / poles, tracks, well pads), and will be for a potential duration of up to 100 years as per likely infrastructure lifespan. Temporary cleared areas left to naturally regeneration will likely take >30 years to recover (dominated by slow growing, perennial communities with a reliance on adequate rainfall for germination / recolonisation).		
		Significance Rating		12 – Non significant	Not significant (<48)		
	Impact Uncertainty	**Inputs**		B – Limited data	Initial baseline assessment employed rapid but recognised field survey methods across a broad study area, which has been coupled with a review of historic databases (BDBSA, PMST) and historic technical studies (BHP Billiton, 2009). Informed assumptions on the likelihood of presence / absence of species have been made on this basis.		
		Method		A – Recognised method	Recognised survey methods were utilised during rapid baseline assessment and in the assimilation of historic records (Appendix D1 of the DA: Ecological Baseline Assessment)		
		Sensitivity		B – Some sensitivity of predictions	Predictions may be sensitive to change with more detailed input (i.e. detailed baseline assessment will be completed, informing micro siting of poles and towers)		
		Uncertainty Rating		17	Not significant (<48)		
	Final Impact Rating	17		**Final Impact Category**	Low		

		Risk Event	Management Controls	Residual Risk (Post Controls)		
				Consequence	Likelihood	Risk
Unplanned Event	**Risk Assessment**	Land clearance outside the intended disturbance footprint or undertaken without prior approval under the *Native Vegetation Act 1991* (SA) results in the loss of abundance and diversity of NPW Act listed flora and fauna	External land disturbance approvals process; appropriate SEB credit established prior to clearance being undertaken Area-specific and site inductions and training Install bunting around potential preferred habitat identified during targeted surveys or pre-disturbance site clearances, where appropriate, to ensure no disturbance beyond the essential vegetation clearance footprint. Compliance with the internal land disturbance approval process. Land disturbance reconciliation during and after construction. GIS system to record / identify clearance areas and status. Protection of sensitive habitats and species, when encountered, in accordance with work plans and training.	3- Moderate	D-Unlikely	9- Moderate

IMPACT ID L04 Land Clearing (EPBC Act Flora and Fauna)

IMPACT ID L04 Land Clearing (EPBC Act Flora and Fauna)	Applicable Alignment Section -ALL			
Potential Impact	Land clearance for the construction of project infrastructure removes vegetation and habitat for fauna, causing a loss of abundance and diversity of EPBC Act-listed flora and fauna.		**Phase**	Construction
Source	Land Disturbance and Natural Regeneration	Construction of the Project will require worst case clearance of 470 ha of native vegetation and habitat. Cleared areas not housing permanent infrastructure will be allowed to regenerate naturally, restoring landscape function over time.		
Pathway	Land	The disturbance will result in reduction of area of vegetation associations present, with the associations with the highest area of clearance (Section 11.2.1) including Bladder Saltbush / Samphire Shrubland (approx. 80 ha), Mulga Mixed Woodland (approx. 80 ha), Sandhill Wattle / Sticky Hopbush Shrubland (approx. 70 ha), Bladder Saltbush / Swamp Canegrass Low Shrubland (approx. 70 ha) and Western Myall Open Woodland (approx. 55 ha) based on worst-case land disturbance estimates.		
Receptor	Terrestrial Ecology (EPBC Flora and fauna)	A significant impact assessment of EPBC Act Protected Matters was undertaken for the Study Area. Threatened Ecological Communities were not identified for the Study Area. The EPBC Act assessment identified two nationally threatened flora, two of which possibly occur (southern sea-heath, *Frankenia plicata*; large-flower groundsel, *Senecio megaglossus*). Of the eight threatened EPBC Act fauna identified, five were assessed as possibly occurring in the Study Area (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall*; curlew sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis*; Plains Mouse, *Pseudomys australis*). The assessment also identified 15 migratory avifauna (2 of these are also EPBC Act threatened), of which 2 are considered likely to occur (Latham's Snipe, *Gallinago hardwickii*; Common Greenshank, *Tringa nebularia*;) and 8 possibly occur in the Study Area (Fork-tailed Swift; *Apus pacificus*; Common Sandpiper, *Actitis hypoleucos*; sharp-tailed sandpiper, *Calidris acuminata*; pectoral sandpiper, *Calidris melanotos;* Ruddy Turnstone, *Arenaria interpres;* Black-tailed Godwit, *Limosa;* and Wood Sandpiper, *Tringa glareola*). With the exception of fork-railed swift, the majority of migratory species would be found in proximity to dams and inland lakes when conditions are suitable.		
Design Controls	Incorporate existing tracks into the design where possible to avoid construction of new access tracks. Minimisation of disturbance footprint wherever possible. Avoidance of EPBC-listed flora and critical habitat for EPBC-listed fauna when micro-siting poles, tracks and laydown areas via targeted surveys.			
Is the Linkage Confirmed	Yes	The construction of project infrastructure will result in the clearance of native vegetation and habitat.	**Uncertainty: S-P-R, impact statement**	Land disturbance has been assessed against the known vegetation associations in the project area. Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.

	Is the S-P-R Material?	Yes	**Justification**	The clearance of native vegetation and habitat requires approval under the *Native Vegetation Act 1991* (SA) and possibly *Environment Protection and Biodiversity Conservation Act 1999* (both designed to protect high value habitats) and is considered material due to other legislative requirements and the need to demonstrate compliance.	**Legislative Requirements**	Native Vegetation Act 1991 (SA) *Environment Protection and Biodiversity Conservation Act 1999* (Cth)
	Impact Significance	**Resilience**		1 - Adaptable to effect / change		In general, habitat types present on the alignment are well represented across the broader landscape, and do not provide critical refuge for any of the EPBC-listed fauna species identified. The footprint for the project will impact a very small proportion of the available habitat for EPBC-listed fauna species. If present, the EPBC-listed fauna are considered adaptable because of their ability to relocate to areas of similar habitat within the greater region. Furthermore, the micro-siting of towers / poles to avoid significant habitats further enhances the resilience and protection of EPBC listed flora and fauna possibly present (Appendix D1 of the DA: Ecological Baseline Assessment).
		Importance		5 – National		Of the seven nationally threatened flora and fauna species possibly occurring in the study area, one is critically endangered, two are endangered and four vulnerable. None were observed by the baseline assessment within the Project Area. The Project will not involve the clearance of any habitat for the Critically Endangered Curlew Sandpiper.
		Duration		3 - 100 years from commencement		Permanent losses of native vegetation and habitat are associated with permanent infrastructure (i.e. towers / poles, tracks, well pads), and will be for a potential duration of up to 100 years as per likely infrastructure lifespan. Temporary cleared areas left to naturally regeneration will likely take >30 years to recover (dominated by slow growing, perennial communities with a reliance on adequate rainfall for germination / recolonisation).
		Significance Rating		15 – Non significant		Not significant (<48)
	Impact Uncertainty	**Inputs**		B – Limited data		Initial baseline assessment employed rapid but recognised field survey methods across a broad study area, which has been coupled with a review of historic databases (BDBSA, PMST) and historic technical studies (BHP Billiton, 2009). Informed assumptions on the likelihood of presence / absence of species have been made on this basis.
		Method		A – Recognised method		Recognised survey methods were utilised during rapid baseline assessment and in the assimilation of historic records (Appendix D1 of the DA: Ecological Baseline Assessment)

		Sensitivity	B – Some sensitivity of predictions	Predictions may be sensitive to change with more detailed input (i.e. detailed baseline assessment will be completed, informing micro siting of poles and towers)
		Uncertainty Rating	21	Not significant (<48)
	Final Impact Rating	21	**Final Impact Category**	Low

				Residual Risk (Post Controls)		
		Risk Event	**Management Controls**	**Consequence**	**Likelihood**	**Risk**
Unplanned Event	**Risk Assessment**	Land clearance outside the intended disturbance footprint or undertaken without prior approval under the *Native Vegetation Act 1991* (SA) results in the loss of abundance and diversity of EPBC Act listed flora and fauna	External land disturbance approvals process; appropriate SEB credit established prior to clearance being undertaken Area-specific and site inductions and training Install bunting around potential preferred habitat identified during targeted surveys or pre-disturbance site clearances, where appropriate, to ensure no disturbance beyond the essential vegetation clearance footprint. Compliance with the internal land disturbance approval process. Land disturbance reconciliation during and after construction. GIS system to record / identify clearance areas and status. Protection of sensitive habitats and species, when encountered, in accordance with work plans and training.	3- Moderate	D-Unlikely	9- Moderate

IMPACT ID L05 Land Fragmentation (Native Fauna)

IMPACT ID L05 Land Fragmentation (Native Fauna)			Applicable Alignment Section -ALL	
Potential Impact	The construction of the powerline and access track leads to fragmentation of habitat resulting in displacement of native fauna		**Phase**	Construction
Source	Project	Construction of the Project will require worst case clearance of 470 ha of native vegetation and habitat. Cleared areas not housing permanent infrastructure will be allowed to regenerate naturally, restoring landscape function over time.		
Pathway	Land	The disturbance of land will result in the clearance of vegetation along an access track approximately 5 m wide and possibly a stringing easement, with discrete clearances at locations such as transmission structures, strain locations and laydowns. The associations with the highest area of clearance (Section 11.2.1) including Bladder Saltbush / Samphire Shrubland (approx. 80 ha), Mulga Mixed Woodland (approx. 80 ha), Sandhill Wattle / Sticky Hopbush Shrubland (approx. 70 ha), Bladder Saltbush / Swamp Canegrass Low Shrubland (approx.. 70 ha) and Western Myall Open Woodland (approx. 55 ha) based on worst-case land disturbance estimates.		
Receptor	Fauna including NPW and EPBC species	Review of the Biological Database of South Australia (BDBSA) records indicate that a total of 469 flora species (consisting of 413 native species and 56 exotic species) have been recorded on or around the Study Area (5 km buffer). Species were largely represented by individuals from the *Chenopodiaceae* (Chenopod) family with other dominant representation provided by *Gramineae* (Grass) species, *Compositae* (Daisies), *Leguminosae* (Peas, Wattles) and *Malvaceae* (Refer Appendix D1 of the DA: Ecological Baseline Assessment). Eight species of state threatened flora but no nationally threatened species have previously been recorded by BDBSA within the study area. BDBSA records indicate the potential presence of up to 268 native fauna species, including 10 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events. Three threatened species have been recorded in the study area; Plains Mouse (*Pseudomys australis*), Common Sandpiper (*Actitis hypoleucos*) and Lathams Snipe (*Gallinago hardwickii*). Nine threatened EPBC Act fauna were identified for the study area, five of which were assessed as possibly occurring in the Study Area. Twenty-seven (27) state threatened fauna were identified as possible by a BDBSA search, 4 of which are also protected by the EPBC Act. Native vegetation communities and habitats supporting native fauna are well represented within the Project footprint and broader Study Area.		
Design Controls	Incorporate existing tracks into the design where possible to avoid construction of new access tracks. Minimisation of disturbance footprint wherever possible.			

	Is the Linkage Confirmed	No	The Project will not result in significant fragmentation, predominantly due to the narrow nature of the access track footprint, discrete nature of disturbance for structures, and the naturally open structure of the vegetation. The ability to micro-site infrastructure to avoid sensitive habitats or to target areas of poorer quality habitat further reduces the effect.	**Uncertainty: S-P-R, impact statement**	Uncertainty around the S-P-R link has been assessed in Appendix D2 of the DA (Ecological Impact Assessment) and is considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	Impact is not considered to be material with there being no effect predicted outside of the footprint, and with impacts further minimised through design and construction controls.		**Legislative Requirements**	Native Vegetation Act 1991 (SA)

IMPACT ID L06 Removal, relocation or damage of artefacts (Barngarla and Kokatha People)

IMPACT ID L06 Removal, relocation or damage of artefacts (Barngarla and Kokatha People)						
Planned Event	**Potential Impact**	Land disturbance associated with the construction of the project results in the removal, relocation or damage of artefacts that are of significance to the heritage and culture of the Aboriginal communities (Barngarla and Kokatha People)			Phase	Construction
	Source	Land disturbance and rehabilitation	Construction of the project components will have a land disturbance footprint of 470 ha including buffers stretched out over 237 km of the Project Area; the areas of disturbance have a relatively small and discrete footprint and are sparsely distributed.			
	Pathway	Land	The region has a long history of occupation by Barngarla and Kokatha People and they maintain a strong association with country. Numerous sites of Aboriginal cultural heritage significance are known to exist within the region. These sites tend to focus around surface water features such as creek lines (DA Section 13.1.1). A search of the Department of State Development Aboriginal Affairs and Reconciliation (DSD-AAR) Central Archive, which includes the Register of Aboriginal Sites and Objects (the Register), identified 32 registered and 103 reported Aboriginal sites in the Study Area. The Central Archive notes that sites or objects may exist in the Study Area, even though the Register does not identify them			
	Receptor	Aboriginal Communities	The land traversed by the transmission line is subject to two Native Title Determinations; The southern 32 kilometre portion of the Project Area is within the determined Barngarla Native Title Claim (NNTT Number SCD2016/001) and the remaining area lies within the determined Kokatha People (Part A) Native Title Determination (National Native Title Tribunal (NNTT) Number SCD2014/004). The Barngarla Determination Aboriginal Corporation (BDAC) is the Registered Native Title Body Coporate who acts as an agent for the Barngarla People in relation to their native title rights and interests. The Kokatha Aboriginal Corporation (KAC) is the Registered Native Title Body Corporate who acts as an agent for the Kokatha People in relation to their native title rights and interests.(DA Section 13.1.1) OZ Minerals respects that the presence of infrastructure on Barngarla and Kokatha and country does not come without pain for the Barngarla and Kokatha peoples and our partnership is focussed on honesty, transparency and mutual benefit as we develop the project.			
	Design Controls	Avoidance of sites of cultural heritage significance as determined in consultation with the Barngarla and Kokatha People.				
	Is the Linkage Confirmed	Yes	Construction activities may result in the clearing and disturbance of artefacts where identified by the Barngarla and Kokatha People. Areas identified for disturbance are surveyed in accordance with the Land Clearance Approval process as agreed between OZ Minerals the	**Uncertainty: S-P-R, impact statement**	Land disturbance associated with project infrastructure has been determined and is subject to heritage surveys with the Barngarla and Kokatha People and their nominated anthropologist.	

