Transgrid

People. Power. Possibilities.

Environmental Impact Statement

EnergyConnect (NSW – Eastern Section)

Main volume

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List of Technical Papers

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Technical paper 2 – Aboriginal cultural heritage assessment

Technical paper 3 – Historic heritage impact assessment

Technical paper 4 – Agricultural land impact assessment

Technical paper 5 – Visual and landscape character impact assessment

Technical paper 6 – Social impact assessment

Technical paper 7 – Economic impact assessment

Technical paper 8 – Hydrology, flooding and water quality

Technical paper 9 – Air quality impact assessment

Technical paper 10 – Noise and vibration impact assessment

Technical paper 11 – Traffic and transport impact assessment

Technical paper 12 – Bushfire impact assessment

Technical paper 13 – Electric and magnetic field study

Technical paper 14 – Phase 1 contamination assessment

Technical paper 15 – Groundwater impact assessment

Abbreviations

Proposal term / acronym	Definition
ABC	Australian Broadcasting Corporation
ABS	Australian Bureau of Statistics
AC	Alternating current
ACT	Australian Capital Territory
AEP	annual exceedance probability
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AHIMS	Aboriginal heritage information management system
Airports Act	*Airports Act 1996*
ANZECC	Australian and New Zealand Environment and Conservation Council
APZ	Asset protection zone
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASRIS	Australian Soils Resource Information System
ASS	Acid sulfate soils
ASSMAC	Acid Sulfate Soil Management Advisory Committee
BAM	Biodiversity Assessment Method
BC Act	(NSW) *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BEEP	Bushfire Emergency and Evacuation Plan
BMEET	Barkindji Maraura Elders Environment Team
BoM	Bureau of Meteorology
BSAL	Biophysical strategic agricultural land
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CEFC	Clean Energy Finance Corporation
CEMP	Construction Environmental Management Plan
CLM Act	(NSW) *Contaminated Land Management Act 1997*
CPA	Contingent Project Application
CSEP	Community and Stakeholder Engagement Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSSI	Critical State significant infrastructure
DAWE	(Australian) Department of Agriculture, Water and the Environment
DC	Direct current

Proposal term / acronym	Definition
DCP	Development Control Plan
DECCW	(former) Department of Environment, Climate Change and Water
DIPNR	Department of Infrastructure, Planning and Natural Resources
DoD	Department of Defence
DPE	(former) Department of Planning and Environment
DPI	Department of Primary Industries
DPIE	(NSW) Department of Planning, Industry and Environment
EEC	Endangered ecological community
EES Group of the DPIE	Environment, Energy and Science Group – a division of the Department of Planning, Industry and Environment (DPIE) (formerly NSW Office of Environment and Heritage)
EIS	Environmental Impact Statement
ELF	Extremely low frequency
EMF	Electric and magnetic fields
EP&A Act	(NSW) *Environmental Planning and Assessment Act 1979*
EP&A Regulation	(NSW) Environmental Planning and Assessment Regulation 2000
EPA	(NSW) Environment Protection Authority
EPBC Act	(Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment protection licence
ESD	Ecologically sustainable development
FM Act	(NSW) *Fisheries Management Act 1994*
FTE	Full time equivalent
GDE	Groundwater Dependent Ecosystem
GPS	Global positioning systems
GRIT procedure	Generation of Regional Input Output Tables procedure
GRP	Gross Regional Product
ha	Hectares
HEPA	Heads of EPAs Australia and New Zealand
HHIMS	Historic Heritage Information Management System
HSU	Hydrostratigraphic units
HVDC	high voltage direct current
HumeLink	Proposed interconnector to access Snowy Hydro's existing and future generation capacity
HV	High Voltage
Hz	Hertz
ICNG	Interim Construction Noise Guideline

Proposal term / acronym	Definition
ICNIRP	International Commission on Non-Ionizing Radiation Protection
Infrastructure SEPP	(NSW) *State Environmental Planning Policy (Infrastructure) 2007*
IO	Input-Output
ISP	Integrated System Plan
KTP	Key threatening processes
kV	Kilovolt
kV/m	Kilovolts per metre
LALC	Local Aboriginal Land Councils
LEP	Local environmental plan
LGA	Local government area
LLS	Local Land Services
LSE	Large Scale Equipment
mAHD	metres above Australian Height Datum
mG	Milligauss
MP	Member of parliament
MVAr	mega volt ampere of reactive power
MW	megawatts
NEM	National Electricity Market
NES	National Environmental Significance
NP&W Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
NGIS	the National Groundwater Information System
NIAA	National Indigenous Australians Agency
NMLs	Noise Management Levels
NP&W Act	(NSW) *National Parks and Wildlife Act 1974*
NRAR	Natural Resources Access Regulator
NSW	New South Wales
OCP	Organochlorine pesticides
OEH	(former) NSW Office of Environment and Heritage to be referred to as the Environment, Energy and Science Group of DPIE from the 1 July 2019
OLS	Obstacle limitation surface
OPGW	overhead optical ground wire
OPP	Organophosphorus pesticides
PAD	Potential Archaeological Deposits
PAH	Polycyclic aromatic hydrocarbon

Proposal term / acronym	Definition
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations
PCT	Plant community types
PMST	EPBC Act Protected Matters Search Tool
POEO Act	(NSW) *Protection of the Environment Operations Act 1997*
QNI Upgrade	Proposed Queensland and NSW interconnector
RAMJO	Riverina and Murray Joint Organisation
RAPs	Registered Aboriginal Parties
REDS	Regional Economic Development Strategies
REZs	Renewable Energy Zones
RFI	Radio Frequency Interference
RIT-T	Regulatory Investment Test for Transmission
Rural SEPP	*State Environmental Planning Policy (Primary Production and Rural Development) 2019*
SA	South Australia
SAII	Serious and irreversible impacts
SEARs	Secretary environmental assessment requirements
SEPP	State environmental planning policy
SEPP 55	State Environmental Planning Policy 55 – Remediation of Land
SES	State Emergency Service
SIA	Social Impact Assessment
SRD SEPP	(NSW) *State Environmental Planning Policy (State and Regional Development) 2011*
SSI	State significant infrastructure
TEC	Threatened ecological community
The Paris Agreement	United Nations Paris Agreement on climate change (2015)
TSR	Travelling stock reserves
TRH	Total recoverable hydrocarbons
UXO	Unexploded ordnance
V	Volts
V/m	Volts per metre
VNI Upgrade	Proposed Victoria and NSW interconnector
WARR Act	*Waste Avoidance and Resource Recovery Act 2007*
WHO	World Health Organisation
WM Act	*Water Management Act 2000*
µT	Microtesla
2020 ISP	Integrated system plan 2020

Glossary

Proposal term	Definition
brake/winch sites	A brake and winch site is a temporarily cleared area where plant and equipment is located for the purposes of spooling and winching a conductor into place on erected transmission line towers along a transmission line easement. Dependent upon the angle of line deviation, the location of the brake and winch site at that angle may or may not be within the nominated transmission line easement. The brake and winch site is only required for the construction phase of the proposal. It does not need to be maintained for ongoing operation and / or maintenance of the transmission line.
construction impact area	Refers to the area that would be directly impacted by construction of the proposal comprising the following: • construction of all proposal infrastructure elements (including the proposed transmission line alignment, transmission line easement, substation site works (at both the proposed Dinawan 330kV and upgraded and expanded Wagga Wagga substations), optical repeater infrastructure, and other ancillary works) • locations for construction elements such as construction compounds and accommodation camps, access tracks (excluding public roads proposed to be used for access routes), site access points, water supply points, laydown and staging areas, concrete batching plants, brake/winch sites and site offices. The area is identified based on realistic project component locations and areas however it is indicative at this stage. The area would be confirmed during finalisation of the design and construction methodology and would be developed as part of the consideration of avoidance and impact minimisation. This area includes the operational impact area (including areas required for maintenance) (refer definition below). For heritage and biodiversity assessments, the construction impact has been divided into three subset disturbance areas. These subsets relate to the identified level of disturbance in each area to reflect construction and operational requirements – specifically: • Disturbance area A, in which ground disturbance would be required • Disturbance area A (centreline) in which ground disturbance would be required • Disturbance area B, in which ground disturbance is not required except in limited circumstances. Further detail of these areas is provided below. From time to time during construction and operation, high risk trees may be removed from within, or adjacent to, the easement but outside the disturbance area.

Proposal term	Definition
disturbance area A	Refers to an area at and around the transmission line towers, areas for brake and winch sites and for new/upgraded access tracks in which vegetation would be removed during construction. The area also includes the proposed Dinawan 330kV substation site, the existing Wagga Wagga substation site and each of the main construction compounds and accommodation camps at Balranald, the Cobb Highway, Dinawan (Kidman Way), Lockhart and Wagga Wagga. It would include vegetation (including tree) removal and potential sub-surface impacts through construction activities such as grading, excavation, and full tree removal (i.e. root ball removal). Except in areas where only temporary disturbance is required (i.e. temporary access tracks and brake and winch sites), this area would also be subject to ongoing maintenance during operation (i.e. removal to ground level) for operational and safety requirements (including bushfire). This zone is a subset to the construction impact area (see definition above).
disturbance area A (centreline)	Refers to a centreline area between the proposed transmission line towers in which all vegetation (including trees) would be removed during construction to ground level. In areas of known or potential heritage subsurface sensitivity (i.e. potential archaeological deposits (PADs)) sub-surface impacts in these areas would be avoided. In these areas vegetation would be cut to ground level and root balls would be retained as necessary to avoid subsurface impacts. Additionally, in areas of key Plains Wanderer primary habitat these centreline areas would not be subject to vegetation clearing. Alternate methods would be adopted in these key habitat areas for the conductor stringing activities. This area would also be subject to ongoing maintenance during operation (i.e. removal to maintain vegetation clearance requirements) for operational and safety requirements (including bushfire). This zone is a subset to the construction impact area (see definition above).
disturbance area B	Refers to an area between transmission line towers in the easement in which removal of vegetation (including trees) would be undertaken where they have the potential to exceed vegetation clearance heights. This removal may result in temporary ground disturbance. Vegetation clearance heights are set by Transgrid for operational and safety requirements, including bushfire risk management. This area would also be subject to ongoing maintenance during operation. This zone is a subset to the construction impact area (see definition above).
EnergyConnect	An electrical interconnector of around 900 kilometres between the electricity grids of South Australia and New South Wales, with an added connection to north west Victoria. In NSW, EnergyConnect comprises two sections – Western Section (which has been the subject of a separate environmental assessment and approval) and the Eastern Section (the proposal the subject of this EIS).
hazard/high risk tree	Hazard/high risk trees are defined under Transgrid procedures and include any tree or part of a tree that if it were to fall would infringe on the vegetation clearance requirements at maximum conductor sag of the transmission lines. Hazard/high risk trees will be confirmed based on the final proposal design (considering the transmission line conductor profile) and following qualified arborist assessment of the tree. All hazard/high risk trees confirmed as posing a risk to the corridor shall be removed.

Proposal term	Definition
operational impact area	Refers to the area that would be directly impacted by permanent components of the proposal, including all proposed infrastructure elements such as the proposed transmission line easement, transmission line and transmission towers, any new or upgraded substation infrastructure, optical repeater sites, and permanent access tracks.
preliminary alignment corridor	A 10 kilometre corridor identified during the initial assessment of transmission line corridor options which is generally based on desktop assessments only.
proponent, the	NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as Transgrid). Transgrid is the operator and manager of the main high voltage (HV) transmission network in NSW and the Australian Capital Territory (ACT), and is the Authorised Network Operator for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.
proposal, the	The proposal is known as 'EnergyConnect (NSW – Eastern Section)' as described in Chapter 5 and Chapter 6 of this document.
proposal study area	The study area for this EIS, which comprises a generally one kilometre wide corridor (500 metres either side of the proposal alignment) between the Buronga substation and the Wagga Wagga substation as well as additional proposal components located away from the transmission line easement (with the exception of the proposed water points which has had a 200 metre diameter applied around each site). The proposal study area has been applied to identify the constraints nearby to the proposal which may or may not be indirectly impacted by the proposal. It encompasses the components including the construction impact area, the optical repeater sites (and associated connections), construction water points and other ancillary construction facilities. Note: Where required, each specialist has also considered a specific specialist study area relevant to their discipline.
transmission line easement	An area surrounding and including the transmission lines, which is a legal right allowing for construction of the transmission line, along with ongoing access and maintenance of the lines and will be acquired from landholders either by agreement or pursuant to compulsory acquisition process. The easement width would be 80 metres wide.

EIS declaration

Submissions of Environmental Impact Statement

This environmental impact statement has been prepared under Part 5, Division 5.2 of the *Planning and Assessment Act 1979* (NSW) and in accordance with Part 3 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

Environmental impact statement prepared by:

	EnergyConnect (NSW – Eastern Section)	
NAME	Emma Taylor on behalf of WSP Australia Pty Ltd	Caitlin Bennett on behalf of WSP Australia Pty Ltd
QUALIFICATIONS	Bachelor of Environmental Science Advanced (Honours) (Land Resources), University of Wollongong Certified Environmental Practitioner Environment Institute of Australia and New Zealand	Bachelor of Science (Environmental Biology), University of Technology, Sydney Master of Urban and Regional Planning, University of Sydney
ADDRESS	Level 27, Ernst & Young Centre 680 George Street Sydney NSW 2000	
PROPONENT NAME AND ADDRESS (THE PROPONENT)	NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as Transgrid) 180 Thomas Street, Sydney, NSW, 2000	
PROPOSED DEVELOPMENT	The proposal would comprise around: • about 375 kilometres of new 330 kilovolt (kV) double circuit transmission line and associated infrastructure between the Buronga substation and the proposed Dinawan 330kV substation • connection of the proposed transmission lines to the existing Buronga substation • construction of a new 330kV substation around 30 kilometres south of Coleambally, known as the proposed Dinawan 330kV substation • connection of the proposed transmission lines to the proposed Dinawan 330kV substation • about 162 kilometres of new 500kV double circuit transmission line and associated infrastructure between the proposed Dinawan 330kV substation and the existing Wagga Wagga substation at Wagga Wagga, NSW • upgrade and expansion of the Wagga Wagga substation to accommodate the new transmission line connections including the installation of new line bays, relocation and upgrade of existing bays and associated electrical and civil works (road, kerb, gutter, drainage works and earthworks) • provision of three optical repeater structures and associated connections to existing local electrical supplies	

	EnergyConnect (NSW – Eastern Section)		
	• new and/or upgrade of access tracks as required • ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps). Full details of the proposed development are included in Chapters 5 and 6 of the Environmental Impact Statement.		
LAND TO BE DEVELOPED	Generally the land which comprises an 80 metre wide easement between the Buronga substation at Buronga and the Wagga Wagga substation (inclusive) at Wagga Wagga, NSW in addition to a widened area to accommodate the proposed Dinawan 330kV substation.		
ENVIRONMENTAL IMPACT STATEMENT	This environmental impact statement addresses all matters specified in accordance with Division 5.2 of the (NSW) *Environmental Planning and Assessment Act 1979* and Schedule 2 of the (NSW) Environmental Planning and Assessment Regulation 2000.		
DECLARATION	We certify that we have prepared this environmental impact statement in accordance with the Secretary's environmental assessment requirements (SSI-9172452 dated 2 October 2020). This environmental impact statement contains all available information that is relevant to the environmental assessment of the infrastructure to which the statement relates. To the best of our knowledge, the information contained in the environmental impact statement is neither false nor misleading.		
SIGNATURE(S)			
NAME	Emma Taylor	Caitlin Bennett	Jarryd Barton
DATE	13 January 2022	13 January 2022	13 January 2022

Executive summary

Overview of the proposal

What is EnergyConnect?

Transgrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect aims to reduce the cost of providing secure and reliable electricity transmission between NSW and SA in the near term, while facilitating the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy sources.

EnergyConnect has been identified as a priority transmission project in the NSW Transmission Infrastructure Strategy (NSW Department of Planning and Environment (DPE), 2018), linking the SA and NSW energy markets and would assist in transporting energy from the South-West Renewable Energy Zone to major demand centres.

EnergyConnect comprises of several sections (shown on Figure ES-1) that would be subject to separate environmental planning approvals under the relevant jurisdictions. It includes:

- NSW sections including:
  - Western Section, which would extend from:
    - the SA/NSW border (near Chowilla in SA) to Transgrid's existing Buronga substation
    - Buronga substation to the NSW/Victoria border at Monak (near Red Cliffs in Victoria)
  - Eastern Section, which would extend from the Buronga substation to the existing Wagga Wagga substation (including the proposed Dinawan 330kV substation)
- a Victorian Section, which would extend from the NSW/Victoria border to Red Cliffs substation
- a SA Section, which would extend from Robertstown to the SA/NSW border.

Transgrid is currently seeking planning approval for the NSW – Eastern Section (the proposal), which is the subject of this EIS. Transgrid received separate environmental planning approvals for both the NSW – Western and Victorian sections of EnergyConnect in late 2021. ElectraNet is responsible for obtaining environmental planning approval for the section of EnergyConnect located in SA.

What are the objectives of the proposal?

The primary objective for EnergyConnect (which the proposal comprises an extensive component of) is to reduce the cost of electricity by providing secure electricity transmission between NSW and SA in the near term and facilitate the longer-term transition of the energy sector across the NEM to low emission energy generation sources. More specifically, EnergyConnect (including the proposal) aims to:

- lower power prices
- improve energy security
- increase economic activity
- support the transition to a lower carbon emission energy system
- support a greater mix of renewable energy in the NEM.