			Barngarla Determination Aboriginal Corporation (BDAC) and the Kokatha Aboriginal Corporation (KAC). OZ Minerals respect the cultural rights of the Barngarla and Kokatha. People and will not disclose results of sensitive discussions.			
	Is the S-P-R Material?	Yes	**Justification**	Consultation with the Barngarla and Kokatha People has been ongoing throughout the project design. OZ Minerals understand that regardless of any agreement or process between the parties, the continued demonstration of management of land clearance in relation to Aboriginal heritage is material.	**Legislative Requirements**	*Aboriginal Heritage Act 1988 (SA)*

				Risk		
		Risk Event	**Management Controls**	**Consequence**	**Likelihood**	**Risk**
Unplanned Event	**Risk Assessment**	Land clearance undertaken without prior approval from the Barngarla and Kokatha People results in the removal, relocation or damage of artefacts.	Cultural Heritage Assessment with the Barngarla and Kokatha People. Area-specific and site inductions and training. GIS system to record/identify clearance areas and status. Cultural Heritage Management Plan, including new discovery reporting procedures. Identification and fencing (where appropriate) of sites of cultural heritage significance. Land disturbance reconciliation during and after construction. The CEMP outlines responsibilities for the adherence to appropriate construction practices.	3 Moderate	D - Unlikely	9- Moderate

IMPACT ID L07 Disturbance to non-Indigenous Heritage (Local Communities)

IMPACT ID L07 Disturbance to non-Indigenous Heritage (Local Communities)							
Applicable Alignment Section -ALL							
Planned Event	**Potential Impact**	Land disturbance associated with the construction of project infrastructure disturbs sites of non-Indigenous heritage resulting in impacts on the State of South Australia			**Phase**	Construction	
	Source	Land disturbance and rehabilitation	Construction of the project components will have a land disturbance footprint of 470 ha including buffers stretched out over 237 km of the Project Area; the areas of disturbance have a relatively small and discrete footprint and are sparsely distributed. With the exception of the establishment of the temporary infrastructure associated with the operation, which would be removed post construction, the only permanent changes to regional topography would be associated with the erection of poles and stringing of wires.				
	Pathway	Land	The study area contains a rich and varied history of non-Indigenous land use. Based on a review of the State Heritage Register, the National Heritage List, Commonwealth Heritage List and the Register of the National Estate, no sites of non-Indigenous historical significance have been identified within the project area (DA Section 13.1.2)				
	Receptor	Local Communities: Third-party Users Future Users	Most sites throughout the region relate to the development of the pastoral industry, as well as the historical themes of transport, mining, exploration and the Woomera Rocket Range. These places link communities with attitudes and values that have shaped the region (DA Section 13.1.2)				
	Design Controls	Elimination and Substitution design control measures were not considered due to the absence of non-Indigenous heritage sites.					
	Is the Linkage Confirmed	No	Based on a review of the State Heritage Register, the National Heritage List, Commonwealth Heritage List and the Register of the National Estate, no sites of non-Indigenous historical significance have been identified within the project area. There are no sites of non-Indigenous heritage significance that will be disturbed by this activity.	**Uncertainty: S-P-R, impact statement**	Land disturbance associated with project infrastructure has been determined and assessed against non-Indigenous heritage databases.		
	Is the S-P-R Material?	No	**Justification**	There are no non-Indigenous heritage sites identified within the project area.	**Legislative Requirements**	*Heritage Places Act 1999 (SA)*	

IMPACT ID L08 Saline Overspray (Vegetation and Fauna)

IMPACT ID L08 Saline Overspray (Vegetation and Fauna)						
Applicable Alignment Section -ALL						
	Potential Impact	Saline overspray from dust suppression that deposits onto soil or native vegetation reduces vegetation health and impacts on the abundance and/or diversity or terrestrial flora and fauna		**Phase**	Construction/Operation	
	Source	Emissions	Saline groundwater may be used for dust suppression on access tracks, stockpiles and to compact foundations at tower / pole locations during the construction phase. Water will be applied via a water cart, sprinklers and or hoses The salinity of groundwater in the Study Area ranges from 6,000 mg/L to over 100,000 mg/L.			
	Pathway	Land	Overspray, if it occurs, is anticipated to be restricted to the immediate vicinity of watered areas such as the access track and stockpiles.			
	Receptor	Terrestrial Ecology	A total of 413 native flora species were identified for the Study Area from historical floristic records within the BDBSA. Species were largely represented by individuals from the *Chenopodiaceae* (Chenopod) family with other dominant representation provided by *Gramineae* (Grass) species, *Compositae* (Daisies), *Leguminosae* (Peas, Wattles) and *Malvaceae* (Refer Appendix D1 Ecological Baseline Assessment). Two nationally threatened flora species have the potential to occur within the Study Area.; *Frankenia plicata* (Braided Sea-heath)(EN) and *Senecio megaglossus* (Large-flower Groundsel) (V). One state-threatened flora species is known to occur within the broader Study Area *Santalum spicatum* (Sandalwood) (V), and five species listed as vulnerable to rare possibly occur within the Study Area (Desert Lime, Large Adders Tongue; Australian Broomrape, One-bristle Everlasting and Wild Violet). None of these species were observed during the baseline survey (EBS 2018). The habitats that support native fauna are well represented within the Project footprint and broader Study Area.			
	Design Controls					
	Is the Linkage Confirmed	No	Dust suppression activities will be small scale and short term. There may be a minor and temporary increase in the salts in the soil or depositing on the leaf surface of plants in the immediate vicinity of areas where dust suppression activities are undertaken, but no effect is expected outside of the disturbance footprint.	**Uncertainty: S-P-R, impact statement**	Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.	
	Is the S-P-R Material?	No	**Justification**	Overspray and runoff of saline water onto native vegetation beyond the disturbance footprint is not expected to occur. Within the footprint, impacts to vegetation are likely to be very minor given the short-term nature of construction activities at any given location. Regional vegetation communities are highly tolerant of saline conditions, with plants naturally depositing salts on the leaf surface as a means of distributing soil-borne salts. The impact is not considered material based on there being no effect predicted outside of the disturbance footprint.	**Legislative Requirements**	*Native Vegetation Act 1991* (SA) *National Parks and Wildlife Act 1972* (SA) *Environment Protection and Biodiversity Conservation Act 1999* (Cth)

IMPACT ID L09 Increased Density of Weeds (Native Vegetation)

IMPACT ID L09 Increased Density of Weeds (Native Vegetation)				Applicable Alignment Section -ALL	
Potential Impact	Land clearing creates conditions favourable for an increase in weed density that out compete native vegetation and impacts on the abundance and diversity of native flora			**Phase**	Construction
Source	Land Disturbance and Natural Regeneration	Construction of the Project will require worst case clearance of 470 ha of native vegetation and habitat. Cleared areas not housing permanent infrastructure will be allowed to regenerate naturally, restoring landscape function over time.			
Pathway	Land	Dispersal mechanisms for weeds in rangeland areas mostly include rainfall events and fauna transportation (native, introduced and stock), however, these species are also easily distributed by vehicle movements along access tracks and by earthwork construction. Arid area weed species are also often annual species which respond to heavy rainfall events and are widespread throughout the arid region. A rapid baseline assessment coupled with a review of BDBSA and EPBC Act databases identified 19 weeds that were either observed, or considered as likely or possible to occur in the Study Area. Of these species, 7 are Weeds of National Significance or WONs (African boxthorn, athel pine, prickly pear 3 spp., silver nightshade, ward's weed) and 15 are declared with varying control requirements (African Boxthorn, *Lycium ferocissimum;* Athel Pine, *Tamarix aphylla*; Bathurst Burr, *Xanthium spinosum*; bitter melon 2 spp., *Citrullus amarus* and *C. lanatus;* black nightshade, *Solanum nigrum*; Buffel Grass, *Cenchrus ciliaris*; Common Sow Thistle, *Sonchus oleraceus*; False Caper, *Euphorbia terracina*; Medic, *Medicago* sp.; Prickly Pears, *Opuntia* spp.; Start Thistle, *Carthamus lanatus*; Smooth Mustard, *Sisymbrium erysimoides*;, Ward's Weed, *Carrichtera annua;* Wild Turnip, *Brassica tournefortii*) (refer Appendix D1 of the DA: Ecological Baseline Assessment).			
Receptor	Terrestrial Flora	A review of the Biological Database of South Australia (BDBSA) records indicate that a total of 469 flora species (consisting of 413 native species and 56 exotic species) have been recorded on or around the Study Area (5 km buffer). Species were largely represented by individuals from the *Chenopodiaceae* (Chenopod) family with other dominant representation provided by *Gramineae* (Grass) species, *Compositae* (Daisies), *Leguminosae* (Peas, Wattles) and *Malvaceae* (Refer Appendix D1 of the DA: Ecological Baseline Assessment). Eight species of state threatened flora but no nationally threatened species have previously been recorded by BDBSA within the study area.			
Design Controls	Minimising ground disturbance; design will consider use of existing tracks wherever possible, minimising new clearance and associated risk of weed incursions.				
Is the Linkage Confirmed	No	An increase in the density of existing weed species or the introduction/recruitment of new weed species outside of the disturbance footprint as a result of Project activities is not anticipated to occur without an unplanned risk event occurring and this has been subject to a risk assessment below.	**Uncertainty: S-P-R, impact statement**	Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.	

	Is the S-P-R Material?	Yes	**Justification**	This impact is considered to be material on the basis of the importance of ensuring appropriate weed eradication programs are maintained throughout all phases of the development.	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA)

		Risk Event	**Management Controls**	**Residual Risk (Post Controls)**		
				Consequence	**Likelihood**	**Risk**
Unplanned Event	**Risk Assessment**	Inadequate weed management practices lead to an increase in density of existing or new weed species that out-compete native vegetation and habitat.	Pre-construction inspection to identify any areas of weed infestation requiring specific management measures. Appropriate disposal of any noxious weeds cleared as part of the project. Implement weed hygiene practices such as vehicle wash-downs and inspections during construction as well as post-construction weed surveillance and control programs. Weed Red Alert List for quick identification, provided with induction program where relevant and available on site. Minimising ground disturbance through restriction of vehicle movements and materials to designated construction zones, laydown areas and tracks. Periodic survey (e.g. post completion of construction, after significant rain) to identify and prioritise treatment programs for declared and environmental weeds.	4-Major	E- Rare	10-Moderate

IMPACT ID L10 Increased Density of Weeds (Fauna)

IMPACT ID L10 Increased Density of Weeds (Fauna)				Applicable Alignment Section -ALL	
Potential Impact	Land clearing creates conditions favourable for an increase in weed density that out compete habitat and impacts on the abundance and diversity of fauna species			**Phase**	Construction
Source	Land Disturbance and regeneration	Construction of the Project will require worst case clearance of 470 ha of native vegetation and habitat. Cleared areas not housing permanent infrastructure will be allowed to regenerate naturally, restoring landscape function over time.			
Pathway	Land	Dispersal mechanisms for weeds in rangeland areas mostly include rainfall events and fauna transportation (native, introduced and stock), however, these species are also easily distributed by vehicle movements along access tracks and by earthwork construction. Arid area weed species are also often annual species which respond to heavy rainfall events and are widespread throughout the arid region. A rapid baseline assessment coupled with a review of BDBSA and EPBC Act databases identified 19 weeks that were either observed, or considered as likely or possible to occur in the Study Area. Of these species, 7 are Weeds of National Significance (WONs; African Boxthorn, Athel Pine, Prickly Pear 3 spp., Silver Nightshade, Ward's Weed) and 15 are declared with varying control requirements (African boxthorn, *Lycium ferocissimum;* athel pine, *Tamarix aphylla*; Bathurst Burr, *Xanthium spinosum*; Bitter Melon 2 spp., *Citrullus amarus* and *C. lanatus;* Black Nightshade, *Solanum nigrum*; Buffel grass, *Cenchrus ciliaris*; common sow thistle, *Sonchus oleraceus*; False Caper, *Euphorbia terracina*; Medic, *Medicago* sp.; Prickly Pears, *Opuntia* spp.; Start Thistle, *Carthamus lanatus*; Smooth Mustard, *Sisymbrium erysimoides*;, Ward's Weed, *Carrichtera annua;* Wild Turnip, *Brassica tournefortii*) (refer Appendix D1 of the DA: Ecological Baseline Assessment).			
Receptor	Terrestrial Fauna	BDBSA records indicate the potential presence of up to 268 native fauna species, including 10 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events. Three threatened species have been recorded in the study area; Plains Mouse (*Pseudomys australis*), Common Sandpiper (*Actitis hypoleucos*) and Lathams Snipe (*Gallinago hardwickii*). Native vegetation communities and habitats supporting native fauna are well represented within the Project footprint and broader Study Area.			
Design Controls	Minimising ground disturbance; design will consider use of existing tracks wherever possible, minimising new clearance and associated risk of weed incursions.				
Is the Linkage Confirmed	No	An increase in the density of existing weed species or the introduction/recruitment of new weed species outside of the disturbance footprint as a result of Project activities is not anticipated to occur without an unplanned risk	**Uncertainty: S-P-R, impact statement**	Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.	

			event occurring and this has been subject to a risk assessment below.			
	Is the S-P-R Material?	Yes	**Justification**	This impact is considered to be material on the basis of the importance of ensuring appropriate weed eradication programs are maintained throughout all phases of the development.	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA) National Parks and Wildlife Act 1972 (SA) Environment Protection and Biodiversity Conservation Act 1999 (Cth)

		Risk Event	**Management Controls**	**Residual Risk (Post Controls)**		
				Consequence	**Likelihood**	**Risk**
Unplanned Event	**Risk Assessment**	Inadequate weed management practices lead to an increase in density of existing or new weed species that out-compete native vegetation and habitat.	Pre-construction inspection to identify any areas of weed infestation requiring specific management measures. Appropriate disposal of any noxious weeds cleared as part of the project. Implement weed hygiene practices such as vehicle wash-downs and inspections during construction as well as post-construction weed surveillance and control programs. Weed Red Alert List for quick identification, provided with induction program where relevant and available on site. Minimising ground disturbance through restriction of vehicle movements and materials to designated construction zones, laydown areas and tracks. Periodic survey (e.g. post completion of construction, after significant rain) to identify and prioritise treatment programs for declared and environmental weeds.	2-Minor	D-Unlikely	5-Low

IMPACT ID L11 Predatory Pests (Common Native Fauna)

IMPACT ID L11 Predatory Pests (Common Native Fauna)									
	Applicable Alignment Section -ALL								
	Potential Impact	Project activities attract predatory pest species to the project area that impact on the abundance and/or diversity of common native fauna species.				**Phase**	Construction		
	Source	Land Disturbance	Temporary construction camps will generate waste and have the potential to attract and support a greater abundance of predatory pest species if not appropriately managed.						
	Pathway	Land	Of the 16 pest fauna species raised by BDBSA and EPBC Act database searches, 3 are likely to predate other fauna and are known or are likely to exist in the Study Area (feral cat, *Felis catus*; European red fox; feral dog, *Canis lupus familiaris*) (Refer Appendix D1 of the DA: Ecological Baseline Assessment). These three species are widespread throughout Australia and are commonly observed throughout much of the arid and semi-arid lands of South Australia. Predatory pest numbers fluctuate with booms in native and introduce fauna populations, usually spurred on by significant rainfall and associated breeding events.						
	Receptor	Terrestrial Ecology (Common Native Fauna)	BDBSA records indicate the potential presence of up to 268 native fauna species, including 18 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events.						
	Design Controls	Waste will be securely stored in temporary bins which are fit for purposes, and transported offsite for disposal. Further design controls are not warranted.							
	Is the Linkage Confirmed	No	No impacts are predicted without an unplanned risk event occurring and this has been subject to a risk assessment below.	**Uncertainty: S-P-R, impact statement**	Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.				
	Is the S-P-R Material?	Yes	**Justification**	This impact is considered to be material on the basis of the importance of ensuring appropriate waste management and pest eradication programs are maintained throughout all phases of the development.		**Legislative Requirements**	*Natural Resources Management Act 2004* (SA)		
Unplanned Event	**Risk Assessment**	**Risk Event**		**Management Controls**		**Residual Risk (Post Controls)**			
						Consequence	**Likelihood**	**Risk**	
		Project activities (inadequate waste management, inadequate pest control) create conditions favourable to existing predatory pests or attract new pest species to the Project Area, impacting the abundance and diversity of common native fauna		Waste Management Plan; implement protocols for management of waste during construction to avoid attracting feral pest animals. Feral Animal Eradication Program should an increase in the abundance or diversity of feral animals be observed. Records of feral animal observations.		2-Minor	D- Unlikely	5-Low	

IMPACT ID L12 Predatory Pests (NPW Act Fauna)

IMPACT ID L12 Predatory Pests (NPW Act Fauna)	Applicable Alignment Section -ALL			
Potential Impact	Project activities attract predatory pest species to the project area that impact on the abundance and/or diversity of NPW Act-listed Fauna		**Phase**	Construction
Source	Project	Temporary construction camps will generate waste and have the potential to attract and support a greater abundance of predatory pest species if not appropriately managed.		
Pathway	Land	Of the 16 pest fauna species raised by BDBSA and EPBC Act database searches, 3 are likely to predate other fauna and are known or are likely to exist in the Study Area (feral cat, *Felis catus*; European red fox; feral dog, *Canis lupus familiaris*) (Refer Appendix D1 of the DA: Ecological Baseline Assessment). These three species are widespread throughout Australia and are commonly observed throughout much of the arid and semi-arid lands of South Australia. Predatory pest numbers fluctuate with booms in native and introduce fauna populations, usually spurred on by significant rainfall and associated breeding events.		
Receptor	Terrestrial Ecology (NPW Fauna)	Twenty-seven (27) state threatened fauna were identified as possible by a BDBSA search, 23 of which are avifauna, 1 a mammal, and 5 of which are also protected by the EPBC Act. Of the state protected avifauna, three are considered likely to occur (Musk Duck, *Biziura lobata*; Blue-billed Duck, *Oxyura* australis; Freckled Duck, *Stictonetta naevosa*) and 10 possibly occur in the Study Area (Banded Stilt, *Cladorhynchus leucocephalus*; Little Egret, *Egretta garzetta*; Peregrine Falcon, *Falco peregrinus*; Major Mitchell's Cockatoo, *Lophochroa leadbeateri*; Blue-winged Parrot, *Neophema chrysostoma;* Scarlet-chested Parrot, *Neophema splendida;* Flock Bronzewing, *Phaps histronica*; Glossy Ibis, *Plegadis falcinellus;* Greater Crested Grebe, *Podiceps cristatus*; Spotless Crake, *Porzana cristatus*) Appendix D1 of the DA: Ecological Baseline Assessment). One state listed mammal was assessed as possibly occurring (Plains Mouse, *Pseudomys australis*) and one state listed reptile is likely to occur (Pernatty knob-tailed Gecko) is the Study Area. The majority of state threatened species likely and possibly occurring are aquatic avifauna, and would be found in proximity to dams and inland lakes when conditions are suitable. Large rainfall events may attract large numbers of migratory avifauna that stay and breed during the southern hemisphere summer. Plains mouse prefers gibber (stone-covered) plains, mid slopes with boulders, small stones and gilgais, which occurs in the study area. Pernatty knob-tailed gecko occupies vegetated sand dune habitat which is present in the study area.		
Design Controls	Waste will be securely stored in temporary bins which are fit for purposes, and transported offsite for disposal. Further design controls are not warranted.			
Is the Linkage Confirmed	No	No impacts are predicted without an unplanned risk event occurring and this has been	**Uncertainty: S-P-R, impact statement**	Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.

			subject to a risk assessment below.				
	Is the S-P-R Material?	Yes	**Justification**	This impact is considered to be material on the basis of the importance of ensuring appropriate waste management and pest eradication programs are maintained throughout all phases of the development.	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA) National Parks and Wildlife Act 1972 (SA)	
Unplanned Event	**Risk Assessment**	**Risk Event**		**Management Controls**	**Residual Risk (Post Controls)**		
					Consequence	**Likelihood**	**Risk**
		Project activities (inadequate waste management, inadequate pest control)_create conditions favourable to existing predatory pests or attract new pest species to the project area, impacting the abundance and diversity of NPW Act threatened fauna		Waste Management Plan; implement protocols for management of waste during construction to avoid attracting feral pest animals. Feral Animal Eradication Program should an increase in the abundance or diversity of feral animals be observed. Records of feral animal observations.	2-Minor	D- Unlikely	5-Low

IMPACT ID L13 Predatory Pests (EPBC Act Fauna)

IMPACT ID L13 Predatory Pests (EPBC Act Fauna)						
Applicable Alignment Section -ALL						
	Potential Impact	Project activities attract predatory pest species to the project area that impact on the abundance and/or diversity of EPBC Act-listed Fauna			**Phase**	Construction
	Source	Project	Temporary construction camps will generate waste and have the potential to attract and support a greater abundance of predatory pest species if not appropriately managed.			
	Pathway	Land	Of the 16 pest fauna species raised by BDBSA and EPBC Act database searches, 3 are likely to predate other fauna and are known or are likely to exist in the Study Area (feral cat, *Felis catus*; European red fox; feral dog, *Canis lupus_familiaris*) (Refer Appendix D1 of the DA: Ecological Baseline Assessment). These three species are widespread throughout Australia and are commonly observed throughout much of the arid and semi-arid lands of South Australia. Predatory pest numbers fluctuate with booms in native and introduce fauna populations, usually spurred on by significant rainfall and associated breeding events.			
	Receptor	Terrestrial Ecology (EPBC Fauna)	A significant impact assessment of EPBC Act Protected Matters was undertaken for the Study Area. Of the nine threatened EPBC Act fauna identified, five were assessed as possibly occurring in the Study Area (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall*; Curlew Sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis*; Plains Mouse, *Pseudomys australis*). The assessment also identified 15 migratory avifauna (3 of these are also EPBC Act threatened), of which 2 are considered likely to occur (Latham's Snipe, *Gallinago hardwickii*; Common Greenshank, *Tringa nebularia*;) and 8 possibly occur in the Study Area (Fork-tailed Swift; *Apus pacificus*; Common Sandpiper, *Actitis hypoleucos*; Sharp-tailed Sandpiper, *Calidris acuminata*; Pectoral Sandpiper, *Calidris melanotos;* Ruddy Turnstone, *Arenaria interpres;* Black-tailed Godwit, *Limosa limosa;* and Wood Sandpiper, *Tringa glareola*). With the exception of Fork-tailed Swift, the majority of migratory fauna would be found in proximity to dams and inland lakes when conditions are suitable. Camp locations will avoid significant habitat for EPBC Act fauna.			
	Design Controls	Waste will be securely stored in temporary bins which are fit for purposes, and transported offsite for disposal. Further design controls are not warranted.				
	Is the Linkage Confirmed	No	No impacts are predicted without an unplanned risk event occurring and this has been subject to a risk assessment below.	**Uncertainty: S-P-R, impact statement**	Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor	
	Is the S-P-R Material?	Yes	**Justification**	This impact is considered to be material on the basis of the importance of ensuring appropriate waste management and pest eradication programs are maintained throughout all phases of the development. The unplanned risk event is considered material based on the moderate consequence	**Legislative Requirements**	*Natural Resources Management Act 2004* (SA) *Environment Protection and Biodiversity Conservation Act 1999* (Cth)

				associated with the risk. A source pathway and receptor linkage would exist if an unplanned risk event occurred.		

Unplanned Event	**Risk Assessment**	**Risk Event**	**Management Controls**	**Residual Risk (Post Controls)**		
				Consequence	**Likelihood**	**Risk**
		Project activities (inadequate waste management, inadequate pest control)_create conditions favourable to existing predatory pests or attract new pest species to the project area, impacting the abundance and diversity of EPBC Act threatened fauna	Waste Management Plan; implement protocols for management of waste during construction to avoid attracting feral pest animals. Feral Animal Eradication Program should an increase in the abundance or diversity of feral animals be observed. Records of feral animal observations.	2-Moderate	C- Unlikely	9-Moderate

IMPACT ID L14 Reduced Visual Amenity (Barngarla and Kokatha People)

IMPACT ID L14 Reduced Visual Amenity (Aboriginal Communities)							
	Applicable Alignment Section -ALL						
Planned Event	**Potential Impact**	Powerline infrastructure leads to change in visual amenity of the landscape for Aboriginal communities			**Phase**	Construction	
	Source	Project	Construction of the project components will have a land disturbance footprint of 470 ha including buffers stretched out over 237 km of the Project Area; the areas of disturbance have a relatively small and discrete footprint and are sparsely distributed. With the exception of the establishment of the temporary infrastructure associated with the operation, which would be removed post construction, the only permanent changes to regional topography would be associated with access track construction and the erection of poles and stringing of wires.					
	Pathway	Land	There are several major Aboriginal storylines passing through the project area, some relating to specific features in the landscape. The main landscape values relate to the region's relatively undisturbed plains, remoteness and scenic attractions in the region such as Lake Torrens and Lake Gairdner National Parks. (DA, Section 12.1).				
	Receptor	Aboriginal Communities	The land traversed by the transmission line is subject to two Native Title Determinations; The southern 32 kilometre portion of the Project Area is within the determined Barngarla Native Title Claim (NNTT Number SCD2016/001) and the remaining area lies within the determined Kokatha People (Part A) Native Title Determination (National Native Title Tribunal (NNTT) Number SCD2014/004). The Barngarla Determination Aboriginal Corporation (BDAC) is the Registered Native Title Body Coporate who acts as an agent for the Barngarla People in relation to their native title rights and interests. The Kokatha Aboriginal Corporation (KAC) is the Registered Native Title Body Corporate who acts as an agent for the Kokatha People in relation to their native title rights and interests.(DA Section 13.1.1). OZ Minerals respects that the presence of infrastructure on Barngarla and Kokatha and country does not come without pain for the Barngarla and Kokatha peoples and our partnership is focussed on honesty, transparency and mutual benefit as we develop the project.(DA Section 13.1.1).				
	Design Controls	Consolidation design of the transmission line alignment with the pre-existing power line infrastructure corridor reduces potential visual amenity impacts					
	Is the Linkage Confirmed	Yes	The visual amenity will be altered by the construction of the infrastructure, although this change will be incremental due to the presence of other infrastructure of a similar visual character.	**Uncertainty: S-P-R, impact statement**	Land disturbance associated with project infrastructure has been determined and will be subject to heritage surveys.		
	Is the S-P-R Material?	Yes	**Justification**	Consultation with the Barngarla and Kokatha People will be ongoing throughout the Project design. OZ Minerals understand that regardless of any agreement or process between the parties, the continued demonstration of management of land disturbance in relation to heritage is material	**Legislative Requirements**	*Aboriginal Heritage Act 1988* (SA)	

IMPACT ID L15 Reduced Visual Amenity (Local Communities)

IMPACT ID L15 Reduced Visual Amenity (Local Communities)				Applicable Alignment Section -ALL	
Planned Event	**Potential Impact**	Powerline infrastructure leads to change in visual amenity of the landscape for local communities		**Phase**	All
	Source	Project	Construction of the project components will have a land disturbance footprint of 470 ha including buffers stretched out over 237 km of the Project Area With the exception of the establishment of the temporary infrastructure associated with the operation, which would be removed post construction, The most significant visual elements of the project will involve: • Access track construction; • Minor clearing of vegetation; • Erection of poles and the stringing of wires..		
	Pathway	Land	The landscape settings of the Project throughout its local, sub-regional and nearer regional surroundings, have absorptive capabilities that are typically high for topography, due to limited opportunities for overlooking, and low vegetation, due to the typically expansive landscapes with low growing vegetation. The proposed power line route is generally located in a setting that has already been subject to modification by power infrastructure development. The colocation of additional infrastructure of a similar visual character will result in incremental change to the character of the landscape setting, rather than a significant change in character. In these situations, the development may be noticeable, but does not markedly contrast with the existing landscape. This effect will decrease as the distance from the line to various viewing locations increases. High visual sensitivity National Parks, Flinders Ranges, Lake Gairdner and Lake Torrens, are located more than 10 km from the Project Area.		
	Receptor	Local communities Third-party Users	The main landscape values relate to the region's relatively undisturbed plains, remoteness and scenic attractions in the region such as Lake Torrens and Lake Gairdner National Parks. The area is sparsely inhabited and distant from recognised tourist attractions. However, there is scenic value of the landscape to occasional outback travelers and local residents (DA Section 12.1). Kootaberra Outstation (0.4 km west) is the only potential dwelling located within 1 km of the proposed transmission line and at the time of writing was unoccupied.		
	Design Controls	Consolidation design of the transmission line alignment with the pre-existing power line infrastructure corridor reduces potential visual amenity impacts			

	Is the Linkage Confirmed	Yes	The visual amenity will be altered by the construction of the infrastructure, although this change will be incremental due to the presence of infrastructure of a similar visual character.	**Uncertainty: S-P-R, impact statement**	Visual amenity associated with the Project has been determined and has been subject to a visual and landscape assessment.	
	Is the S-P-R Material?	Yes	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.	**Legislative Requirements**	N/A
	Impact Significance	**Resilience**	1 - Adaptable	The components of the Project will be visually compatible with the existing power infrastructure within the Project Area. Consolidation of alike elements reduces impacts on the landscape. Given the relatively slender form of the components of the project, consolidation of alignments will result in a minimal cumulative impact on the surrounding landscape.		
		Importance	1 - Individual	The visual amenity value of the land is subjective and the remote, sparsely inhabited region alongside distance of the Project from recognised tourist attractions and consolidation of the Project design with existing infrastructure reduces visual impact from the Project to an individual level.		
		Duration	3 - One hundred years from commencement of impact	Effect will exist over life of infrastructure		
		Significance Rating	3	Not significant (<48)		
	Impact Uncertainty	**Inputs**	B – Limited data	Limited data; use of industry recognized or benchmarked data; some assumptions		
		Method	B – Benchmarked data	Approach based on literature rather than on consultations.		
		Sensitivity	C – Sensitivity not known	Design planning has already mitigated many of these effects however, the residual effects are unquantified and sensitivity is unknown.		
		Uncertainty Rating	5	Not Significant (<48)		
	Final Impact Rating	5	**Final Impact Category**	Low		

IMPACT ID L16 Fauna Interaction (Construction Activity and Vehicles)

IMPACT ID L16 Fauna Interaction (Construction Activity and Vehicles)	Applicable Alignment Section -ALL				
Potential Impact	Project activity / vehicle movements interact with native and introduced fauna, including stock, causing serious injury or death impacting on the abundance and/or diversity of fauna			**Phase**	Construction
Source	Project	Heavy and light vehicle movements, and associated risk of striking native fauna or stock, will peak during the construction phase of the Project and then significantly reduce with far fewer movements required during the operation and maintenance phase. Open excavations during construction may be a source of interaction with native fauna. Excavations will be limited in extent and open for a short time.			
Pathway	Land	The Project Area is situated on an operating pastoral lease which run stock, predominantly sheep and some cattle. The semi-arid / arid environment is dominated by low chenopod shrubland interspersed with taller shrubs and trees particularly scattered along watercourses, and a range of native fauna as described below.			
Receptor	Terrestrial Ecology Fauna including NPW and EPBC species	Larger common native and introduced animals are highly visible when moving through this landscape (e.g. sheep, kangaroos, emus) and can be easily avoided. Smaller native animals are highly mobile and likely to move away from vehicle noise well before the vehicle reaches striking range. One state and federally listed mammal was assessed as possibly occurring (plains mouse, *Pseudomys australis*) and one state listed reptile is likely to occur (Pernatty knob-tailed gecko, *Nephrurus deleani*) in the Study Area. Plains mouse (vulnerable, NPW Act, EPBC Act) prefers gibber (stone-covered) plains, mid slopes with boulders, small stones and gilgais, which occurs in the study area. Pernatty knob-tailed gecko (rare – NPW Act) occupies vegetated sand dune habitat which is present in the study area.			
Design Controls	This risk is more appropriately addressed through management controls				
Is the Linkage Confirmed	No	Any injuries or deaths as a result of interaction with the Project would be as a result of an unplanned event	**Uncertainty: S-P-R, impact statement**	Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.	
Is the S-P-R Material?	No	**Justification**	The unplanned risk event is not considered material based on the low residual risk (refer below).	**Legislative Requirements**	*National Parks and Wildlife Act 1972* (SA) *Environment Protection and Biodiversity Conservation Act 1999* (Cth) *Pastoral Land Management and Conservation Act 1989*