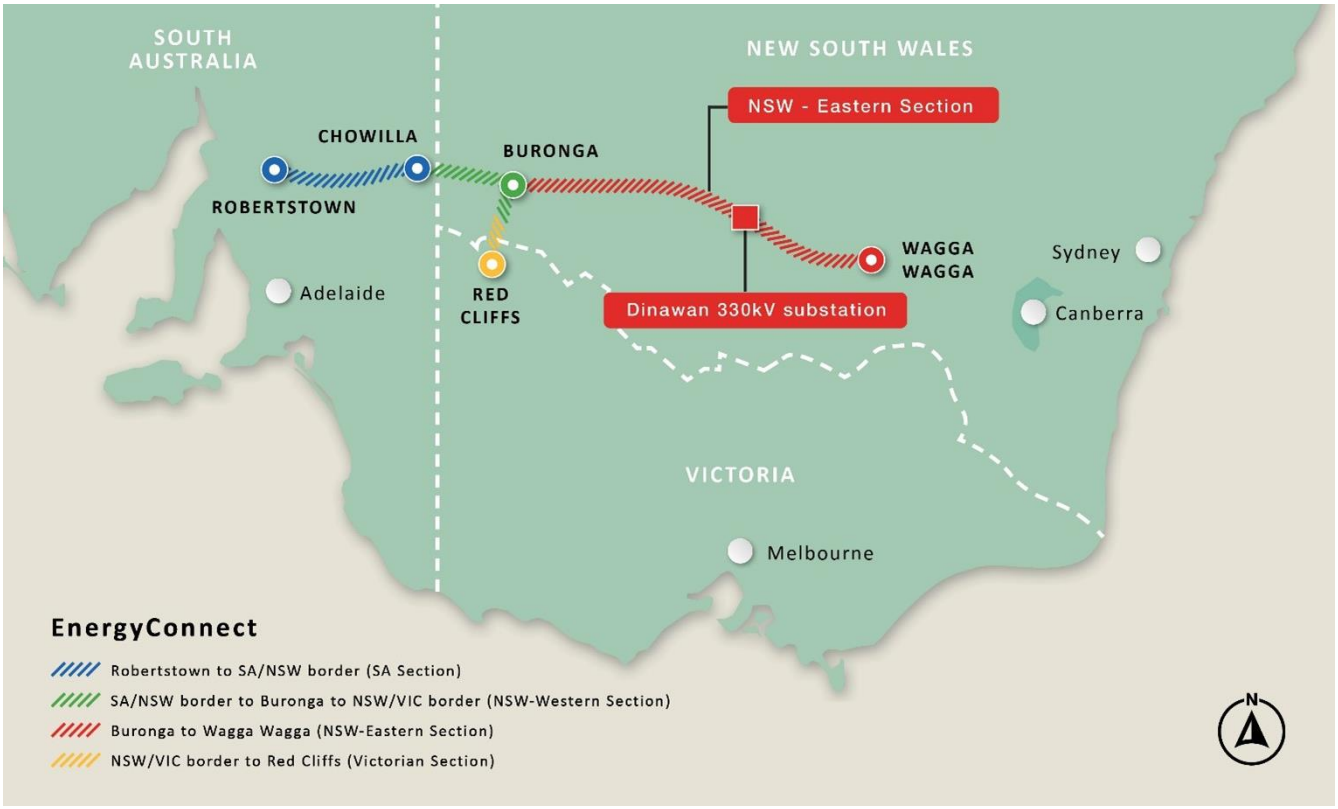

Figure ES-1 Overview of EnergyConnect

What is the proposal?

The key components of the proposal include:

- about 375 kilometres of new 330 kilovolt (kV) double circuit transmission line and associated infrastructure between the Buronga substation and the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the existing Buronga substation
- construction of a new 330kV substation around 30 kilometres south of Coleambally, referred to as the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the proposed Dinawan 330kV substation
- about 162 kilometres of new 500kV double circuit transmission line and associated infrastructure between the proposed Dinawan 330kV substation and the existing Wagga Wagga substation at Wagga Wagga, NSW
- upgrade and expansion of the Wagga Wagga substation to accommodate the new transmission line connections including the installation of new line bays, relocation and upgrade of existing bays and associated electrical and civil works (road, kerb, gutter, drainage works and earthworks)
- provision of three optical repeater structures and associated connections to existing local electrical supplies
- new and/or upgrade of access tracks as required
- ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

An overview of the proposal is provided in Figure ES-2. Further detail on the key infrastructure components of the proposal and construction activities are provided in Chapters 5 and 6 of this EIS respectively.

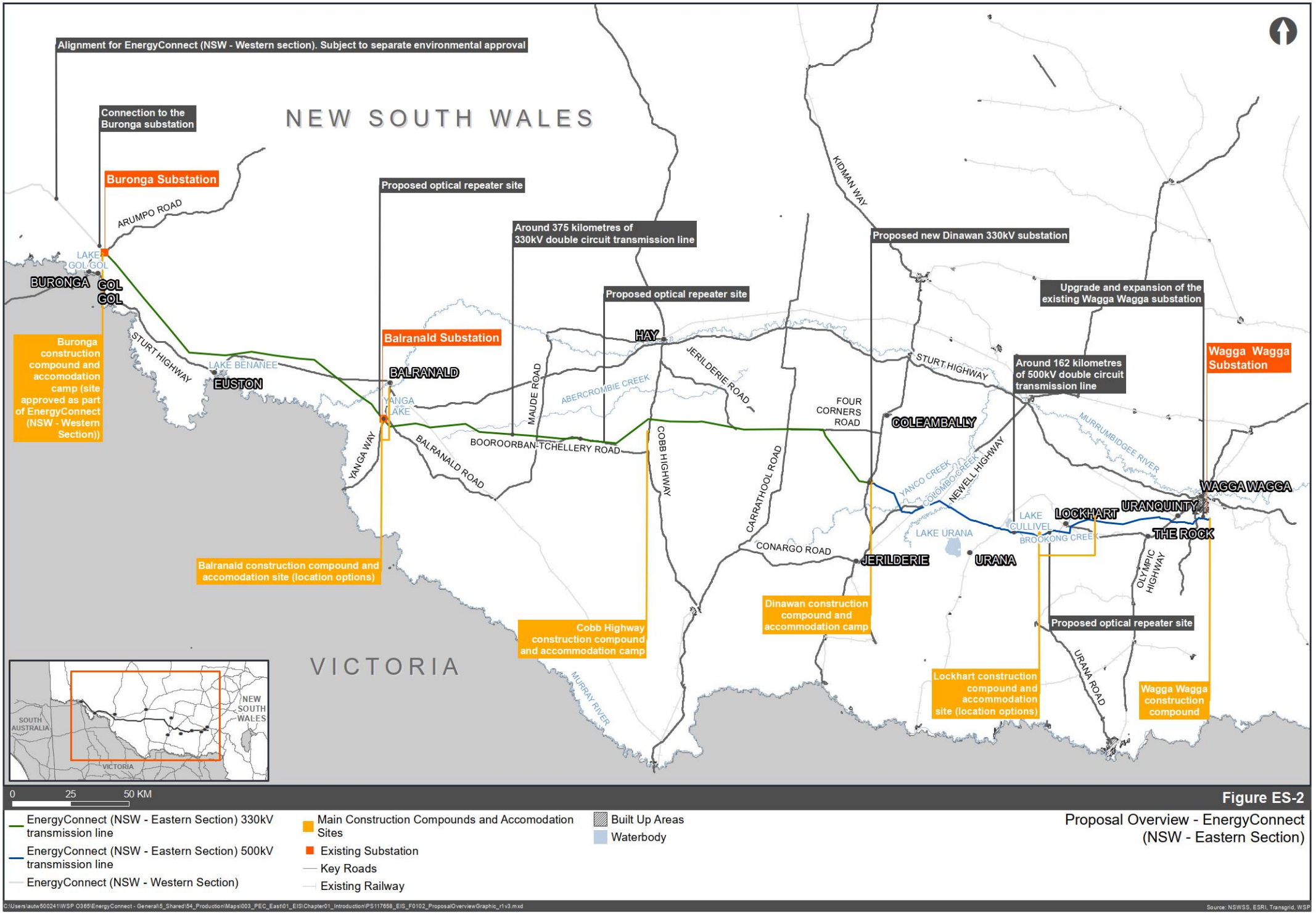

Figure ES-2

Proposal Overview - EnergyConnect (NSW - Eastern Section)

The proposal would be located across a number of local government area (LGAs) which consist of the following: Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart and Wagga Wagga LGAs.

The proposal alignment has been designed to maximise the route running parallel to existing transmission lines as far as possible in consideration of other constraints and operational requirements. The proposed alignment of the proposal easement would be parallel to existing lines for around 407 kilometres of the full approximately 537 kilometre-long route.

Because of the type of design and construction methodology associated with this type of infrastructure proposal there would be reduced impacts compared to other typical long linear infrastructure projects (such as a railway or road corridor). During construction the impacts would be concentrated at the tower sites, along the centreline between towers (required for safe conductor line stringing activities), the Dinawan substation location and at the limited new access track sites along the route. Impacts would be limited in the broader easement areas to generally the taller vegetation which has the potential to pose a hazard and a safety risk to the new transmission lines.

During the operational phase the impact footprint would be concentrated primarily to the permanent infrastructure footprints and easement restrictions on tall vegetation which would allow for re-establishment of much of the lower growth height vegetation between towers. The nature of the infrastructure allows for minimal fragmentation and severance of existing land uses.

What is the timing of construction?

Construction of the proposal would commence in late-2022 (enabling works phase), subject to NSW Government and Commonwealth planning approvals. The main construction works phase for the transmission lines and substation facilities would take around 18 months. The upgraded Wagga Wagga substation and proposed Dinawan 330kV substation are expected to be operational by August 2024. Removal and re-instatement of construction compounds and associated works and remediation would extend around six months beyond the commissioning phase, with estimated completion in March 2025.

Who is the Proponent?

The proposal would be carried out by NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as Transgrid). Transgrid is the operator and manager of the main high voltage transmission network in NSW and the Australian Capital Territory (ACT) and is the Authorised Network Operator (ANO) for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.

Proposal need and benefits

Why is EnergyConnect needed?

Need for emissions reduction

Electricity is Australia's largest source of emissions, accounting for around 33 per cent of Australia's total annual emissions (Department of Industry, Science Energy and Resources, March 2021). The role of the transmission system is crucial in all decarbonising scenarios for Australia. Transgrid is reviewing its emissions reduction pathway and climate strategy to ensure they play their role in facilitating Australia's clean energy transition.