		Risk Event	Management Controls	Residual Risk (Post Controls)		
				Consequence	Likelihood	Risk
Unplanned Event	**Risk Assessment**	Project construction activities and vehicle movements interact with native and introduced fauna, including stock, causing serious injury or death and a reduction in fauna abundance and or diversity	Traffic Management Plan; including designated speed limits, appropriate constraints on travel at dawn and dusk. Record native fauna interactions. Area-specific and site inductions and training. Regularly check any open excavations for trapped fauna and provide measures to allow their escape. Temporary fencing used to prevent stock or large fauna entrapment in excavations where appropriate.	2-Minor	D-Unlikely	5-Low

IMPACT ID L17 Fauna Interaction (Infrastructure) (Common Native Fauna)

IMPACT ID L17 Fauna Interaction (Infrastructure) (Common Native Fauna)						
Applicable Alignment Section -ALL						
Potential Impact	Presence of powerline infrastructure including towers, lines and conductors leads to serious injury or death, impacting on the abundance and diversity of common native avifauna.				**Phase**	Operations
Source	Project	The project will include installation of 275 kV and 132 kV transmission lines. Lattice towers typically 50 to 60 m in height will support the 275 kV line, with the taller height generally required for longer spans. Steel monopoles or possibly smaller lattice towers will be used for the 132 kV line. Mortality risk is expected to be greater in the vicinity of Island and Pernatty Lagoons and Lake Windabout, and the smaller Arcoona system lakes, which can support large populations of waterbirds including migratory species. The effect will be fully realised in the operations phase once infrastructure has been commissioned.				
Pathway	Land	The semi-arid / arid environment is dominated by low chenopod shrubland interspersed with taller shrubs and trees particularly scattered along watercourses, and supporting a range of native fauna as described below. Ground dwelling fauna are not at risk from interaction with powerline infrastructure. Avifauna, particularly ones which fly at greater heights above the ground (e.g. raptors, migrators, aerial species) and prefer open perches (e.g. raptors), are at most risk of interaction with the infrastructure.				
Receptor	Terrestrial Ecology (Native Fauna)	BDBSA records indicate the potential presence of up to 268 native fauna species, including 18 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events.				
Design Controls	Line spacing between phase and ground conductors will be greater than 150 cm Transmission line insulation of phase and/or grounds where necessary and use of perch discouragers where necessary. Attach bird diverters to transmission line conductors and/or the top-most earth/shield wire at regular intervals to increase visibility of the lines on sections of the alignment adjacent to Use of ball markers and flappers to reduce bird collisions with the line where appropriate.					
Is the Linkage Confirmed	No	Any injuries or deaths as a result of interaction with the infrastructure would be as a result of an unplanned event (electrocution of birds striking or roosting on transmission lines).	**Uncertainty: S-P-R, impact statement**	Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor		
Is the S-P-R Material?	No	**Justification**	The unplanned risk event is not considered material based on the low residual risk (refer below).		**Legislative Requirements**	*National Parks and Wildlife Act 1972* (SA)

Unplanned Event	**Risk Assessment**	**Risk Event**	**Management Controls**	**Residual Risk (Post Controls)**		
				Consequence	**Likelihood**	**Risk**
		Presence of powerline infrastructure leads to serious injury or death of avifauna, impacting associated diversity and abundance of common native fauna	This risk is more appropriately addressed through the implementation of design controls (described above), which are considered here by the risk assessment	2-Minor	D-Unlikely	5-Low

IMPACT ID L18 Fauna Interaction (Infrastructure) (NPW Fauna)

IMPACT ID L18 Fauna Interaction (Infrastructure) (Native Fauna)					Applicable Alignment Section -ALL
Potential Impact	Presence of powerline infrastructure including towers, lines and conductors leads to serious injury or death, impacting on the abundance and diversity of NPW Act-listed avifauna.			**Phase**	Operations
Source	Project	The project will include installation of 275 kV and 132 kV transmission lines. Lattice towers typically 50 to 60 m in height will support the 275 kV line, with the taller height generally required for longer spans. Steel monopoles or possibly smaller lattice towers will be used for the 132 kV line. Mortality risk is expected to be greater in the vicinity of Island and Pernatty Lagoons and Lake Windabout, and the smaller Arcoona system lakes, which can support large populations of waterbirds including migratory species. The effect will be fully realised in the operations phase once infrastructure has been commissioned.			
Pathway	Land	The semi-arid / arid environment is dominated by low chenopod shrubland interspersed with taller shrubs and trees particularly scattered along watercourses, and supporting a range of native fauna as described below. Ground dwelling fauna are not at risk from interaction with powerline infrastructure. Avifauna, particularly ones which fly at greater heights above the ground (e.g. raptors, migrators, aerial species) and prefer open perches (e.g. raptors), are at most risk of interaction with the infrastructure.			
Receptor	Terrestrial Ecology (NPW Fauna)	Twenty-seven (27) state threatened fauna were identified as possible by a BDBSA search, 23 of which are avifauna and 4 of which are also protected by the EPBC Act (see L19) . Of the state protected avifauna, three are considered likely to occur (musk duck, *Biziura lobata*; blue-billed duck, *Oxyura* australis; freckled duck, *Stictonetta naevosa*) and 10 possibly occur in the Study Area (banded stilt, *Cladorhynchus leucocephalus*; little egret, *Egretta garzetta*; peregrine falcon, *Falco peregrinus*; Major Mitchell's cockatoo, *Lophochroa leadbeateri*; blue-winged parrot, *Neophema chrysostoma;* scarlet-chested parrot, *Neophema splendida;* flock bronzewing, *Phaps histronica*; glossy ibis, *Plegadis falcinellus;* greater crested grebe, *Podiceps cristatus*; spotless crake, *Porzana cristatus*) Appendix D1 of the DA: Ecological Baseline Assessment). The majority of state threatened species likely and possibly occurring are aquatic avifauna, and would be found in proximity to dams and inland lakes where the risk of such an interaction is highest. Large rainfall events may attract large numbers of migratory avifauna that stay and breed during the southern hemisphere summer.			
Design Controls	Line spacing between phase and ground conductors will be greater than 150 cm Insulation of phase and/or grounds where necessary Use of perch discouragers where necessary Use of ball markers and flappers to reduce bird or airplane collisions with the line				
Is the Linkage Confirmed	No	Any injuries or deaths as a result of interaction with the Project would be as a result of an	**Uncertainty: S-P-R, impact statement**		Baseline ecology is well understood with survey undertaken in March 2018 and extensive

			unplanned event (electrocution of birds striking or roosting on transmission lines).		previous survey work undertaken for the infrastructure corridor		
	Is the S-P-R Material?	No	**Justification**	The unplanned risk event is not considered material based on the low residual risk (refer below).	**Legislative Requirements**	*National Parks and Wildlife Act 1972* (SA)	

Unplanned Event	**Risk Assessment**	**Risk Event**	**Management Controls**	**Residual Risk (Post Controls)**		
				Consequence	**Likelihood**	**Risk**
		Presence of powerline infrastructure leads to serious injury or death of avifauna, impacting associated diversity and abundance of NPW Act listed fauna	This risk is more appropriately addressed through the implementation of design controls (described above), which are considered here by the risk assessment	2-Minor	D-Unlikely	5-Low

IMPACT ID L19 Fauna Interaction (Infrastructure) (EPBC Act Avifauna)

IMPACT ID L19 Fauna Interaction (Infrastructure) (EPBC Act Fauna)			**Applicable Alignment Section -ALL**	
Potential Impact	Presence of powerline infrastructure including towers, lines and conductors leads to serious injury or death, impacting on the abundance and diversity of EPBC Act-listed avifauna.		**Phase**	Operations
Source	Project	The project will include installation of 275 kV and 132 kV transmission lines. Lattice towers typically 50 to 60 m in height will support the 275 kV line, with the taller height generally required for longer spans. Steel monopoles or possibly smaller lattice towers will be used for the 132 kV line. Mortality risk is expected to be greater in the vicinity of Island and Pernatty Lagoons and Lake Windabout, and the smaller Arcoona system lakes, which can support large populations of waterbirds including migratory species. The effect will be fully realised in the operations phase once infrastructure has been commissioned.		
Pathway	Land	The semi-arid / arid environment is dominated by low chenopod shrubland interspersed with taller shrubs and trees particularly scattered along watercourses, and supporting a range of native fauna as described below. Ground dwelling fauna are not at risk from interaction with powerline infrastructure. Avifauna, particularly ones which fly at greater heights above the ground (e.g. raptors, migrators, aerial species) and prefer open perches (e.g. raptors), are at most risk of interaction with the infrastructure.		
Receptor	Terrestrial Ecology EPBC Fauna	Nine threatened EPBC Act fauna were identified for the study area, five of which were assessed as possibly occurring in the Study Area and four of which are avifauna (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall*; Curlew Sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis*). Birds that predominantly live on the ground or within low shrubbery are highly unlikely to interact with transmission infrastructure (i.e. Grasswrens and Night Parrot). Collisions with powerlines are not considered likely to be a common cause of mortality for Curlew Sandpiper. The species has a large population in Australia and globally and there are only occasional and low numbers of historic records of the species in the Study Area, The assessment also identified 15 migratory species of which 2 are considered likely to occur (Latham's Snipe, *Gallinago hardwickii*; Common Greenshank, *Tringa nebularia*;) and 48 possibly occur in the Study Area (Fork-tailed Swift; *Apus pacificus*; Common Sandpiper, *Actitis hypoleucos*; Sharp-tailed Sandpiper, *Calidris acuminata*; Pectoral Sandpiper, *Calidris melanotos*; Ruddy Turnstone, *Arenaria interpres*; Black-tailed Godwit, *Limosa limosa*; and Wood Sandpiper, *Tringa glareola*). With the exception of Fork-tailed Swift, the majority of birds would be found in proximity to dams and inland lakes when conditions are suitable and where they would be at most risk of such an interaction.		
Design Controls	Line spacing between phase and ground conductors will be greater than 150 cm Insulation of phase and/or grounds where necessary Use of perch discouragers where necessary Use of ball markers and flappers to reduce bird or airplane collisions with the line			

	Is the Linkage Confirmed	No	Any injuries or deaths as a result of interaction with the Project would be as a result of an unplanned event (electrocution of birds striking or roosting on transmission lines).	**Uncertainty: S-P-R, impact statement**	Baseline ecology is well understood with survey undertaken in March 2018 and extensive previous survey work undertaken for the infrastructure corridor.		
	Is the S-P-R Material?	No	**Justification**	The unplanned risk event is not considered material based on the low residual risk (refer below).	**Legislative Requirements**	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)	

Unplanned Event	**Risk Assessment**	**Risk Event**	**Management Controls**	**Residual Risk (Post Controls)**		
				Consequence	**Likelihood**	**Risk**
		Presence of powerline infrastructure leads to serious injury or death of avifauna, impacting associated diversity and abundance of EPBC Act listed fauna	This risk is more appropriately addressed through the implementation of design controls (described above), which are considered here by the risk assessment	3-Minor	D-Unlikely	5-Low

IMPACT ID L20 Accidental Fires (Terrestrial Ecology)

IMPACT ID L20 Accidental Fires (Terrestrial Ecology)			Applicable Alignment Section -ALL	
Potential Impact	Fire resulting from construction and operation of the transmission line result in a loss of native vegetation and fauna habitat and reduced abundance and/or diversity of terrestrial ecology including NPW Act and EPBC Act listed species.		**Phase**	All
Source	Project	Fire initiated by construction site activities (e.g. sparks from vehicles or equipment, welding, cigarette butts) has the potential to impact large areas of vegetation. Ignition sources will be managed in accordance with the requirements of the Fire and Emergency Services Act and the Country Fire Service.		
Pathway	Land	The Project is situated within the Gawler Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion , and crosses three IBRA Subregions; Arcoona Plateau, Gawler Lakes and Roxby. The alignment study area is characterized by flat topped to broadly rounded hills of the Gawler Range Volcanics and Proterozoic sediments, low plateaux on sandstone and quartzite with an undulating surface of aeolian sand or gibbers and rocky quartzite hills with colluvial footslopes, erosional and depositional plains and salt encrusted lake beds. Spinifex grasslands, open woodlands and chenopod shrubs occur on shallow loams, calcareous earths and hard red duplex soils. A significant proportion of the Project Area is dominated by low lying Bladder Salt Bush Shrubland where the potential for fires to spread is considered to be limited The loss of native vegetation or habitat from fire attributed to fire ignition sources will only occur as a result of unplanned risk events. There is limited, potential for bushfires to be initiated by vegetation coming into contact with transmission lines, as the vegetation density in the region is typically low.		
Receptor	Terrestrial Ecology	A total of 413 native flora species were identified for the Study Area from historical floristic records within the BDBSA. Species were largely represented by individuals from the *Chenopodiaceae* (Chenopod) family with other dominant representation provided by *Gramineae* (Grass) species, *Compositae* (Daisies), *Leguminosae* (Peas, Wattles) and *Malvaceae* (Refer Appendix D1 of the DA: Ecological Baseline Assessment). Two nationally threatened flora species have the potential to occur within the Study Area.; *Frankenia plicata* (Braided Sea-heath)(EN) and *Senecio megaglossus* (Large-flower Groundsel) (V). One state-threatened flora species is known to occur within the broader Study Area *Santalum spicatum* (Sandalwood) (V), and five species listed as vulnerable to rare possibly occur within the Study Area (Desert Lime, Large Adders Tongue; Australian Broomrape, One-bristle Everlasting and Wild Violet). None of these species were observed during the baseline survey (EBS 2018). BDBSA records indicate the potential presence of up to 268 native fauna species, including 18 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events.		

			Of the eight nationally threatened EPBC Act fauna identified in desktop studies, five were assessed as possibly occurring in the Study Area ranging from vulnerable to critically endangered (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall;* Curlew Sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis*; Plains Mouse, *Pseudomys australis*). Twelve EPBC-listed migratory species were assessed as having the potential to occur in the Study Area. Of the 27 state threatened fauna within the Study Area, four state only listed species were considered likely to occur in the Project Area ranging from vulnerable to rare; the Musk Duck, Blue-billed Duck, Freckled Duck and Pernatty Knob-tailed Gecko and one species possibly occurs; Australian Bustard. None of these species were observed during the baseline survey (EBS 2018).				
	Design Controls	No Elimination or Substitution design control measures have been considered.					
	Is the Linkage Confirmed	No	Any fires associated with ignition sources will only occur as a result of an unplanned risk event which has been further assessed below	**Uncertainty: S-P-R, impact statement**	Land disturbance associated with project infrastructure has been assessed against the known vegetation associations in the project area. Baseline ecology is well understood.		
	Is the S-P-R Material?	Yes/No	**Justification**	The impact will not occur without an unplanned risk event (assessed below). OZ Minerals will commit to environmental management strategies for the response, containment and remediation of any accidental fires from construction and operations.	**Legislative Requirements**	*Native Vegetation Act 1991 (SA)* *Fire and Emergency Services Act 2005 (SA).*	

Unplanned Event		**Risk Event**	**Management Controls**	**Risk (Post Controls)**		
				Consequence	**Likelihood**	**Risk**
	Risk Assessment	Accidental fires associated with fire ignition sources results in loss of native vegetation	All equipment fitted with appropriate firefighting equipment. Project-based emergency response team. Minimisation of ignition risk through operation of vehicles and other equipment with ignition sources within designated construction zones, laydown areas and tracks only. Clearance distances between vegetation and transmission lines established and maintained in accordance with the *Electricity (Principles of Vegetation Clearance) Regulations 2010*.	2 – Minor	E – Rare	3 - Low

IMPACT ID L21 Accidental Spills (Native Fauna)

IMPACT ID L21 Accidental Spills (Native Fauna)						
Applicable Alignment Section -ALL						
	Potential Impact	Accidental Spills from the transport, storage and handling of hydrocarbons and chemicals contaminates land leading to a decrease in soil quality resulting in a loss of abundance and/or diversity of native fauna			**Phase**	All
	Source	Project	The construction of Project infrastructure and operation of various project activities will require the consumption of chemicals and fuel.			
	Pathway	Land (Secondary pathways include surface water and groundwater)	Chemicals and hydrocarbons will be stored in accordance with relevant standards and guidelines. This restricts accidental release to land without an unplanned risk event occurring.			
	Receptor	Terrestrial Ecology (Native Fauna)	The habitats that support native fauna are well represented within the Project footprint and broader Study Area. BDBSA records indicate the potential presence of up to 268 native fauna species, including 18 mammals, 77 reptiles, and 171 birds (Refer Appendix D1 of the DA: Ecological Baseline Assessment). The arid lands are typically known to support relatively low mammal and reptile species diversity and abundance when compared with other habitats due to the simplicity and uniformity of the habitat structure. Of the avian species, 54 are considered to be aquatic avifauna and are likely to inhabit regional lake systems preferentially and generally after significant rainfall events. Of the eight nationally threatened EPBC Act fauna identified in desktop studies, five were assessed as possibly occurring in the Study Area ranging from vulnerable to critically endangered (Thick-billed Grasswren, *Amytornis modestus*; Western Grasswren (Gawler Ranges), *Amytornis textilis myall;* Curlew Sandpiper, *Calidris ferruginea*; Night Parrot, *Pezoporus occidentalis*; Plains Mouse, *Pseudomys australis*). Twelve EPBC-listed migratory species were assessed as having the potential to occur in the Study Area. Of the 27 state threatened fauna within the Study Area, four state only listed species were considered likely to occur in the Project Area ranging from vulnerable to rare; the Musk Duck, Blue-billed Duck, Freckled Duck and Pernatty Knob-tailed Gecko and one species possibly occurs; Australian Bustard. None of these species were observed during the baseline survey (EBS 2018).			
	Design Controls	Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards.				
	Is the Linkage Confirmed	No	Hydrocarbons and chemicals will be stored within appropriate containers relevant to the material being stored. An impact can only occur as a result of an unplanned event that results in the uncontrolled release of hydrocarbons or chemicals.		**Uncertainty: S-P-R, impact statement**	There is no identified uncertainty based on the planned event.
	Is the S-P-R Material?	Yes	**Justification**	The impact will not occur without an unplanned risk event (assessed below).	**Legislative Requirements**	*Dangerous Substances Act 1979* (SA) *Environment Protection Act 1993* (SA)

		Risk Event	Management Controls	Risk (Post Controls)		
				Consequence	Likelihood	Risk
Unplanned Event	**Risk Assessment**	The transport, storage and handling of hydrocarbons and chemicals results in an accidental spill that contaminates land and secondary pathways and leads to a loss of abundance and/or diversity of native fauna.	Accidental Spill management controls: • Equipment maintenance • Spill and emergency response procedures • SA EPA Licensed transporters • Contaminated land register • Regular inspection programs of construction sites where bunding, either temporary or permanent, is installed to ensure appropriate use, placement of spill kits, clean up procedures and handling procedures • Induction contains process for bringing chemicals and hydrocarbons onsite including requirements for storage, handling and disposal • Contracts contain conditions relevant to design, management of the storage and handling of chemicals and hydrocarbons • All commercial or industrial waste is disposed of in an EPA licensed facility • Establishment of Chemical Database including copies of SDS and storage, handling and disposal requirements. • Wastewater managed in accordance with health regulations and Environment Protection (Water Quality) Policy. • Locate camps and mobile facilities away from watercourses and lakes. • Equipment maintenance to prevent spills.	2 – Minor	D – Unlikely	5 -Low

IMPACT ID L22 Accidental Spills (Third-party User)

IMPACT ID L22 Accidental Spills (Third-party User)								
Applicable Alignment Section -ALL								
Planned Event	**Potential Impact**	The transport, storage and handling of hydrocarbons and chemicals may result in an accidental spill, which if uncontained, can contaminate land leading to a decrease in soil quality impacting on the income and business viability of pastoral stations.			**Phase**	All		
	Source	Project	The construction of Project infrastructure and operation of various project activities will require the consumption of reagents, chemicals and fuel during all phases of the project.					
	Pathway	Land	Chemicals and hydrocarbons will be stored within appropriate containers relevant to the material being stored. This restricts accidental release to land without an unplanned risk event occurring.					
	Receptor	Third-party Users	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs and Andamooka.					
	Design Controls	Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards.						
	Is the Linkage Confirmed	No	Hydrocarbons and chemicals will be stored within appropriate containers relevant to the material being stored. An impact can only occur as a result of an unplanned event that results in the uncontrolled release of hydrocarbons or chemicals.	**Uncertainty: S-P-R, impact statement**	There is no identified uncertainty based on the unplanned event.			
	Is the S-P-R Material?	No	**Justification**	The unplanned risk event is not considered material based on the low risk.	**Legislative Requirements**	*Dangerous Substances Act 1979* (SA) *Environment Protection Act 1993* (SA)		
Unplanned	**Risk Assessment**	**Risk Event**		**Management Controls**	**Risk (Post Controls)**			
					Consequence	**Likelihood**	**Risk**	
		The transport, storage and handling of hydrocarbons and chemicals may result in an accidental spill, which if uncontained, contaminates land leading to a decrease in soil quality impacting on the income and business viability of pastoral stations.		Accidental Spill management controls: • Equipment maintenance • Spill and emergency response procedures • SA EPA Licensed transporters • Contaminated land register	2 – Minor	D – Unlikely	5 - Low	

			• Regular inspection programs of construction sites where bunding, either temporary or permanent, is installed to ensure appropriate use, placement of spill kits, clean up procedures and handling procedures • Induction contains process for bringing chemicals and hydrocarbons onsite including requirements for storage, handling and disposal • Contracts contain conditions relevant to design, management of the storage and handling of chemicals and hydrocarbons • All commercial or industrial waste is disposed of in an EPA licensed facility • Establishment of Chemical Database including copies of SDS and storage, handling and disposal requirements. • Wastewater managed in accordance with health regulations and Environment Protection (Water Quality) Policy. • Locate camps and mobile facilities away from watercourses and lakes. • Equipment maintenance to prevent spills.			

IMPACT ID L23 Disturbance of cultural sites (Barngarla and Kokatha People)

IMPACT ID L23 Disturbance of cultural sites (Barngarla and Kokatha People)		Applicable Alignment Section -ALL			
Planned Event	**Potential Impact**	The project results in the disturbance of sites that are of significance to the culture and storylines of Aboriginal communities (Barngarla and Kokatha People)		**Phase**	Construction
	Source	Land disturbance and rehabilitation	Construction of the project components will have a land disturbance footprint of 470 ha including buffers stretched out over 237 km of the Project Area; the areas of disturbance have a relatively small and discrete footprint and are sparsely distributed. The Project will involve disturbance from access tracks, transmission structures and conductors.		
	Pathway	Land	There are several major story lines passing through the study area, some relating to specific features in the landscape (DA Section 13.1.1)		
	Receptor	Aboriginal communities	The land traversed by the transmission line is subject to two Native Title Determinations; The southern 32 kilometre portion of the Project Area is within the determined Barngarla Native Title Claim (NNTT Number SCD2016/001) and the remaining area lies within the determined Kokatha People (Part A) Native Title Determination (National Native Title Tribunal (NNTT) Number SCD2014/004). The Barngarla Determination Aboriginal Corporation (BDAC) is the Registered Native Title Body Corporate who acts as an agent for the Barngarla People in relation to their native title rights and interests. The Kokatha Aboriginal Corporation (KAC) is the Registered Native Title Body Corporate who acts as an agent for the Kokatha People in relation to their native title rights and interests.(DA Section 13.1.1) OZ Minerals respects that the presence of infrastructure on Barngarla and Kokatha and country does not come without pain for the Barngarla and Kokatha peoples and our partnership is focussed on honesty, transparency and mutual benefit as we develop the project.		
	Design Controls	Avoidance of sites of cultural heritage significance as determined in consultation with the Barngarla and Kokatha People.			
	Is the Linkage Confirmed	Yes	Construction activities may result in the clearing and disturbance of artefacts where identified by the Barngarla and Kokatha People. All areas identified for disturbance are surveyed in accordance with the Land Clearance Approval process as agreed between OZ Minerals the Barngarla Determination Aboriginal Corporation (BDAC) and the Kokatha Aboriginal Corporation (KAC). OZ Minerals respect the cultural rights of the Barngarla and Kokatha. People and will not disclose results of sensitive discussions.	**Uncertainty: S-P-R, impact statement**	Land disturbance associated with project infrastructure has been determined and is subject to heritage surveys with the Barngarla and Kokatha People and their nominated anthropologist.

	Is the S-P-R Material?	Yes	**Justification**	Cultural respect program will be run on site to cultural heritage values are appropriately understood and respected.	**Legislative Requirements**	*Aboriginal Heritage Act 1988 (SA)*

		Risk Event	**Management Controls**	**Risk**		
				Consequence	**Likelihood**	**Risk**
Unplanned Event	**Risk Assessment**	The project results in the disturbance of sites that are of significance to the culture and storylines of Aboriginal communities. (Barngarla and Kokatha People)	Cultural Heritage Assessment with the Barngarla and Kokatha People. Area-specific and site inductions and training. GIS system to record/identify clearance areas and status. Cultural Heritage Management Plan, including new discovery reporting procedures. Identification and fencing (where appropriate) of sites of cultural heritage significance. Land disturbance reconciliation during and after construction.	3 Moderate	D - Unlikely	9- Moderate

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7 SOCIO-ECONOMIC IMPACT ASSESSMENT

IMPACT ID SE01 Increased Traffic

IMPACT ID SE01 Increased Traffic							
	Applicable Alignment Section -ALL						
Planned Event	**Potential Impact**	Increased traffic on public roads associated with the movement of construction and operational fleet and materials to and from the Project Area influences travel times for road users.			**Phase**	All	
	Source	Transport	The proposed alignment traverses the Stuart Highway through rural towns Pimba, Woomera and Roxby Downs. The proposed transmission line will cross the Olympic Dam Highway.				
	Pathway	Social Infrastructure	During the construction phase, the Project may increase in traffic volume along the expected vehicle route between 0.1 % - 23.2 % on the main roads. Main roads in the region are generally classified as high capacity, capable of accommodating up to an estimated 15,000 daily vehicle movements. Consequently, any additional traffic generated during the construction phase would have minimal impact on the existing road function. The increase in traffic volume is expected to have no material effect on travel times. No delays due to road closures are expected to result from the Project construction. The increase in traffic volume is expected to have no material effect on travel times during inspection and maintenance operations for the Project.				
	Receptor	Local communities	The largest population centres in the vicinity of the proposed transmission line are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808). The Stuart Highway is the major primary road in the region connecting these communities and is used by residents, tourists, goods and service providers and other industries.				
	Design Controls	Intersections with the Stuart Highway constructed to appropriate standards in consultation with DPTI. Rural basic right-turn (BAR) and rural basic left-turn (BAL) treatments, if required, will be designed as per Austroads Guide to Road Design Part 4: Intersections and Crossings – General, and Part 4A: Unsignalised and Signalised Intersections					
	Is the Linkage Confirmed	Yes	There will be an increase in traffic volumes.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with increased traffic volumes has been assessed in Appendix F2 & G2 of the DA, and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The increase in Project traffic volumes in both the construction and operation phases is expected to have no material effect on travel times.	**Legislative Requirements**	*Highways Act 1926* (SA)	
		Resilience		1 - Adaptable	Local community will be adaptable to Project-related traffic volumes..		

	Impact Significance	**Importance**	2 - Local	Traffic volumes leading to disruption are of local importance.
		Duration	1 – One year from commencement of impact	The impact will occur during construction and operations (in reduced volumes). The increase in traffic volume is expected to have no material effect on travel times during inspection and maintenance operations for the Project, therefore the duration of potential impacts would only occurring during the construction period.
		Significance Rating	2	Not Significant (<48)
	Impact Uncertainty	**Inputs**	A - Verified data	For most of the route, field verified data used
		Method	A – Industry standard approach	Industry standard approach
		Sensitivity	B – Some sensitivity of predictions to input variations	Socio-economic modelling used conservative inputs in assessing Project effects. Sensitivity of predictions to input variations was identified for the Olympic Dam Highway and Olympic Way, where full implementation of estimated Project volumes leads to 14% and 23% increase in traffic volumes.
		Uncertainty Rating	3	Not Significant (<48)
	Final Impact Rating	3	**Final Impact Category**	Very Low

IMPACT ID SE02 Increased traffic – Road Wear

IMPACT ID SE02 Increased traffic – Road Wear							Applicable Alignment Section -ALL	
Planned Event	**Potential Impact**	Increased traffic on the roads from the Project during construction and operations contributes to the general deterioration of condition of the public roads over time, resulting in impacts to the local community.				**Phase**	All	
	Source	Transport	The proposed alignment traverses the Stuart Highway through rural towns Pimba, Woomera and Roxby Downs. The proposed transmission line will cross the Olympic Dam Highway.					
	Pathway	Social Infrastructure	During the construction phase, the Project may increase road wear (contributed by heavy vehicle traffic volumes) along the expected vehicle route between 0.2 % - 11.7 % on main roads. As no heavy vehicle movements are required to inspect the transmission line, the operational phase is expected to result in no road wear					
	Receptor	Local communities	The largest population centres in the vicinity of the proposed transmission line are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808). The Stuart Highway is the major primary road in the region connecting these communities and is used by residents, tourists, goods and service providers and other industries.					
	Design Controls	There are no elimination or substitution control measures considered.						
	Is the Linkage Confirmed	Yes	Increased heavy vehicle traffic will contribute to general deterioration of road conditions.		**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential increased road wear has been assessed in Appendix F2 & G2 of the DA, and has been considered appropriate.		
	Is the S-P-R Material?	Yes	**Justification**	Increased heavy vehicle traffic will contribute to general deterioration of road conditions and therefore the S-P-R is considered material.		**Legislative Requirements**	*Highways Act 1926* (SA)	
	Impact Significance	**Resilience**		1 - Adaptable	Local community will be adaptable to Project-related time delays.			
		Importance		2 - Local	Traffic volumes leading to disruption are of local importance.			
		Duration		1 – One year from commencement of impact	The impact will occur during construction and operations (in reduced volumes). The increase in traffic volume is expected to have no material effect on travel times during inspection and maintenance operations for the Project, therefore the duration of potential impacts would only occurring during the construction period.			
		Significance Rating		2	Not Significant (<48)			
	Impact Uncertainty	**Inputs**		A - Verified data	For most of the route, field verified data used			
		Method		A – Industry standard approach	Industry standard approach			