The Australian Government has ratified the United Nations Paris Agreement and has set interim emission reduction targets, including a commitment to reduce emissions by 26 to 28 per cent below 2005 levels by 2030. Independently, every state and territory in Australia has set a goal or target to achieve net zero emissions by 2050. The Australian Government has also recently announced a target of net zero emissions by 2050 and reaffirmed interim targets to reduce emissions by between 26 and 28 per cent below 2005 levels by 2030. Preceding this, every state and territory in Australia has set a target to achieve net zero emissions by 2050.

One of the methods which is being undertaken to assist in achieving this target, is through the transmission of the Australian energy landscape to a greater mix of low-emission renewable energy sources, such as wind and solar. At the same time, consumers are demanding lower power bills and more secure and reliable energy services. EnergyConnect (including the proposal) will deliver a key component of the infrastructure required to support this transition by providing a connection between the energy grids of NSW, SA and Victoria. This connection will expand the wholesale electricity market across the three states, meaning increased reliability and security of electricity supply and lower power bills.

EnergyConnect is one of Australia's largest energy infrastructure projects and a key element of the Australian Energy Market Operator's *Integrated System Plan*. The following sections provide greater detail as to the need for the proposal.

As an owner of an electrical distribution network, Transgrid is able to facilitate the transition from traditional energy sources to lower emission alternatives, including renewable energy, through the delivery of projects such as EnergyConnect.

Shift towards renewable energy

The *2020 Integrated System Plan* (2020 ISP) (AEMO, 2020) estimates that over 26 gigawatts of new grid-scale renewables is needed to replace the approximately 15 gigawatts, or 63 per cent, of Australia's coal-fired generation that will reach the end of its technical life and so likely retire by 2040. This will increase pressure on energy supply, particularly as energy consumption continues to increase in NSW (Transgrid, 2018). The National Electricity Market (NEM) needs to identify and connect to new low emission energy generation sources to continue to have enough energy to meet the future demand, while meeting Australia's carbon emissions policy commitments (ElectraNet, 2019a).

The development of EnergyConnect (including the proposal) will provide a key electricity distribution connection within western NSW to encourage future renewable energy providers to invest in lower emission electrical generation alternatives within this region.

Challenges for the National Energy Market

Current interest in new energy generation projects in the NEM exceeds the existing transmission network capacity in several locations, meaning that not all projects would be viable. The existing network is estimated to have a connection capacity of 13 gigawatts in areas with favourable renewable resources, which is significantly less than the 26 gigawatts (or more) of new grid-scale renewables required by 2040 (AEMO, 2020).

Several Renewable Energy Zones (REZs) have been identified across the NEM, which are areas of high energy resource potential where strategic transmission infrastructure upgrades can connect multiple projects at lower cost (AEMO, 2020). EnergyConnect will be crucial in meeting the requirements for the connection of the identified REZs and will assist in leveraging large scale private sector investment opportunities, boosting regional economies and building the state's resilience by ensuring there are enough new energy projects coming online to replace the retiring traditional power stations expected over the next two decades.

EnergyConnect would also complement several additional major inter-regional interconnectors that have been identified in the 2020 ISP. Together, these interconnectors would augment the national transmission grid and address cost, security and reliability issues.

Key benefits of EnergyConnect

EnergyConnect is expected to deliver positive net market benefits and support the energy market transition to a lower carbon emissions future as soon as it can be built. In particular, it would reduce the cost of providing secure and reliable electricity transmission between NSW and SA in the near term. This is because it would allow for a greater sharing of energy resources across regions to smooth demand and supply fluctuations, reduce reliance on increasingly expensive gas generation in SA and meet overall demand and system reliability requirements at lowest cost.

EnergyConnect, inclusive of the proposal, is expected to have the following key benefits:

- delivery of net market benefits of around $900 million over 21 years (in present value terms) including wholesale market fuel cost savings in excess of $100 million per year as soon as it is energised (primarily from avoided expensive gas-fired generation in SA)
- provision of diverse low-cost renewable generation sources to help service NSW demand going forward, particularly as existing coal-fired generators retire
- avoidance of substantial capital costs associated with enabling greater integration of renewables in the NEM
- generation of sufficient benefits to recover the proposal capital costs within nine years of completion
- reduction to annual residential bills and small business customer bills in SA and NSW
- delivery of flow on economic benefits to the wider economy totalling over $6 billion across SA and NSW (in present value terms)
- generation of around 1,500 jobs (including up to around 300 local/regional jobs) during construction, including specifically for the proposal around 500 jobs (including around 100 local/regional jobs)
- improvement to the security, reliability and resilience of the power network in SA and NSW
- improvement to the ability of parties to obtain hedging contracts in SA and help relieve the tight liquidity in hedging markets currently.

With regard to job creation, over the period from 2021 to 2040, it is projected that around 18,800 employee years of full time equivalent (FTE) direct and indirect jobs would be created by EnergyConnect (Acil Allen, 2019).

Further discussion regarding the need for the proposal and key benefits that are envisaged is provided in Chapter 2 of this EIS.

Planning, design and approval process

How was the proposal developed?

Four main interconnector options were initially identified for EnergyConnect to achieve a new electrical transmission line between SA and the NEM. These options included a 'no-interconnector' option as well as a series of options involving new interconnectors to NSW, Queensland and Victoria. These options were investigated as part of the EnergyConnect Regulatory Investment Test for Transmission (RIT-T) assessment process undertaken by ElectraNet. The RIT-T concluded that a new 330kV interconnector between Robertstown in mid-north SA and Wagga Wagga in NSW, via Buronga with an augmentation between Buronga and Red Cliffs was expected to deliver the highest net market benefits and is therefore the current preferred strategic option.

Following identification of the preferred strategic option to provide a new 330kV interconnector between Robertstown in SA and Wagga Wagga in NSW, the corridor for this interconnector was then considered. The corridor selection and refinement methodology for the proposal was based on a 'hierarchy of constraints', which was developed to inform the initial preliminary corridor alignment and to narrow the corridor. The identification of constraints was informed by analysis of extensive geospatial data, ecology and heritage surveys as well as engagement with the community and stakeholders. This process was undertaken for both the current proposal (EnergyConnect (NSW – Eastern Section) and the approved NSW – Western Section.

With respect to the NSW – Eastern Section proposal, this process identified a preferred corridor between the existing Buronga substation and Wagga Wagga substation which provided for a new substation facility at an approximate midway point to enable network operational requirements to be met. Ongoing refinement of this corridor resulted in the development of a proposed transmission line easement, within which the proposed transmission line and associated works would be located. This easement has been determined based on the avoidance of key environmental constraints as far as practicably possible and has been confirmed as a suitable alignment through extensive landholder engagement.

Examples of the refinement of the proposal alignment and components to avoid impacts has included:

- minimising impacts to the relatively extensive and scattered primary habitat locations of the Plains Wanderer (a highly endangered bird species) in the central portion of the proposal. This has also specifically included locating the proposed transmission line easement within the vicinity of the Newell Highway at Bundure to avoid impacts to habitat areas in this section. Bespoke methods for construction (i.e. tower stringing activities) in areas near this habitat have also been adopted to reduce potential for impacts
- minimising impacts on the Yanga State Conservation area by locating the proposed transmission line parallel to and as close to the existing transmission line as operationally possible
- refinement of the proposal to avoid the Morundah Receiver Station (defence communications receiver facility) interference buffer zone
- refining the proposal to avoid direct impacts to the township of Lockhart
- locating the transmission line easement where possible along existing property boundaries to minimise disruption to agricultural activities
- minimising impacts on land uses such as travelling stock reserves
- locating the proposal to the north of Yanco Creek within the vicinity of Thurrowa Road to accommodate landholder feedback on their property

- refining the proposal alignment to the east and south of Lake Cullivel to accommodate landholder feedback regarding potential impacts to their property and farming operations and in consideration of ecological and heritage constraints
- minimising proposal components being located within close proximity of water crossings and other water bodies
- adjustment of some proposed tower locations and relocation of proposed new access tracks to avoid areas of Potential Archaeological Deposits (PADs) or other ecological identified constraints where practicable
- locating larger areas of impact within one location and away from sensitive receivers (where possible), such as the proposed Dinawan 330kV substation and the temporary main construction compounds and accommodation camps in areas of existing disturbance, where possible
- excluding site location options from the proposal for construction temporary ancillary facilities for locations which were identified to have heritage or ecological significance.

Some aspects of the proposal design would continue to be refined as part of the finalisation of the design. Aspects of the proposal that may be subject to further refinement include:

- the final transmission line component locations, including the specific location, height and type of transmission line structures, location of some access tracks and confirmation of the required vegetation clearance and disturbance areas after design refinement. Wherever possible, design refinement would reduce vegetation clearing and disturbance areas to be below those assessed in this EIS
- final locations and layouts of the main construction compound and accommodation camp sites - including selection of the final site where location options have been provided at Balranald and Lockhart
- final arrangement of the Dinawan 330kV substation facility within the identified parcel of land
- water supply points and other ancillary construction facilities
- construction method and staging.

Further discussion regarding the development of the proposal, together with details on route selection and design refinement are provided in Chapter 3 of this EIS.

How have the community and stakeholders been involved?

Engagement activities for the proposal have been carried out since November 2018, including (but not limited to):

- stakeholder briefings including, but not limited to, with all relevant Councils through which the proposal passes, NSW and Australian Government agencies, local MPs, NSW Aboriginal Land Councils and Aboriginal stakeholders
- face-to-face meetings, phone calls and direct correspondence via email with directly affected landholders, particularly during the route refinement process to provide information about into the constraints and opportunities
- print advertisements in several local newspapers to advertise the community drop-in sessions and request registration of Aboriginal stakeholders to participate in the assessment of cultural heritage
- consultation with registered Aboriginal parties in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2020* (Office of Environment and Heritage, 2010)
- holding community drop-in sessions and public events.

Consultation for the proposal has also been undertaken in the context of ongoing COVID restrictions and, where possible, Transgrid have sought to proactively manage consultation so that communities, stakeholders and interested parties have been given every opportunity to participate in the development of this assessment.

Consultation activities would continue as the proposal progresses, including finalisation of the proposal design and throughout construction. Further discussion of the community and stakeholder involvement for the proposal is provided in Chapter 7 of this EIS.

What is the planning approval process?

The NSW Minister for Planning and Public Spaces declared the NSW portions of EnergyConnect to be Critical State significant infrastructure (CSSI) under section 5.13 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act) and by amendment to Schedule 5, clause 15 of the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP). As CSSI, the proposal requires approval from the NSW Minister for Planning and Public Spaces under Division 5.2, Part 5 of the (NSW) EP&A Act.

A referral under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was submitted on 25 August 2020. The Australian Department of Agriculture, Water and the Environment (DAWE) determined the proposal to be a controlled action on 30 September 2020 and that it would be assessed using the bilateral assessment process. As such, the proposal also requires approval from the Australian Minister for the Environment under Part 9 of the EPBC Act.

Environmental assessment

How were the impacts assessed?

This EIS has been prepared in accordance with the provisions of Division 5.2, Part 5 of the EP&A Act. In particular, it addresses the Secretary environmental assessment requirements (SEARs) provided for the proposal by the Secretary of the Department of Planning, Industry and Environment (DPIE) (refer to Appendix A) and the Australian Minister for the Environment (under the EPBC Act). It also includes consideration of the issues raised by the community and stakeholders during the development of the proposal.

Some aspects of the proposal design would continue to be refined as opportunities to improve the proposal design and construction methodology are further investigated. To achieve a level of flexibility while undertaking a rigorous level of impact assessment, the approach adopted for this EIS has been to assess a potential 'worst case' impact within the defined construction impact area. This area has been identified based on realistic project component locations and areas.

Most of the impact assessments (with the exception of biodiversity and heritage for the reasons outlined below) have conservatively assumed that any area could be impacted by the proposal within the whole of the construction impact area. This area would comprise the following elements:

- areas for construction of all proposal infrastructure elements including the proposed transmission line alignment, transmission line easement, substation site works (at both the proposed Dinawan 330kV and upgraded and expanded Wagga Wagga substations), optical repeater infrastructure, and other ancillary works

- locations for construction elements such as construction compounds and accommodation camps (including options for some sites at Balranald and Lockhart), access tracks (excluding public roads proposed to be used for access routes), site access points, water supply points, laydown and staging areas, concrete batching plants, brake/winch sites and site offices.

For biodiversity and heritage, more refined subset disturbance areas within the construction impact area have been assessed to provide a greater understanding of the likely magnitude of direct impacts expected from the proposal (within the broader construction impact area). This approach was adopted to avoid a 'worst case' approach that would result in substantial overestimation of the likely biodiversity and heritage impacts (for example, assuming the whole of the transmission line easement would be fully cleared of vegetation when this is known to not be the case), but to adopt as realistic an assessment as possible.

The final design would be reviewed for consistency with the assessment contained in this EIS, including any mitigation measures, and any conditions of approval. If design refinements are not consistent with any approval from the Minister for Planning and Public Spaces, approval would be sought from the Minister for any such modifications in accordance with the requirements of Division 5.2 of the EP&A Act.

What are the key findings of the EIS?

Table ES-1 provides a summary of the potential positive or negative impacts that may occur during construction and operation of the proposal.

Table ES-1 Summary of potential impacts of the proposal – EnergyConnect (NSW – Eastern Section)

Issue	Potential impacts
Biodiversity	The proposal would traverse a wide diversity of landscapes in varying degrees of disturbance. The western third of the alignment is dominated by semi-arid and largely naturally vegetated Mallee rangelands and riverine floodplains. The central portion of the alignment is generally occupied by native dominated and derived grasslands/ chenopod shrublands that have been largely altered by historical sheep grazing and cropping. While the eastern portion largely transverses the fertile soils and intensive agricultural/cropping areas with relatively minor intersection of remnant native vegetation in the form of roadside remnants and isolated fragmented patches. The assessment of biodiversity impacts considered a conservative estimate of the area subject to direct impacts. The proposal has been developed to date to avoid and minimise impacts to biodiversity values, and further opportunities to minimise impacts would be achieved as part of finalisation of the proposal design and construction methodology. However, based on the potential impacts within the identified disturbance area, the proposal would have the potential to result in the following impacts: • *direct impacts to native vegetation*: the proposal would impact up to around 1,550 hectares of native vegetation. Up to 200 hectares of this native vegetation would comprise various threatened ecological communities (TEC) listed under the (NSW) *Biodiversity Conservation Act 2016* (BC Act). However, much of this native vegetation has been subject to ongoing historical agricultural use, primarily for grazing. Therefore it is considered that, while the region is partially comprised of native vegetation, much of it is not considered to represent high quality undisturbed native vegetation or habitat

Issue	Potential impacts
	• *direct impacts to threatened ecological communities* including: - a total of six TECs listed under the BC Act, comprising up to 200 hectares. Two of the threatened ecological communities are listed as serious and irreversible impacts (SAIIs) - seven threatened ecological communities listed under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), including likely significant impacts to four of these ecological communities • *direct impacts to threatened flora species* including: - nine threatened flora species listed under the BC Act. Two of the threatened flora species are listed as SAIIs (Austral Pillwort and Thyme Rice-Flower) - four threatened flora species listed under the EPBC Act, including likely significant impacts to three of these species • *direct impacts to candidate threatened fauna species* including: - a total of six threatened fauna species listed under the BC Act - one of the threatened fauna species is listed as a SAII (Plains-wanderer) - four threatened fauna species listed under the EPBC Act, however no species are considered likely to be significantly impacted - four threatened fauna species which were also conservatively considered to be potentially indirectly impacted by line strike and electric and magnetic fields. The biodiversity assessment also found that: • indirect impacts are considered unlikely given the retention of certain vegetation within the easement • impacts to threatened aquatic species, ecological communities or their habitats are unlikely • impacts to groundwater dependant ecosystems are unlikely • impacts to wetlands of national or international importance are unlikely • the proposal would be unlikely to lead to a significant impact on any migratory birds (and their habitat) listed under the EPBC Act. To offset the residual impacts to biodiversity, biodiversity offsets would be required and would be met through the implementation of the following (or combination of): • the purchase and retirement of existing biodiversity credits • establishing biodiversity stewardship site(s) on lands with like for like biodiversity values to those impacted by the proposal • making a payment into the Biodiversity Conservation Fund • alternative strategic offset outcomes. Opportunities to further reduce impacts would be considered during finalisation of the proposal design and construction methodology. This would include aspects such as the selection of the final transmission tower structure locations.

Issue	Potential impacts
Aboriginal heritage	The proposal has the potential to directly and/or indirectly impact Aboriginal sites including: • four artefact-only sites of low significance and seven with moderate significance • four artefact and hearth sites with moderate significance • one artefact scatter, hearth and modified tree site with moderate to high significance • three earth mound and hearth sites with moderate significance • five hearth-only sites with moderate significance • 15 isolated finds with low significance and five with moderate significance • five isolated finds and hearth sites with moderate significance • one midden site with moderate significance • seven modified/scar tree sites with moderate significance. The proposal also has the potential to directly and/or indirectly Potential Archaeological Deposits (PADs) including: • 23 PADs through direct impact • 16 PADs through potential direct impact. The significance of the PADs would be confirmed as part of the ongoing test excavation process which is currently being conducted. Opportunities to avoid or minimise these impacts through siting of the towers and other project aspects (including construction work areas) would be explored during finalisation of the proposal design and construction methodology. Where impacts cannot be avoided, a range of mitigation and management measures would be implemented in consultation with Registered Aboriginal Parties (RAPs).
Historic heritage	The construction impact area (including the transmission line easement) would pass through the curtilage of the Yanga Pastoral Station Complex. However, the major historical elements of this site, including the homestead complex, would not be directly impacted by the proposal and would only have a minor impact on the heritage significance of the curtilage of this item. The sheep yards within the Willows Precinct (items not specifically listed on the Historic Heritage Information Management System) would also be located within the construction impact area (disturbance area A and B) and there would be an impact to the significance of the item as a result of the proposal. A previously unrecorded survey marker tree (assessed as having local significance value) was also found within the construction impact area during the field survey work and may be directly impacted by the vegetation clearance requirements within the disturbance area. Impacts to this item would be confirmed during as part of the finalisation of the proposal design. Two other heritage items have been identified as within the construction impact area for the proposal. These include the Bundure Railway Station artefact scatter and Hut site (located towards the outer edge of the construction impact area) and the Nyingay pastoral holding (the final location of which is yet to be confirmed following proposed future survey of this property). Impacts to these items would be confirmed during as part of the finalisation of the proposal design and may include a requirement to provide exclusion fencing to avoid potential impacts.