		Sensitivity	B	Predictions will have some sensitivity to input variations.
		Uncertainty Rating	3	Not Significant (<48)
	Final Impact Rating	3	**Final Impact Category**	Very Low

IMPACT ID SE03 Increased Traffic – Public Safety

IMPACT ID SE03 Increased Traffic – Public Safety									
Applicable Alignment Section -ALL									
Planned Event	**Potential Impact**	Increased traffic volumes on public roads affects public safety.				**Phase**	Construction/Operations		
	Source	Transport	The proposed alignment traverses the Stuart Highway through rural towns Pimba, Woomera and Roxby Downs. The proposed transmission line will cross the Olympic Dam Highway.						
	Pathway	Social	During the construction phase, the Project may increase in traffic volume along the expected vehicle route between 0.1 % - 23.2 % on the main roads. Main roads in the region are generally classified as high capacity, capable of accommodating up to an estimated 15,000 daily vehicle movements. Consequently, any additional traffic generated during the construction phase would have minimal impact on the existing road function. Any injuries as a result of interaction with project related traffic will be as a result of an unplanned risk event.						
	Receptor	Local communities	The largest population centres in the vicinity of the ETL are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808). The Stuart Highway is the major primary road in the region connecting these communities and is used by residents, tourists, goods and service providers and other industries.						
	Design Controls	Intersections with the Stuart Highway constructed to appropriate standards established in consultation with DPTI. BAR and BAL treatments (if required) will be designed as per Austroads Guide to Road Design Part 4: Intersections and Crossings – General, and Part 4A: Unsignalised and Signalised Intersections. Design and construction of transmission line at crossings of DPTI roads in accordance with DPTI requirements.							
	Is the Linkage Confirmed	No	Road accidents are not a planned event. Any road accidents will be a result of an unplanned risk event which has been further assessed below.		**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential increase in traffic volume has been assessed and has been considered appropriate.			
	Is the S-P-R Material?	Yes	**Justification**	The unplanned risk event is considered material based on the level of risk.	**Legislative Requirements**	Work Health and Safety Act 2012 (SA) Work Health and Safety Regulations 2012 (SA) *Roads Traffic Act 1961* (SA)			
Unplanned Event	**Risk Assessment**	**Risk Event**		**Management Controls**		**Risk**			
						Consequence	**Likelihood**	**Risk**	
		Increased traffic volumes on public roads results in serious injury or death.		• Traffic Management Plans and speed limits • Area-specific and site inductions and training • Contractor vehicle maintenance.		4 - Major	D - Rare	10 - Moderate	

			• Consultation undertaken prior to construction with the appropriate roads authority • Procedures for oversize loads.			

IMPACT ID SE04 Increased Competition for Labour

IMPACT ID SE04 Increased Competition for Labour							**Applicable Alignment Section -ALL**
Planned Event	**Potential Impact**	Job creation in the region during construction and operation reduces the availability of labour for existing businesses which could lead to a short-term increase in wage costs or shortage of specific skills.				**Phase**	All
	Source	Social interaction – Work demand	The Project will create approximately 200 short term jobs for the construction of the line. Workers may be required from further afield (e.g. Interstate, Port Augusta, Adelaide) and will be accommodated at temporary accommodation camps. Construction workforce would largely be FIFO from Adelaide, with a small proportion of DIDO from local communities. Operational workforce is likely to be small and only required for inspection and maintenance activities.				
	Pathway	Social - Economy	The unemployment rate is around 10 % in Port Augusta, Whyalla, Port Pirie, Andamooka and Coober Pedy, and indicate low competition for labour in these towns. The unemployment rate is 0 % for Pimba and Woomera, however due to the small labour force in each town, unemployment rates are not expected to change. The unemployment rate of 1.6 % in Roxby Downs is low and is likely an indicator of high competition for labour.				
	Receptor	Local communities	The largest population centres in the vicinity of the proposed transmission line are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808). The Stuart Highway is the major primary road in the region connecting these communities and is used by residents, tourists, goods and services providers and other industries. Metal ore mining is one of the largest employment industries for the region in which the Project will be built, as well as correctional and detention services, hospitals, education and construction.				
	Design Controls	No design controls proposed.					
	Is the Linkage Confirmed	No	No notable increase in competition for labour is expected for the construction stage of the Project. No effect is expected during the operation phase as the labour associated with maintenance is negligible.		**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential increased labour competition has been assessed in Appendix G2 of the DA, and has been considered appropriate.	
	Is the S-P-R Material?	No	**Justification**	There is no notable effect on the labour market predicted and therefore the S-P-R is considered not material.		**Legislative Requirements**	N/A

IMPACT ID SE05 Road Conditions – Time Delays and Disruption

<table>
<tr><th colspan="5">IMPACT ID SE05 Road Conditions – Time Delays and Disruption</th><th colspan="3">Applicable Alignment Section -ALL</th></tr>
<tr><td rowspan="8">Planned Event</td><td>Potential Impact</td><td colspan="4">Infrastructure construction works near or on public roads influences travel time for road users.</td><td>Phase</td><td>Construction</td></tr>
<tr><td>Source</td><td colspan="2">Traffic</td><td colspan="4">The proposed alignment traverses the Stuart Highway through rural towns Pimba, Woomera and Roxby Downs. The proposed transmission line will cross the Olympic Dam Highway.</td></tr>
<tr><td>Pathway</td><td colspan="2">Social</td><td colspan="4">Project construction works (e.g. establishing shoulders to allow turn offs, tower installation immediately adjacent to roads if required or conductor stringing across roads) may affect travellers on the Stuart Highway, Olympic Dam Highway and Olympic Way, traveling along the route between Port Augusta and Roxby Downs. The expected delay for these travellers would be less than five minutes per one kilometre construction zone (assuming a 25 km/hr speed limit through roadworks) along the route. However, this delay may be longer depending on requirements for traffic stoppages during construction works.
No significant delays due to road closures are expected to result from the Project construction. Any delays during key construction activities (e.g. stringing of conductors across roads) would be temporary and very short term .</td></tr>
<tr><td>Receptor</td><td colspan="2">Local communities
Third-party users</td><td colspan="4">The largest population centres in the vicinity of the ETL are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808).
The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs, and Andamooka.
OZ Minerals has consulted with directly affected landowners throughout the planning of the Project to discuss the level of impact the transmission line may have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation.
The Stuart Highway is the major primary road in the region connecting these communities and is used by residents, tourists, goods and service providers and other industries.</td></tr>
<tr><td>Design Controls</td><td colspan="6">No design controls proposed.</td></tr>
<tr><td>Is the Linkage Confirmed</td><td>No</td><td colspan="2">Construction works are not expected to have a material effect on travel times</td><td>Uncertainty: S-P-R, impact statement</td><td colspan="2">Uncertainty analysis associated with potential time delays and disruption has been assessed in Appendix F2 & G2 of the DA, and has been considered appropriate.</td></tr>
<tr><td>Is the S-P-R Material?</td><td>No</td><td>Justification</td><td colspan="2">Local community and third-party users will be adaptable to Project-related time delays and disruption</td><td>Legislative Requirements</td><td>Highways Act 1926 (SA)</td></tr>
</table>

IMPACT ID SE06 Damage to Other Infrastructure

IMPACT ID SE06 Damage to other Infrastructure									
Applicable Alignment Section -ALL									
Planned Event	**Potential Impact**	Construction activities result in damage to other infrastructure (e.g., pipelines and powerlines).				**Phase**	Construction		
	Source	Project Construction	During construction there will be a minor increase in traffic volumes on the adjacent public roads, pastoral and access tracks. Existing roads and tracks will be used wherever possible. In areas where there is no existing access track or where use of nearby tracks is not permitted by the owner, a new track generally paralleling the transmission line route would be constructed. Construction activities will require the use of heavy machinery for foundation preparation, tower assembly and installation and cable stringing.						
	Pathway	Land use	Third-party users may also rely on the transport route and existing tracks used during the construction phase.						
	Receptor	Local community and Third-party users	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs, and Andamooka. The Stuart Highway is the major primary road in the region connecting these communities and is used by residents, tourists, goods and services providers and other industries.						
	Design Controls	Third-party infrastructure identified during detailed design and addressed in construction documentation as appropriate.							
	Is the Linkage Confirmed	No	Damage to infrastructure is not a planned event. Any damage will be a result of an unplanned risk event which has been further assessed below.		**Uncertainty: S-P-R, impact statement**	Management controls will include the implementation of appropriate construction practices.			
	Is the S-P-R Material?	No	**Justification**	The unplanned risk event is not considered material based on the low residual risk.		**Legislative Requirements**	N/A		
Unplanned Event	**Risk Assessment**	**Risk Event**		**Management Controls**		**Risk**			
						Consequence	**Likelihood**	**Risk**	
		Civil works damage underground pipeline.		Design / construction documentation identifies third party infrastructure The CEMP outlines responsibilities for the adherence to appropriate construction practices		2 - Minor	E - Rare	3 – Very Low	
		Heavy machinery accident results in damage to nearby infrastructure.		Design / construction documentation identifies third party infrastructure The CEMP outlines responsibilities for the adherence to appropriate construction practices		2 - Minor	D - Unlikely	5 - Low	

IMPACT ID SE07 In–migration - Social Disruption

IMPACT ID SE07 In-migration – Social Disruption								
Applicable Alignment Section -ALL								
Planned Event	**Potential Impact**	The in-migration of construction workers to residential centres and construction camps in the region has the potential to cause social disruption in local communities.				**Phase**	Construction	
	Source	Social interaction – Workforce demand	The Project will create approximately 200 short term jobs for the construction of the transmission line. Workers may be required from further afield (e.g. Interstate, Port Augusta, Adelaide) and will be accommodated at temporary accommodation camps. Construction workforce would largely be FIFO from Adelaide, with a small proportion of DIDO from local communities. Operational workforce is likely to be small and only required for inspection and maintenance activities.					
	Pathway	Social	Construction camps are expected to house between 80 and 100 workers each and will likely be located well outside of the residential centres in the Project Area (at least 30 km from any towns). A small amount of in-migration is expected in Pimba, Woomera and Roxby Downs (ranging from one to six workers).					
	Receptor	Local communities	The largest population centres in the vicinity of the Project are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808). Local residents may be concerned about interacting with workers on highways in the local area of the construction camps and when workers visit nearby towns for recreational reasons or to return to their usual residence.					
	Design Controls	No design controls proposed.						
	Is the Linkage Confirmed	No	Social disruption by construction crews is not a planned event. Any disruption will be a result of an unplanned risk event which has been further assessed below.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential social disruption from in-migration has been assessed in Appendix G2 of the DA, and has been considered appropriate.			
	Is the S-P-R Material?	No	**Justification**	The unplanned risk event is not considered material based on the low risk.		**Legislative Requirements**	N/A	

				Risk		
		Risk Event	**Management Controls**	**Consequence**	**Likelihood**	**Risk**
Unplanned Event	**Risk Assessment**	In-migration of construction workers to residential centres and construction camps in the region has the potential to cause social disruption in local communities.	OZ Minerals Health and Wellbeing Performance Standards, including Fitness for Work Standard Contractor selection. Contractor management. Locally sensitive inductions	2 - Minor	D - Unlikely	5- Low

IMPACT ID SE08 In–migration - Pressure on Local Services

IMPACT ID SE08 In–migration - Pressure on Local Services								
Applicable Alignment Section -ALL								
Planned Event	**Potential Impact**	In-migration of construction workers to residential centres in the region has the potential to put strain on local services (such as social and medical services), reducing their availability to the local communities.				**Phase**	Construction	
	Source	Social interaction – Workforce demand	The Project will create approximately 200 short term jobs for the construction of the transmission line. Workers may be required from further afield (e.g. Interstate, Port Augusta, Adelaide) and will be accommodated at temporary accommodation camps. Construction workforce would largely be FIFO from Adelaide, with a small proportion of DIDO from local communities. Operational workforce is likely to be small and only required for inspection and maintenance activities.					
	Pathway	Social	Most towns, with the exception of Woomera, Pimba and Andamooka, have access to hospitals and other community health services. The Royal Flying Doctor Service has a base in Port Augusta and provides emergency medical services as well as routine clinics to people in remote and isolated areas of South Australia. Pika Wiya Health Service Aboriginal Corporation is located at Port Augusta and is the centre for Aboriginal health services in the Far North region. Social services and infrastructure are well established in a number of the towns in the Project region and are outlined in Appendix G1 of the DA. A small amount of in-migration is expected in Pimba, Woomera and Roxby Downs (ranging from one to six workers).					
	Receptor	Local communities	The largest population centres in the vicinity of the transmission line are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808). The towns in the region of the Project have seen a general decline in population in the 5 years prior to the 2016 Census.					
	Design Controls	No design controls proposed.						
	Is the Linkage Confirmed	No	In-migration due to the Project only moderates a trend of population decrease in these towns and will not put additional pressure on local services.		**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential pressures on local services from in-migration has been assessed in Appendix G2 of the DA, and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	There is no effect on services predicted and therefore no S-P-R linkage exists.			**Legislative Requirements**	N/A

IMPACT ID SE09 In-migration – Pressure on Local Businesses

IMPACT ID SE09 In-migration – Pressure on local businesses								**Applicable Alignment Section -ALL**
Planned Event	**Potential Impact**	In-migration of construction workers to residential centres in the Regional Study Area has the potential to put strain on local business which may cause shortages of basic services to these communities (for example retail and recreation).					**Phase**	Construction
	Source	Social interaction – Workforce demand	The Project will create approximately 200 short term jobs for the construction of the transmission line. Workers may be required from further afield (e.g. Interstate, Port Augusta, Adelaide) and will be accommodated at temporary accommodation camps. This has the potential to place added pressure on local amenities and businesses.					
	Pathway	Social	The population centers within the region provide a range of community and recreation facilities and social services. Social services and infrastructure are well established in a number of the towns in the Project region and are outlined in Appendix G1 of the DA. A small amount of in-migration is expected in Pimba, Woomera and Roxby Downs (ranging from one to six workers).					
	Receptor	Local communities	The largest population centres in the vicinity of the ETL are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808). The towns in the region of the Project have seen a general decline in population in the 5 years prior to the 2016 Census.					
	Design Controls	No design controls proposed.						
	Is the Linkage Confirmed	No	In-migration due to the Project only moderates a trend of population decrease in these towns and will not put additional pressure on local businesses.		**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential pressures on local businesses from in-migration has been assessed in Appendix G2 of the DA, and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	There is no effect on local businesses predicted and therefore no S-P-R linkage exists.			**Legislative Requirements**	N/A

IMPACT ID SE10 In-migration – Housing Pressures

IMPACT ID SE10 In-migration – Housing Pressure						**Applicable Alignment Section -ALL**	
Planned Event	**Potential Impact**	Construction activity encourages people to move to nearby communities, influencing housing availability and/or affordability.				**Phase**	Construction
	Source	Social interaction	The Project will create approximately 200 short term jobs for the construction of the transmission line. Workers may be required from further afield (e.g. Interstate, Port Augusta, Adelaide) and will be accommodated at temporary accommodation camps.				
	Pathway	Social	A small amount of in-migration is expected in Pimba, Woomera and Roxby Downs (ranging from one to six workers). Permanent in-migration for employment opportunities is expected to be unlikely due to the temporary period for employment and procurement.				
	Receptor	Local communities	Across all locations, the proportion of unoccupied houses are above both the state and national averages. In Woomera and Andamooka over 70% of dwellings are unoccupied at the last census (2016) and in Coober Pedy approximately 40% of dwellings were unoccupied. Median rents across the region are lower than the state and national equivalents No decrease in housing availability or affordability is expected in Port Augusta, Coober Pedy, Andamooka, Port Pirie, Pimba or Woomera. The estimated in-migration of workers to Roxby Downs is expected to decrease housing vacancies by around 1.7%. This decrease in availability has the potential to marginally decrease affordability for residents during the construction period.				
	Design Controls	No design controls proposed.					
	Is the Linkage Confirmed	Yes	The estimated in-migration of workers to Roxby Downs is expected to decrease housing vacancies by around 1.7% during construction. This decrease in availability has the potential to marginally decrease affordability for residents.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential pressures on housing from in - migration has been assessed in Appendix G2 of the DA, and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.		**Legislative Requirements**	N/A
	Impact Significance	**Resilience**		1 – Adaptable	There is a low probability of uptake of accommodation at Roxby downs and accommodation facilities will be provided at the construction camps.		
		Importance		2 – Local	Potential housing pressure may affect accommodation access at the local level.		