Issue	Potential impacts
Land use and property	**Construction** Construction of the proposal would require the acquisition and/or temporary leasing of land. This may temporarily disrupt (primarily) agricultural land uses within and surrounding the transmission line easement. However, the disruptions would generally be temporary and of a relatively short duration due to the progressive nature of construction (noting that some access tracks across some properties would be used to access multiple works sites and would therefore be utilised for slightly longer periods. The acquisition of any interest in land would be acquired by private treaty or, if required, compulsory process under the *Land Acquisition (Just terms Compensation) Act 1991*. It is possible that some movement of livestock along travelling stock reserves or public roads may be affected temporarily as a result of restricted access through construction areas. However, these restrictions would be of a short duration and the proposal is not expected to significantly prevent or hinder livestock movements. **Operation** Operation of the proposal would result in permanent land use changes due to the new transmission line (including the towers, conductors and easements), proposed Dinawan 330kV substation, optical repeater sites and access tracks (where they are proposed to be retained beyond construction). The easement for the new transmission line may restrict certain agricultural activities and/or require different farming methodologies to be adopted. However, the overall impact on existing agricultural activities is expected to be relatively minor, particularly as grazing and other agricultural activities would typically be able to continue within the easements. Additionally, there are biosecurity risks that animal diseases, plant diseases, feral pests and (especially) weeds that could be introduced or spread during the construction and operation of the proposal through vehicle, machinery or personnel movements. Mitigation measures have been identified to manage these risks.
Landscape character and visual amenity	**Landscape character impacts** For a proposal of this length and scale, the visual landscape character impacts are considered to be relatively low and would have a relatively small influence. Any visual impacts would be low, low-moderate or moderate visual impacts, due to the relatively small area of direct impact from each proposed tower. There is also a substantial portion of the alignment which would be co-located parallel to existing transmission infrastructure. Towers would however be visible across typically flat and open landscapes. The view from The Rock nature reserve was the only significant vista identified along the proposal and no mapped scenic views were identified. It is expected that there would be no overall visual impact in the view from this vista. Impacts associated with the proposed Dinawan 330kV substation and the expansion and upgrade of the Wagga Wagga substation are expected to be generally limited to the construction phase. **Impacts to public viewpoints** High-moderate impacts to views within the vicinity of Urana-Lockhart Road would occur due to the construction of the new transmission lines through the areas such as Cullivel Sate Forest and Brookong State Forest and the need to create cleared vegetation corridors through these areas.

Issue	Potential impacts
	Impacts to private viewpoints The visual impacts to views from private property would depend on the final distance between the transmission line towers and the residences, the visibility of the infrastructure from the residence and the presence of any intervening vegetation. There would be mainly low potential for visual impacts in areas associated with the western end of the proposal where there are fewer private dwellings, and visual compatibility with existing transmission line infrastructure. Further towards the eastern end of the proposal (typically east of the township of Lockhart) there would be the potential for higher visual impacts (pre-mitigation) due to the closer proximity of the proposal, increase number of residential properties and limited vegetation cover along this section of the alignment. Overall, the proposal is anticipated to result in a (pre-mitigation) impact on several properties where there is the potential for a moderate (73 properties), high (36 properties) or very high (1 properties) visual impact. For residences where there is a higher potential visual impact mitigation measures would be considered in consultation with landholders. These measures may include providing screening vegetation on the impacted property. Such measures would be expected to reduce the extent of potential visual impact. **Night time impacts** Night time impacts during operation would be negligible as there is no lighting proposed along the transmission line easement. While some security lighting would occur at the proposed Dinawan 330kV substation, there would be a large distance to sensitive receivers from this location, minimising potential impacts. Lighting proposed at the Wagga Wagga substation expansion would be in character with the existing substation.
Social	A range of social impacts, both positive and adverse, are anticipated as a result of the proposed construction and operation of the proposal. **Construction** Potential positive social effect associated with the construction of the proposal would include: • opportunities for local and regional procurement of services and employment during construction (including opportunities with local Aboriginal communities), which has the ability to benefit the wider community • access to employment and training opportunities • economic benefit to landholders from easement compensation. Potential adverse social impacts associated with the construction of the proposal would include: • construction related amenity impacts for residential properties • potential short-term impacts to journey travel times due to increased construction traffic movements • increased demand for private rental properties, in particular within Wagga Wagga • potential to result in changes to the environment and sites of cultural heritage significance. Overall, the proposal would temporarily increase the population and change the composition of a number of the local communities along the alignment due to the incoming construction workforce (towns such as Buronga, Balranald, Hay, Lockhart and Wagga Wagga).

Issue	Potential impacts
	Operation Potential positive social effect associated with the operation of the proposal would include: • increased development occurring across the region and associated employment opportunities • the Community Partnership Program has the potential to improve the financial viability of local community services and facilities. Potential negative social impacts associated with the operation of the proposal would include: • operation related amenity impacts • perceived health impacts associated with electric and magnetic fields • the perceived risk of bushfires associated with electricity infrastructure • visual impacts for some residential properties • restriction or alteration of how some landholders manage their property. Overall, the operation of the proposal is expected to facilitate enhanced security and reliability of the energy supply with associated social and economic benefits to consumers at the State level across NSW, SA and Victoria. Transgrid would continue to work with local landholders to address potential negative social impacts through the implementation of mitigation measures.
Economic	The main economic effect for NSW would relates to its contribution to the provision of secure and reliable electricity in the near term, while facilitating the longer-term transition across the NEM to low-emission energy sources. The new interconnector is expected to deliver net market benefits of around $900 million over 21 years (in present value terms). The total economic impact of the (non-wage) expenditure in the regional economy during the first full year of construction is estimated at up to: • $159 million in annual direct and indirect regional output • $70 million in annual direct and indirect value-add • $36 million in annual direct and indirect income • 571 direct and indirect jobs. The flow-on economic impact of the incremental wage spending ($3.9 million) of the estimated 100 local people directly employed during year 1 (a full year) of construction is estimated at up to: • $3 million in annual direct and indirect regional output • $2 million in annual direct and indirect value-add • $1 million in annual direct and indirect income • 17 direct and indirect jobs. The remaining period of construction (6-months) would provide half the above level of regional economic activity.

Issue	Potential impacts
Hydrology, flooding and water quality	**Construction** During construction, the proposal has the potential to result in minor localised impacts including changes in water flows due to the temporary works changing local runoff behaviour and increased sediment load from construction area runoff. **Operation** During operation, the proposal is not expected to result in notable changes to flood levels, depths or velocities. An increase in impervious surfaces at the proposed new Dinawan 330kV substation and the upgraded and expanded Wagga Wagga substation may result in minor increases in pollutant loads at these two sites, however potential water quality impacts would be minimised by appropriately designed drainage systems.
Air quality	**Construction** Construction of the proposal may result in temporary minor dust and gaseous emissions from construction activities such as earthworks, physical construction works, operation of plant and equipment and movement of vehicles (in particular on unsealed roads). Construction vehicles travelling on haulage routes have the potential to generate dust that may have an amenity impact on nearby sensitive receivers. Dust generated from construction vehicles (particularly on unsealed roads) has the potential to result in high amenity impacts particularly under certain conditions (dry surface roads and high winds). However, these impacts would be intermittent, of typically short duration and would likely only impact a small number of receivers at any one given time. These impacts are expected to be generally localised and are not anticipated to significantly influence local air quality. **Operation** During normal operations, no air emissions would be generated from the operation of transmission lines or the proposed Dinawan 330kV substation (or upgraded and expanded substation at Wagga Wagga). Operational activities would be infrequent, and the number of vehicles required during this period would be small.
Noise and vibration	**Construction** *Transmission lines* Transmission line construction activities would be undertaken progressively along the proposal alignment and be undertaken in work stages with only short durations of activities at each transmission line tower worksite. This would include periods of no activity (i.e. respite periods) between each stage of work. A such, impacts would not occur to receivers throughout the full duration of construction program. Worst-case noise impacts are expected during the access and clearing works (due to the typical equipment used during such as chainsaws) during which up to: • 166 receivers (including one non-residential receiver) are predicted to exceed the standard hours noise management level (NML) • 745 residential receivers are predicted to exceed the day time out of hours NMLs (if works outside of standard hours are required) • 1,633 residential receivers are predicted to exceed the evening/night NMLs (if works outside of standard hours are required).

Issue	Potential impacts
	The predicted exceedances are based on conservative assumptions to understand the potential 'worst case' impacts, and in reality, these 'worst case' assumptions are unlikely to occur. The typical noise levels experienced during construction would be below these predicted noise levels and each receiver would only be affected for a short duration of typically less than one week periods. *Main construction compounds and accommodation camps* Exceedances of construction NMLs are predicted at all but three of the main construction compounds and/or accommodation camp sites (being Buronga, Balranald and Dinawan). These exceedances would typically only occur during the site establishment and decommissioning phases (which would occur over periods of around six weeks), but would exceed NMLs at some receivers by more than 20 dB during and outside standard construction hours. During the operation of these sites, exceedances of the NMLs are only predicted at Lockhart (both options) and at Wagga Wagga during and outside standard construction hours. The operation of the construction compound components would however be limited to the period 7 am to 7 pm, seven days a week. This would limit the maximum predicted noise levels during these more sensitive times. *Dinawan 330kV substation and Wagga Wagga upgrade and expansion works* Works at the proposed Dinawan 330kV substation site would not exceed NMLs at sensitive receivers. Works during the upgrade and expansion of the Wagga Wagga substation would result in exceedances of NMLs at a large number of sensitive receivers, particularly when works occur outside standard construction hours. However, most works would generally be conducted between 7 am and 7 pm. This would limit potential amenity impacts during more sensitive times. *Vibration* No vibration impacts are expected for receivers outside of the transmission line corridor as they would be located beyond the minimum working distances for potential vibration impacts, with the exception of one receiver at Cullivel. At this location, human comfort criteria may be exceeded during access and clearing, earthworks and civil construction works, and final completion stages of construction. The risk of vibration impacts would be minimised through refinement of the construction methodology. No vibration related impacts are anticipated as a result of construction works at the proposed new and upgraded substations or activities at the main construction compounds and accommodation camps. *Traffic noise* An extensive network or roads is proposed to be used to enable the construction of the proposal along its full length between Buronga and Wagga Wagga. Road traffic noise levels would increase by more than 2 dB at around 15,000 properties (due to the relative increase in traffic volumes on these roads due to low existing based volume). Road traffic noise levels would however only exceed the noise criteria at an estimated 16 properties. These roads would also only be used intermittently for a temporary period of up to around six months. Construction traffic noise impacts are presented as the worst-case scenario. Typical noise levels are likely to be lower than those predicted exceedances. Typical noise impacts would also be intermittent throughout the construction program.

Issue	Potential impacts
	Managing residual construction noise impacts The final construction strategy for the proposal would aim to minimise construction noise and vibration impacts through refinement of the methodology and construction locations, where possible. Monitoring would be carried out at some stages during construction to confirm the effectiveness of the noise and vibration mitigation measures implemented. **Operation** *Transmission lines* During operation, the transmission lines may generate audible noise associated with accumulation of pollution and/or water droplets on the conductor surface of the transmission lines, which can result in corona discharge noise. This corona discharge noise is more prominent during wet weather (rain, mist or fog) and often sounds like a 'crackling noise'. These wet weather conditions are predicted to occur for between 20 and 40 per cent of the days throughout a typical year, noting that these conditions can occur for only short durations on these days. In fair weather conditions, no sensitive receivers are expected to experience audible noise above the adopted criteria. Up to 23 receivers have been identified as potentially exceeding operational criteria as a result of coronal noise under the worst case operating scenario (pre-mitigation). Furthermore, the majority of these receivers (12) are predicted to only experience a negligible significance level noise impact. Three receivers are predicted to experience a moderate significance impact level and two a potential significant level significance impact. Impacts at all of these receivers are expected to be able to be mitigated to acceptable levels with at receiver treatments implemented (which would be determined in consultation with landholders once the transmission line is operational and noise impact able to be confirmed). *Dinawan and Wagga Wagga substations* Operational noise impacts associated with the proposed Dinawan 330kV substation, Wagga Wagga substation and general ongoing maintenance of the proposal are predicted to comply with relevant noise limits at the nearest sensitive receivers.
Traffic and access	**Construction** An extensive network of roads is proposed to be used to enable the construction of the proposal with roads identified for either primary haulage routes, secondary haulage routes and/or water supply routes. During construction peaks, there would typically be a low overall increase in peak hourly traffic. The median total traffic increase would be around 22 vehicles per hour in one direction and around 90 per cent of the haulage roads would have a total traffic increase of up to around 56 vehicles per hour in one direction (equating to less than one additional vehicle per minute during these peak periods). For all roads assessed, levels of service would continue to perform at good levels of operation. Overall, the proposal would not adversely affect the road capacity performance of any haulage routes. The construction of the proposal is not expected to have any noticeable impacts on other traffic and access elements such as active transport, public transport or property access. Where required to deliver large proposal components (such as substation equipment) haulage routes for oversized and overmass vehicles would be necessary. The use of oversize and overmass vehicles would be planned to minimise the impact to the surrounding road network.

Issue	Potential impacts
	Construction heavy vehicle movements are likely to have minor impact to the condition of the existing sealed road network due to the increase in use of these roads. For unsealed roads, construction traffic is likely to have some impact on existing road condition. Impacts are expected to roads such as Spraydon Road and Urana Road due to the volume of proposed heavy vehicle traffic. The construction contractor would work with asset owners and local councils to make sure unsealed roads remain fit for purpose during, and at the completion of, the construction period. **Operation** Traffic generation by the proposal during the maintenance phase would be minimal and infrequent. Due to the low level of additional light vehicle traffic generated over the operational and maintenance phase, impacts during this period are expected to be negligible.
Hazards and risks	Hazards and risks during construction and operation of the proposal may include: • use and storage of hazardous materials and chemicals • construction or maintenance activities close to active electrical infrastructure • the risk of bushfire to or caused by the proposal • electric and magnetic fields surrounding electrical infrastructure • potential radio frequency interference to certain electrical equipment or GPS navigation systems used for remote farming operations. These risks are considered to be manageable through ongoing design of the proposal and/or standard mitigation and management measures.
Soil, contamination and groundwater	The proposal may result in some soil erosion or compaction from construction or maintenance activities as well as localised contamination from leaks and spills. These impacts are considered to be manageable through standard mitigation and management measures. Potential impacts to groundwater due to construction may occur where the depth of excavations for transmission towers intersect the level of groundwater, and dewatering is required. Additionally, if blasting is required to be undertaken (for areas of hard rock), this activity has the potential to fracture the surrounding rock which may increase groundwater connectivity and could potentially alter local groundwater flow paths. However, any dewatering would be limited to discrete locations, temporary and managed to minimise impacts to groundwater levels.
Waste management and resource use	During construction, the proposal would generate waste and require use of common resources, including about 1.1 gigalitres of water that would be sourced from existing water infrastructure. Impacts associated with waste and resource use are considered to be manageable through standard mitigation and management measures. Minimal operational waste or resource impacts are anticipated during the operation of the proposal.

Issue	Potential impacts
Cumulative impacts	Overall, there is the potential for cumulative impacts between the current proposal and other projects that may be constructed (or operate) in the broader region at the same or similar times. These impacts would generally occur during construction and would typically relate to amenity-type impacts. Cumulative impacts with other major projects in the vicinity of the proposal would primarily include: • cumulative social impacts (such as an overall increase in worker population across the region which may put increased strain on existing regional resources, facilities and accommodation) • traffic and transport (including increase overall traffic on local and regional roads) • noise and vibration impacts (due to increased overall levels of construction, in particular where projects are geographically close to each other). The interface of construction activities between identified projects and the proposal are considered to be generally low and readily manageable. The key potential cumulative impacts that may occur during combined construction and operation would be broader regional impacts associated with biodiversity and Aboriginal heritage. A biodiversity offsets strategy would identify opportunities for offsetting the potential biodiversity impacts of the proposal within the broader region. Where direct impacts to Aboriginal heritage sites cannot be avoided during design and construction methodology refinement, mitigation measures would be implemented to minimise the potential impacts on Aboriginal heritage. This would include surface salvage of artefacts or a program of salvage excavations. No substantial operational cumulative impacts are expected between the proposal and the other identified projects within the vicinity of the proposal.

Further information regarding the potential range of environmental impacts is presented in Part C (Chapter 9 to Chapter 23) of this EIS.

How would the impacts be managed?

The approach to environmental management for the proposal would be consistent with:

- the environmental management system (EMS) of the construction contractor and Transgrid during operation respectively
- measures to avoid and minimise impacts that have been incorporated into the corridor selection and proposal design
- construction and operational environmental management, as described in the following sections. This will be consistent with Transgrid's *HSE Handbook* (Transgrid, 2020) as relevant, which provides the minimum environmental controls for all construction and maintenance works on the Transgrid network.
- mitigation measures – the measures are identified as an outcome of this environmental impact assessment.

Further discussion regarding the environmental management of the proposal is provided in Chapter 24 of this EIS.

Justification and conclusion

The proposal is a critical component in delivering long term benefits to the SA and NSW electricity consumers, providing security to the NEM and facilitating the transition to a lower carbon emissions future.

The proposal has been designed to date, to the greatest extent possible, to avoid and minimise impacts, and to respond to the issues raised by the community and stakeholders. The finalisation of the design and construction methodology for the proposal would be further developed with the objective of further avoiding and minimising potential impacts on the local and regional environment, and the local community.

Although many impacts would be avoided and/or minimised through design, some residual impacts would remain. These would be addressed through the implementation of the proposed mitigation measures, and the potential residual impacts are considered manageable and/or would be offset.

Next steps

Transgrid is seeking approval from the NSW Minister for Planning and Public Spaces, and the Australian Minister for the Environment for the construction and operation of the proposal. Subsequent steps in the process include:

- exhibition of the Environmental Impact Statement for a minimum of 28 days and invitation for the community and stakeholders to make submissions
- consideration of submissions. Submissions received by the Secretary of the Department of Planning, Industry and Environment would be provided to Transgrid who may then be required to prepare and submit:
  - a submissions report, responding to issues raised in the submissions
  - a preferred infrastructure report and/or an amendment report, outlining any proposed changes to the proposal to minimise its environmental impacts or to deal with any other issues raised during the assessment of this application
- determination of the proposal by the NSW Minister for Planning and Public Spaces including, if approved, any conditions of approval
- determination of the proposal by the Australian Minister for the Environment including, if approved, any conditions of approval.

Consultation with the community and stakeholders would continue throughout the finalisation of the proposal design and construction phases.

Any person wishing to make a submission should use the online form if possible. To find the online form go to the web-page for the proposal via www.planningportal.nsw.gov.au/major-projects/projects/on-exhibition.

Part A – Introduction and need

1. Introduction

This chapter provides an overview and background to EnergyConnect, and specifically the NSW – Eastern Section of EnergyConnect (the proposal). This chapter provides a summary of the proposal details, including the objectives for EnergyConnect (including the proposal). The chapter also outlines the purpose and structure of this Environmental Impact Statement (EIS) and the key report terminology.

1.1. EnergyConnect

Transgrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect aims to reduce the cost of providing secure and reliable electricity transmission between NSW and SA in the near term, while facilitating the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy sources.