		Duration	1 – One year from commencement of impact	The Project construction activities are short in duration, reducing the potential pressure on housing availability.
		Significance Rating	2	Not significant (<48)
	Impact Uncertainty	**Inputs**	B – Use of industry recognised data	Australian Bureau of Statistics data are used for population characteristics. In-migration is estimated through EconSearch analysis described in Appendix G2 of the DA.
		Method	B – Application of existing method	Comparison of housing expected to be occupied by in-migrants to residential vacancy rate trend is a direct method of estimating housing availability and an indirect method of determining changes to affordability.
		Sensitivity	B – Some sensitivity to input variations	The worst case scenario is to assume all employees in-migrate and reside in towns in the Regional Study Area (i.e. no employment from the local unemployed and no FIFO), which would reduce housing vacancy in Port Augusta, Whyalla and Port Pirie (Appendix G2 of the DA), and housing availability in Roxby Downs (Appendix G2 of the DA). However, construction camps will provide accommodation for, at minimum, 80% of the work force
		Uncertainty Rating	3	Not Significant (<48)
	Final Impact Rating	3	**Final Impact Category**	Very Low

IMPACT ID SE11 Local Price Inflation

IMPACT ID SE11 Local Price Inflation								**Applicable Alignment Section -ALL**
Planned Event	**Potential Impact**	The establishment of a relatively highly paid workforce within regional townships influences inflation of prices for goods and services creating an impact on local communities.					**Phase**	Construction
	Source	Social interaction – Workforce demand	The Project will create approximately 200 short term jobs for the construction of the transmission line. Workers may be required from further afield (e.g. Interstate, Port Augusta, Adelaide) and will be accommodated at temporary accommodation camps.					
	Pathway	Social	A small amount of in-migration is expected in Pimba, Woomera and Roxby Downs (ranging from one to six workers).					
	Receptor	Local communities	The largest population centres in the vicinity of the ETL are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808). Median weekly individual incomes range from $604 in Port Augusta to $1,547 at Roxby Downs. Estimated personal income for workers at the Project, on average, is around $2,500 per week.					
	Design Controls	No design controls proposed.						
	Is the Linkage Confirmed	No	No local price inflation is expected in any of the residential centers in the regional as the number of employees expected to be based in each is small, and temporary.		**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential pressures from local price inflation has been assessed in Appendix G2 of the DA, and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	There is no effect on inflation predicted and therefore no S-P-R linkage exists.			**Legislative Requirements**	N/A

IMPACT ID SE12 Increased Access to Pastoral Stations

IMPACT ID SE12 Increased Access to Pastoral Stations									
Applicable Alignment Section -ALL									
Planned Event	**Potential Impact**	Increased access by construction personnel to Project construction sites and camps located within pastoral stations during construction has the potential to cause social disruption.				**Phase**	Construction		
	Source	Social interaction – Workforce Presence	Construction of the transmission line will involve the construction of new access tracks along the proposed alignment. The Project will create approximately 200 short term jobs for the construction of the transmission line.						
	Pathway	Social	Social disruption encompasses real or perceived safety and security, including issues such as the misuse of alcohol and drugs, and crime and anti-social behavior. Social disruption from temporary construction camps and associated workforce may be perceived to be a concern for pastoral lessees, potentially effecting their privacy and business activities.. While these concerns related to a permanent camp for a major mine, the same concerns could be expected to transfer to the temporary construction camps for the Project as a similar workforce will be located there. Furthermore, pastoral lessees may have concerns relating to their privacy and running their pastoral business without interruption/interference.						
	Receptor	Third-party Users	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs and Andamooka.						
	Design Controls	No design controls proposed.							
	Is the Linkage Confirmed	No	Social disruption by construction crews is not a planned event. Any disruption will be a result of an unplanned risk event which has been further assessed below.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential social disruption from increased access to pastoral stations has been assessed in Appendix G2 of the DA, and has been considered appropriate.				
	Is the S-P-R Material?	No	**Justification**	The unplanned risk event is not considered material based on the low residual risk.		**Legislative Requirements**	n/a		
Unplanned Event	**Risk Assessment**	**Risk Event**		**Management Controls**		**Risk**			
						Consequence	**Likelihood**	**Risk**	
		Increased access by construction personnel to Project construction sites and camps located within pastoral stations during construction has the potential to cause social disruption.		OZ Minerals Health and Wellbeing Performance Standards, including Fitness for Work Standard Contractor selection. Contractor management. Locally sensitive inductions		2 - Minor	D - Unlikely	5- Low	

IMPACT ID SE13 Value of Pastoral Stations – Permanent loss of Land

IMPACT ID SE13 Value of Pastoral Stations – Permanent loss of Land							
Applicable Alignment Section -ALL							
Planned Event	**Potential Impact**	Permanent loss of land as a result of Project activities may be perceived to, or may actually constrain pastoralists' activities in conducting their agricultural businesses.			**Phase**	All	
	Source	Project Infrastructure and land clearance	The proposed alignment crosses 15 land titles, held under a combination of land tenures including freehold, perpetual lease, pastoral lease, unalienated Crown land and Crown Leases by various parties. Permanent clearance of areas will be required for the transmission line structures (towers/poles) and for access to the transmission line structures. Total disturbance of land is estimated at the worst case to be approximately 470 ha prior to rehabilitation of laydown areas				
	Pathway	Social	All pastoral leases through which the transmission line will traverse, are estimated to each lose less than 0.2 km^2 of area to the Project (which is less than 0.1% of their pastoral lease areas). The reduction in area is unlikely to require a reduction in stocking rates and is unlikely to reduce the value of pastoral leases.				
	Receptor	Third-party users – Pastoral Leases	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs, Andamooka. OZ Minerals has consulted with directly affected landowners throughout the planning of the project to discuss the level of impact the transmission line will have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation.				
	Design Controls	No design controls proposed					
	Is the Linkage Confirmed	Yes	The permanent clearance of areas along the Project transmission line for the transmission line structures and associated access will reduce areas available for pastoral production.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with permanent loss of land to pastoral stations has been assessed in Appendix G2 of the DA, and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.	**Legislative Requirements**	N/A	
	Impact Significance	**Resilience**		1 – Adaptable	The reduction in area is unlikely to require a reduction in stocking rates and is unlikely to reduce the value of pastoral leases.		
		Importance		1 – Individual	Each pastoral lease may be affected differently, but impact is less than 0.1% of each pastoral lease area		

		Duration	3 - One hundred years from commencement of impact	Clearance is a permanent change and will exist over life of infrastructure
		Significance Rating	3	Not Significant (<48)
	Impact Uncertainty	**Inputs**	C – Numerous Assumptions	Land area requirements per structure/track based on ElectraNet industry standard; numbers of structures and length of access track based on high-level assumptions
		Method	A - Industry standard approach	Industry standard approach
		Sensitivity	A – Predictions no sensitive to input variation	Doubling the land area excluded does not materially change conclusions
		Uncertainty Rating	4	Not Significant (<48)
	Final Impact Rating	4	**Final Impact Category**	Very Low

IMPACT ID SE14 Value of Pastoral Stations – Land Fragmentation

IMPACT ID SE14 Value of Pastoral Stations – Land Fragmentation								
Applicable Alignment Section -ALL								
Planned Event	**Potential Impact**	Project activities may be perceived to, or may actually constrain pastoralists' activities (as a result of land fragmentation) in conducting their agricultural businesses.				**Phase**	All	
	Source	Project Infrastructure and land clearance	The proposed alignment crosses 15 land titles, held under a combination of land tenures including freehold, perpetual lease, pastoral lease, unalienated Crown land and Crown Leases by various parties. Permanent clearance of areas will be required for the transmission line structures (towers/poles) and for access to the transmission line structures. Total disturbance of land is estimated at the worst case to be approximately 470 ha prior to rehabilitation of laydown areas					
	Pathway	Social	The Project may bisect paddocks or other structures relevant to pastoral lease activities, which may restrict access and constrain pastoralists' activities. This may in turn influence the value of the pastoral leases.					
	Receptor	Third-party Users – Pastoral lease	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs, Andamooka OZ Minerals has consulted with directly affected landowners throughout the planning of the Project to discuss the level of impact the ETL will have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation.					
	Design Controls	No design controls are proposed.						
	Is the Linkage Confirmed	No	Changes in existing levels of fragmentation as a result of the Project are unlikely for identified pastoral stations		**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with land fragmentation to pastoral stations has been assessed in Appendix G2 of the DA and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The Project transmission line will run adjacent to the existing transmission line through seven of the Pastoral stations and adjacent to the existing highway through two Pastoral stations, therefore not increasing land fragmentation and limiting any constraint to pastoralists activities.		**Legislative Requirements**	N/A	

IMPACT ID SE15 Value of Pastoral Stations – Future development

IMPACT ID SE15 Value of Pastoral Stations – Future development							
					Applicable Alignment Section -ALL		
Planned Event	**Potential Impact**	Project activities may be perceived to, or may actually constrain pastoralists' activities in conducting their l businesses with respect to future developments.				**Phase**	All
	Source	Project Infrastructure and land clearance	The proposed alignment crosses 15 land titles, held under a combination of land tenures including freehold, perpetual lease, pastoral lease, unalienated Crown land and Crown Leases by various parties. Permanent clearance of areas will be required for the transmission line structures (towers/poles) and for access to the transmission line structures. Total disturbance of land is estimated at the worst case to be approximately 470 ha prior to rehabilitation of laydown areas. It is planned to obtain easements for the Project transmission line route which will be obtained by OZ Minerals.				
	Pathway	Social	The allocation of the powerline easement has the potential to affect future development. For this Project, easements will typically be 50 m wide. All pastoral leases through which the transmission line will traverse, are estimated to each lose less than 0.2 km^2 of area to the Project (which is less than 0.1% of their pastoral lease areas). An assessment was undertaken using a potential future development scenario (Appendix G2 of the DA), which found that the potential development restriction footprint for each pastoral lease ranges from 0.1 km^2 – 2.0 km^2 (0.01% – 0.19%).				
	Receptor	Third-party Users – Pastoral lease	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs, Andamooka OZ Minerals has consulted with directly affected landowners throughout the planning of the Project to discuss the level of impact the ETL will have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation. Other infrastructure and operations in proximity to the proposed alignment include existing transmission lines (BHP's 275 kV line, ElectraNet's 132 kV line and Prominent Hill transmission line) and the Solar Reserve's proposed Aurora Concentrated Solar Project.				
	Design Controls	No design controls are proposed.					
	Is the Linkage Confirmed	Yes	The Project may lead to restriction of some pastoral activities for pastoral leases within the Project Area, this may, in turn, lead to an actual or perceived constraint on future developments by pastoral enterprises.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with future development to pastoral stations has been assessed in Appendix G2 of the DA, and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.		**Legislative Requirements**	N/A

	Impact Significance	**Resilience**	1 – Adaptable	The Project has a relatively small footprint within each pastoral lease and this reduces the likelihood of actual development constraints occurring.
		Importance	1 – Individual	The majority of potential development restrictions would apply to less than 0.5% of each pastoral lease area within the Project Area.
		Duration	3 - One hundred years from commencement of impact	Clearance is a permanent change and will exist over life of infrastructure
		Significance Rating	3	Not Significant (<48)
	Impact Uncertainty	**Inputs**	B – Limited data	Limited data; use of industry recognized or benchmarked data (RFDS n.d.); some assumptions
		Method	B - not industry recognised	Informal methodology used
		Sensitivity	A - Predictions not sensitive to input variation	No sensitivity to the assessment has been identified. A worst case scenarios for future development potential was used to assess any impact from the present of the proposed transmission line corridor across pastoral stations.
		Uncertainty Rating	4	Not Significant (<48)
	Final Impact Rating	4	**Final Impact Category**	Very Low

IMPACT ID SE16 Effects on Pastoralists' Activities – Access Roads

IMPACT ID SE16 Effects on Pastoralists' Activities – Access Roads								
Applicable Alignment Section -ALL								
Planned Event	**Potential Impact**	Access to powerline disrupts pastoral operations, e.g. use of pastoralist roads.				**Phase**	Construction	
	Source	Project Infrastructure and land clearance	Access during the construction phase of the transmission line will use existing tracks wherever possible.					
	Pathway	Social	The expected delay for pastoralists would be negligible (estimated to be less than five minutes) per one kilometre of construction zone, however delays may be longer depending on requirements for traffic stoppages during construction works. If full closures of the pastoral tracks are required, OZ Minerals would communicate this with potentially affected pastoralists to allow access through construction areas. If access cannot be provided, pastoralists may have to use alternate routes and accordingly experience increased travel times for the duration of construction. Sections of pastoral properties may also become temporarily inaccessible if access through construction areas or alternate routes are not available.					
	Receptor	Third-party Users – Pastoral lease	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs, Andamooka OZ Minerals has consulted with directly affected landowners throughout the planning of the Project to discuss the level of impact the transmission line will have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation.					
	Design Controls	No design controls are proposed.						
	Is the Linkage Confirmed	Yes	Access during construction phase will use existing tracks wherever possible, and therefore may result in disruptions to pastoralist activities.		**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with effects on Pastoralists activities in relation to track access has been assessed in Appendix G2 of the DA, and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.		**Legislative Requirements**	N/A	
	Impact Significance	**Resilience**		1 – Adaptable	The effect from loss of access to pastoral areas is expected to be negligible, given alternative arrangements will be provided, and the limited extent of works to be performed at a given location			
		Importance		1 – Individual	This potential impact will be limited to individual pastoralists during stages of construction.			
		Duration		1 – One year from commencement of impact	Construction activities are short term and temporary within each pastoral area.			

		Significance Rating	1	Not Significant (<48)
	Impact Uncertainty	**Inputs**	C – Numerous assumptions	Data unavailable in relation to construction schedule and effect due to restrictions/temporary closures. Current and restricted travel speeds are modelled on hypothetical values
		Method	C – Informal approach	Industry standard approach for speed restrictions Informal methodology used for full track closure effects.
		Sensitivity	C – Predictions highly sensitive to input variations	Partial track closures only consider speed restrictions. It is possible that further traffic controls may be required, such as sectioning off parts of pastoral tracks. Note that this can add to the delay time, which is likely to be a few minutes. Full track closure effects were unquantifiable, although likely to be brief.
		Uncertainty Rating	1	Not Significant (<48)
	Final Impact Rating	2	**Final Impact Category**	Very Low

IMPACT ID SE17 Effects on Pastoralists' Activities - Restricted Height Operations

IMPACT ID SE17 Effects on Pastoralists' Activities – Restricted Height Operations								
	Applicable Alignment Section -ALL							
Planned Event	**Potential Impact**	Transmission line clearance requirements disrupts pastoral operations by limiting vehicle access below the transmission line.				**Phase**	All	
	Source	Project Infrastructure	Lattice towers are expected to be used for the 275 kV line and would typically be 50 to 60 m in height, with the taller height generally required for longer spans. Monopoles or possibly smaller lattice towers will be used for the 132 kV line and would typically be 25 to 45 m in height.					
	Pathway	Social	Vehicles between 4.3 m and 4.9 m high (maximum permitted height of vehicles in South Australia) are required to confirm their route with SA Power Networks, because of potential transmission line clearance restrictions (DTEI 2008). The minimum clearance distance between a vehicle and load to be transported and transmission lines is 2.4 m (132 kV line) and 3.2 m (275kV line) (*Electricity (General) Regulations 2012* under the *Electricity Act 1996* (SA)).					
	Receptor	Third-party Users – Pastoral lease	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs and Andamooka. OZ Minerals has consulted with directly affected landowners throughout the planning of the project to discuss the level of` impact the transmission line will have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation.					
	Design Controls	A Right of Way (ROW) will be designed to provide a safety clearance margin between the high voltage power lines and surrounding structures and vegetation						
	Is the Linkage Confirmed	Yes	The Project transmission line route does not run adjacent to existing transmission lines when it traverses Purple Downs and Roxby Downs. On these properties there is potential for pastoral operations to be affected when oversize vehicles (greater than 4.3 m in height) are required to move across these properties.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with effects on Pastoralists activities in relation to pastoral operations has been assessed in Appendix G2 of the DA and has been considered appropriate.			
	Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.		**Legislative Requirements**	*Electricity Act 1996* (SA) *Electricity (General) Regulations 2012*	

	Impact Significance	**Resilience**	1 – Adaptable	Operations using oversized vehicles between 4.3 m and 4.9 m are required to confirm their route with SA Power Networks, because of potential transmission line clearance restrictions. This requirement is not a new effect to pastoralists based on the existing powerline infrastructure
		Importance	1 – Individual	Effects are specific to pastoralists in which the transmission line does not run adjacent to pre-existing infrastructure.
		Duration	3 - One hundred years from commencement of impact	Effect will exist over life of infrastructure
		Significance Rating	3	Not Significant (<48)
	Impact Uncertainty	**Inputs**	C – Numerous assumptions	Vehicle heights and restrictions based on industry standard, however, assumptions were made on use for pastoral activities and associated requirements
		Method	B – Benchmarked data	Approach based on literature
		Sensitivity	C – Sensitivity not known	Construction planning has already mitigated many of these effects however, the residual effects are unquantified and sensitivity is unknown.
		Uncertainty Rating	5	Not Significant (<48
	Final Impact Rating	5	**Final Impact Category**	Low

IMPACT ID SE18 Effects on Pastoralists' activities – Aerial Mustering Operations

IMPACT ID SE18 Effects on Pastoralists' Activities – Aerial Mustering Operations							
Planned Event	**Potential Impact**	Presence of transmission line disrupts pastoral operations by affecting aerial mustering near the transmission line.				**Phase**	All
	Source	Project Infrastructure	Lattice towers are expected to be used for the 275 kV line and would typically be 50 to 60 m in height, with the taller height generally required for longer spans. Monopoles or possibly smaller lattice towers will be used for the 132 kV line and would typically be 25 to 45 m in height.				
	Pathway	Social	Aerial mustering operations which occur in the vicinity of transmission lines may need to modify their operations (e.g. be limited to stock spotting) to minimise the risk of wire strike.				
	Receptor	Third-party Users – Pastoral lease	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs, Andamooka OZ Minerals has consulted with directly affected landowners throughout the planning of the Project to discuss the level of impact the transmission line will have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation.				
	Design Controls	Design of the transmission line has taken into consideration the consolidation of the new transmission line within the existing transmission line corridor					
	Is the Linkage Confirmed	Yes	The Project transmission line route does not run adjacent to existing transmission lines when it traverses Purple Downs and Roxby Downs. On these properties there is potential for aerial mustering operations to be affected when they occur in the vicinity of the Project transmission line route.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with effects on Pastoralists activities in relation to pastoral aerial mustering operations has been assessed in Appendix G2 of the DA and has been considered appropriate.		
	Is the S-P-R Material?	No	**Justification**	The potential impact of disruption to aerial mustering must be undertaken under existing civil aviation safety legislation. The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.		**Legislative Requirements**	*Civil Aviation Act 1988 (Cth)*
	Impact Significance	**Resilience**		1 – Adaptable	It is generally recommended that aerial mustering aircraft fly with a minimum of 100ft (31m) clearance from other objects (FSF 2016). On-going marking of transmission lines, both physically and on aviation maps (CASA 2015) and wire strike avoidance seminars/discussions with aerial mustering operators will assist to reduce the hazard (CASA 2015). Aerial mustering operations which occur in the vicinity of transmission lines will need to modify their operations (e.g. be limited to stock spotting) to minimise the risk of wire strike. This requirement is not a new effect to pastoralists based on the existing powerline infrastructure		

		Importance	1 – Individual	Effects are specific to pastoralists in which the transmission line does not run adjacent to pre-existing infrastructure.
		Duration	3 - One hundred years from commencement of impact	Effect will exist over life of infrastructure
		Significance Rating	3	Not Significant (<48)
	Impact Uncertainty	**Inputs**	C – Numerous assumptions	Aerial mustering hazards and safety of operation standards based on industry standard however, on-property vehicle routes unknown.
		Method	B – Benchmarked data	Approach based on literature
		Sensitivity	C – Sensitivity not known	Design planning has already mitigated many of these effects however, the residual effects are unquantified and sensitivity is unknown.
		Uncertainty Rating	5	Not Significant (<48)
	Final Impact Rating	5	**Final Impact Category**	Low

IMPACT ID SE19 Infrastructure Affects Air Access

IMPACT ID SE19 Infrastructure Affects Air Access								
		Applicable Alignment Section -ALL						
Planned Event	**Potential Impact**	Presence of the powerline affects air access, e.g. flying doctor, local airstrips.				**Phase**	All	
	Source	Project	Lattice structures are expected to be used for the 275 kV line and would typically be 50 to 60 m in height, with the taller height generally required for longer spans. Monopoles or possibly smaller lattice structures will be used for the 132 kV line and would typically be 25 to 45 m in height.					
	Pathway	Social	The presence of the towers may affect flight paths of the Royal Flying Doctor Service (RFDS), local airstrips and / or commercial flights into surrounding airports.					
	Receptor	Third-party users	Around 75 airstrips are located in towns and remote areas of the State and are used for medical services RFDS, policing, education, mine access, charter traffic and basic community access. As mentioned in Section 15.1.5, there are three commercial airports operating in the Far North (Port Augusta, Olympic Dam and Coober Pedy), and a number of privately operated airstrips associated with pastoral stations (generally consisting of graded earth and with no other services or infrastructure) The closest airstrips to the proposed transmission line include Alliance Airlines' Olympic Dam airport (6.1 km to the north of the line) and Mount Gunson private airstrip (6.8 km to the east of the line).					
	Design Controls	Tower design and lighting in accordance with Civil Aviation Safety Authority (CASA) requirements.						
	Is the Linkage Confirmed	No	Existing powerline infrastructure in the area has pre-established the requirements for awareness of powerline infrastructure for flight path planning. The proposed transmission design, predominantly, remains within the foot print of existing infrastructure.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with restricted air access from the powerline infrastructure has been assessed and has been considered appropriate.			
	Is the S-P-R Material?	No	**Justification**	The potential impact of disruption to air access is not material as any aerial activities must be undertaken under existing civil aviation safety legislation.		**Legislative Requirements**	*Civil Aviation Act 1988 (Cth)*	

IMPACT ID SE20 Access to Powerline Infrastructure – Public Safety

IMPACT ID SE20 Access to Powerline Infrastructure – Public Safety								
Applicable Alignment Section -ALL								
Planned Event	**Potential Impact**	Access to the powerline area by the general public results in serious injury or death.				**Phase**	All	
	Source	Social interaction	Construction activities (i.e., land clearing, civil works, tower assembly and installation and cable stringing) will require the use of earthmoving equipment and mobile fleet (including helicopters), with the potential for blasting to be required in some geologic conditions. The operational phase of the transmission line may enable unrestricted access to the public.					
	Pathway	Social	Any injuries or deaths will be as a result of unauthorised access and an unplanned risk event.					
	Receptor	Local communities	The largest population centres in the vicinity of the ETL are Roxby Downs (4.5 km east, population of 3,884), Woomera (6.6 km west, population of 146), Pimba (9.6 km west, population of 63) and Port Augusta (22.5 km south east, population of 13,808). The land traversed by the transmission line is subject to two Native Title Determinations; The southern 32 kilometre portion of the Project Area is within the determined Barngarla Native Title Claim (NNTT Number SCD2016/001) and the remaining area lies within the determined Kokatha People (Part A) Native Title Determination (National Native Title Tribunal (NNTT) Number SCD2014/004). The Barngarla Determination Aboriginal Corporation (BDAC) is the Registered Native Title Body Corporate who acts as an agent for the Barngarla People in relation to their native title rights and interests. The Kokatha Aboriginal Corporation (KAC) is the Registered Native Title Body Corporate who acts as an agent for the Kokatha People in relation to their native title rights and interests.(DA Section 13.1.1)					
	Design Controls	No design controls are proposed.						
	Is the Linkage Confirmed	No	Accidents as a result of unauthorised access are not a planned event. Any accidents will be a result of an unplanned risk event which has been further assessed below.	**Uncertainty: S-P-R, impact statement**	Uncertainty analysis associated with potential public safety issues from unauthorised access to the powerline infrastructure has been assessed and has been considered appropriate.			
	Is the S-P-R Material?	Yes	**Justification**	The unplanned risk event is considered material based on the High risk.		**Legislative Requirements**	N/A	

Unplanned Event	**Risk Assessment**	**Risk Event**	**Management Controls**	**Risk**		
				Consequence	**Likelihood**	**Risk**
		Unauthorised access to the project site or infrastructure by members of the public results in serious injury or death.	• Appropriate signage on infrastructure and key access points • Traffic Management Plan and CEMP including traffic management and speed limits • Contractor vehicle maintenance.	4 - Major	E - Rare	10 - Moderate

IMPACT ID SE21 Effects on Pastoralists' Activities – Damage to Access Roads

IMPACT ID SE21 Effects on Pastoralists' activities – Damage to access roads							
Applicable Alignment Section -ALL							
Planned Event	**Potential Impact**	Damage to access roads from construction and maintenance activities prevents access by pastoralists.			**Phase**	All	
	Source	Project Infrastructure and land clearance	Existing roads will be used wherever possible. In areas where there is no existing access track or where use of nearby tracks is not permitted by the owner, a new track generally paralleling the transmission line route would be constructed. Operations and maintenance activities will typically include twice yearly visual inspections, annual helicopter-based inspections and a vehicle-based inspection every four years. These activities will generate a negligible increase in traffic volumes on access roads for limited periods of time.				
	Pathway	Social / Economic	The Project could affect the condition of unsealed pastoral access tracks through road wear from additional Project traffic (particularly heavy loads) during the construction phase and through unplanned events (e.g. Project vehicle accidents or bogging) leading to damage to the tracks. These effects, if they occur, are likely to result in nuisance to pastoralists (e.g. discomfort from using tracks in poor condition, time delays or the need to use alternative routes if access tracks become unusable/impassable). OZ Minerals has consulted with potentially affected landowners throughout the planning of the Project to discuss the level of impact the transmission line will have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation. It is expected that, through this process, the Project will identify pastoral access tracks that are at risk of deterioration due to Project transport activities and will undertake measures to mitigate the effect.				
	Receptor	Third-party Users – Pastoral lease	The Project will intersect or is immediately adjacent the following pastoral stations, from South to North: Carriewerloo, Mount Arden, Kootaberra, Oakden Hills, Pernatty, Arcoona, Purple Downs, Roxby Downs, Andamooka OZ Minerals has consulted with directly affected landowners throughout the planning of the project to discuss the level of impact the transmission line will have on their properties, design alternatives and options, management issues, continuity of current operations, access arrangement and compensation.				
	Design Controls	Restrict the Project footprint to the minimum necessary.					
	Is the Linkage Confirmed	Yes	Access during the construction phase will use existing tracks wherever possible, and therefore may result in disruptions to pastoralist activities.		**Uncertainty: S-P-R, impact statement**	Yes	
	Is the S-P-R Material?	No	**Justification**	The effect assessed is not considered to be material based on the supporting impact significance and uncertainty assessment detailed below.	**Legislative Requirements**		

	Impact Significance	**Resilience**	1 - Adaptable	Local community and third-party users will be adaptable to damage to pastoral tracks. OZ Minerals will provide notice to pastoralists for any specific incidents that will directly impact them. Maintenance of tracks will be undertaken in consultation with the owner.
		Importance	2 - Local	Potential damage to access tracks is related to specific pastoral stations and may have an effect at the local level.
		Duration	3 – One hundred years from commencement of impact	The impact may occur during construction and potentially operations (in reduced volumes).
		Significance Rating	6	Not Significant (<48)
	Impact Uncertainty	**Inputs**	C – Numerous assumptions	Data unavailable in relation to pastoral access track conditions, construction schedules.
		Method	C – Informal approach	Informal, qualitative methodology used for assessing effects.
		Sensitivity	B – Some sensitivity of predictions to input variations	Addressing effects through company policy
		Uncertainty Rating	11	Not Significant (<48)
	Final Impact Rating	11	**Final Impact Category**	Low

Unplanned Event	**Risk Assessment**	**Risk Event**	**Management Controls**	**Residual Risk (Post Controls)**		
				Consequence	**Likelihood**	**Risk**
		The Project could affect the condition of unsealed pastoral access tracks through unplanned events (e.g. Project vehicle accidents or bogging) leading to damage to the tracks.	• Maintenance of unsealed roads • Traffic Management Plan and CEMP including traffic management and speed limits • Contractor vehicle maintenance. • Ongoing consultation with landowners regarding activities.	2 - Minor	D – Unlikely	5 - Low

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