EnergyConnect has been identified as a priority transmission project in the NSW Transmission Infrastructure Strategy (NSW Department of Planning and Environment (DPE), 2018), linking the SA and NSW energy markets and would assist in transporting energy from the South-West Renewable Energy Zone to major demand centres.

EnergyConnect comprises of several sections (shown on Figure 1-1) that would be subject to separate environmental planning approvals under the relevant jurisdictions. It includes:

- NSW sections including:
  - Western Section, which would extend from:
    - the SA/NSW border (near Chowilla in SA) to Transgrid's existing Buronga substation
    - Buronga substation to the NSW/Victoria border at Monak (near Red Cliffs in Victoria)
  - Eastern Section, which would extend from the Buronga substation to the existing Wagga Wagga substation (including the proposed Dinawan 330kV substation)
- a Victorian Section, which would extend from the NSW/Victoria border to Red Cliffs substation
- a SA Section, which would extend from Robertstown to the SA/NSW border.

Transgrid is currently seeking planning approval for the NSW – Eastern Section (the proposal), which is the subject of this EIS. Transgrid has received separate environmental planning approvals for the NSW – Western Section of EnergyConnect and the Victorian Section. ElectraNet is responsible for obtaining environmental planning approval for the section of EnergyConnect located in SA.

1.1.1. Proposal objectives

The primary objective for EnergyConnect (comprising the Eastern and Western sections) is to reduce the cost of electricity by providing secure electricity transmission between NSW and SA in the near term and facilitate the longer-term transition of the energy sector across the NEM to low emission energy generation sources.

More specifically, EnergyConnect (including the proposal) aims to:

- lower power prices
- improve energy security
- increase economic activity
- support the transition to a lower carbon emission energy system
- support a greater mix of renewable energy in the NEM.

Figure 1-1 Overview of EnergyConnect

1.2. Proposal overview

1.2.1. Key features of the proposal

The key components of the proposal include:

- about 375 kilometres of new 330kV double circuit transmission line and associated infrastructure between the Buronga substation and the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the existing Buronga substation
- construction of a new 330kV substation around 30 kilometres south of Coleambally, referred to as the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the proposed Dinawan 330kV substation
- about 162 kilometres of new 500kV double circuit transmission line and associated infrastructure between the proposed Dinawan 330kV substation and the existing Wagga Wagga substation at Wagga Wagga, NSW
- upgrade and expansion of the Wagga Wagga substation to accommodate the new transmission line connections including the installation of new line bays, relocation and upgrade of existing bays and associated electrical and civil works (road, kerb, gutter, drainage works and earthworks)
- provision of three optical repeater structures and associated connections to existing local electrical supplies
- new/and or upgrade of access tracks as required
- ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

An overview of the proposal is provided in Figure 1-2. Further detail on the key infrastructure components of the proposal and construction activities are provided in Chapter 5 and Chapter 6 respectively.
A consolidated set of plans providing details on the key infrastructure components of the proposal and construction locations is also provided in Appendix F.

The proposal alignment has been designed to maximise the route running parallel to existing transmission lines as far as possible in consideration of other constraints and operational requirements. The proposed alignment of the proposal easement would be parallel to existing lines for around 407 kilometres of the full approximately 537 kilometre-long route (refer Figure 1-3).

The proposal would be located across a number of local government area (LGAs) which consist of the following: Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart and Wagga Wagga LGAs.

1.3. The proponent

The proposal would be carried out by NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as Transgrid). Transgrid is the operator and manager of the main high voltage transmission network in NSW and the Australian Capital Territory (ACT) and is the Authorised Network Operator for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.

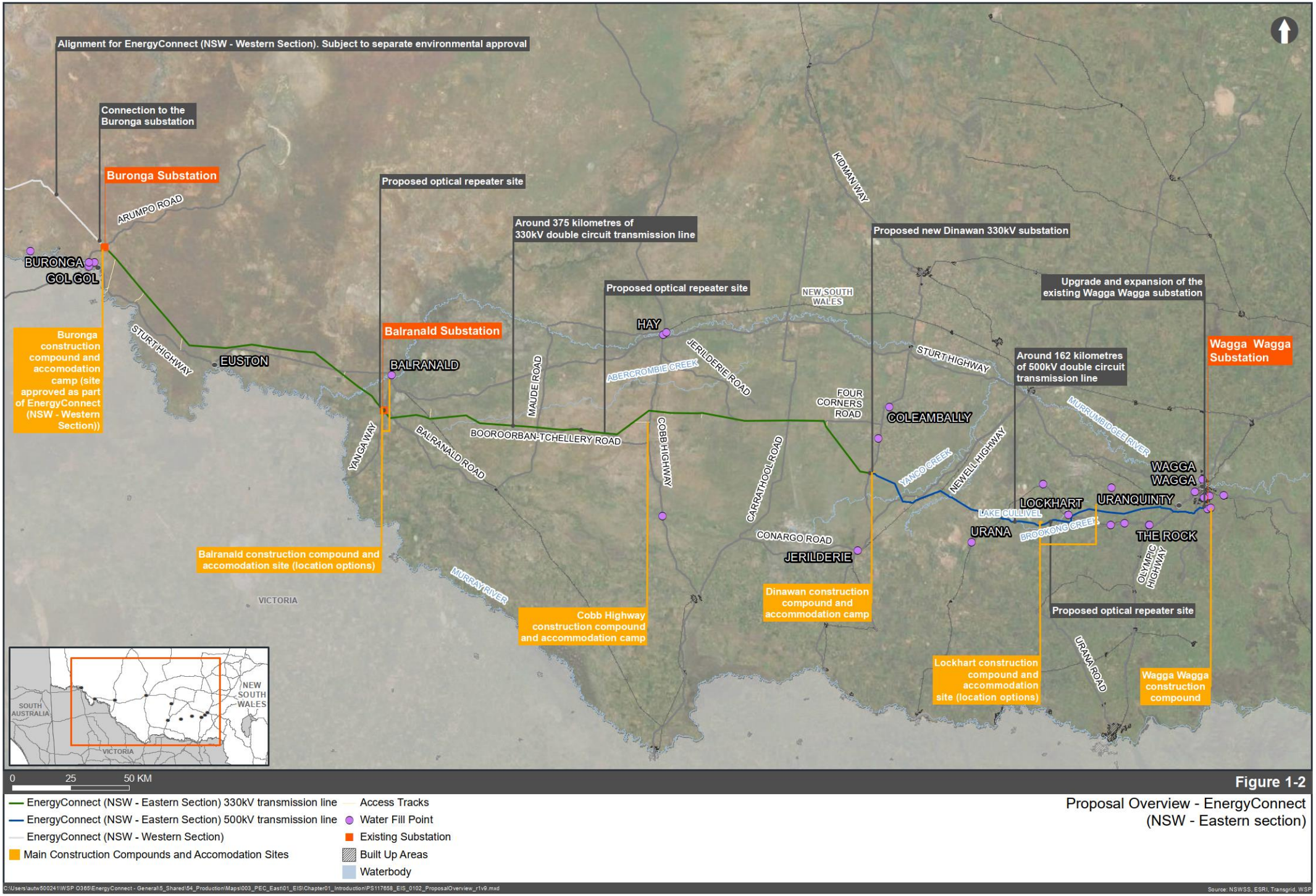

Figure 1-2

Proposal Overview - EnergyConnect (NSW - Eastern section)

Figure 1-3

Proposal Alignment and Existing Transmission Lines Arrangements - EnergyConnect (NSW – Eastern Section)

- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Greenfield)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Greenfield)
- EnergyConnect (NSW - Western Section)
- Main Construction Compounds and Accomodation Sites
- Water Fill Point
- Existing Substation
- Built Up Areas
- Waterbody
- Existing Transmission Line

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Source: NSWSS, ESRI, Transgrid, WSP

1.4. Planning and statutory requirements

1.4.1. Commonwealth approval requirements

A referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was submitted on 25 August 2020. The Australian Department of Agriculture, Water and the Environment (DAWE) determined the proposal to be a controlled action on 30 September 2020 and will be assessed using the bilateral assessment process with this EIS addressing the Commonwealth's assessment requirements for the purposes of the bilateral agreement. The Secretary environmental assessment requirements (SEARs) that were issued on 2 October 2020 included the relevant Commonwealth requirements under the bilateral assessment process.

1.4.2. NSW planning requirements

The applicable planning approvals process for the proposal is summarised in Figure 1-4. The NSW Minister for Planning and Public Spaces, by Ministerial Order, declared the NSW portions of EnergyConnect to be State Significant Infrastructure (SSI) and Critical State Significant Infrastructure (CSSI) under Schedule 5, Clause 15 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). As CSSI, the proposal requires approval from the NSW Minister for Planning and Public Spaces under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The SEARs for the proposal were issued on 2 October 2020 (refer to Appendix A). This EIS has been prepared to address the SEARs and the requirements of Schedule 2, Part 3 of the (NSW) Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) (refer to Appendix B).

The proposal may also require the following approval under other NSW legislation:

- a road occupancy licence under the *Roads Act 1993* where works are carried out on classified roads
- an environmental protection licence for the proposed screening activities at the earthwork material site
- granting of an easement to Transgrid for a transmission line for areas of land reserved under the *National Parks and Wildlife Act 1974* (NP&W Act).

The proposal would be constructed and operated in accordance with the mitigation measures proposed in this EIS, any submissions report and/or preferred infrastructure report/amendment report (if required), and the conditions of approval.

Further detail regarding the approval requirements and statutory planning requirements is provided in Appendix C.

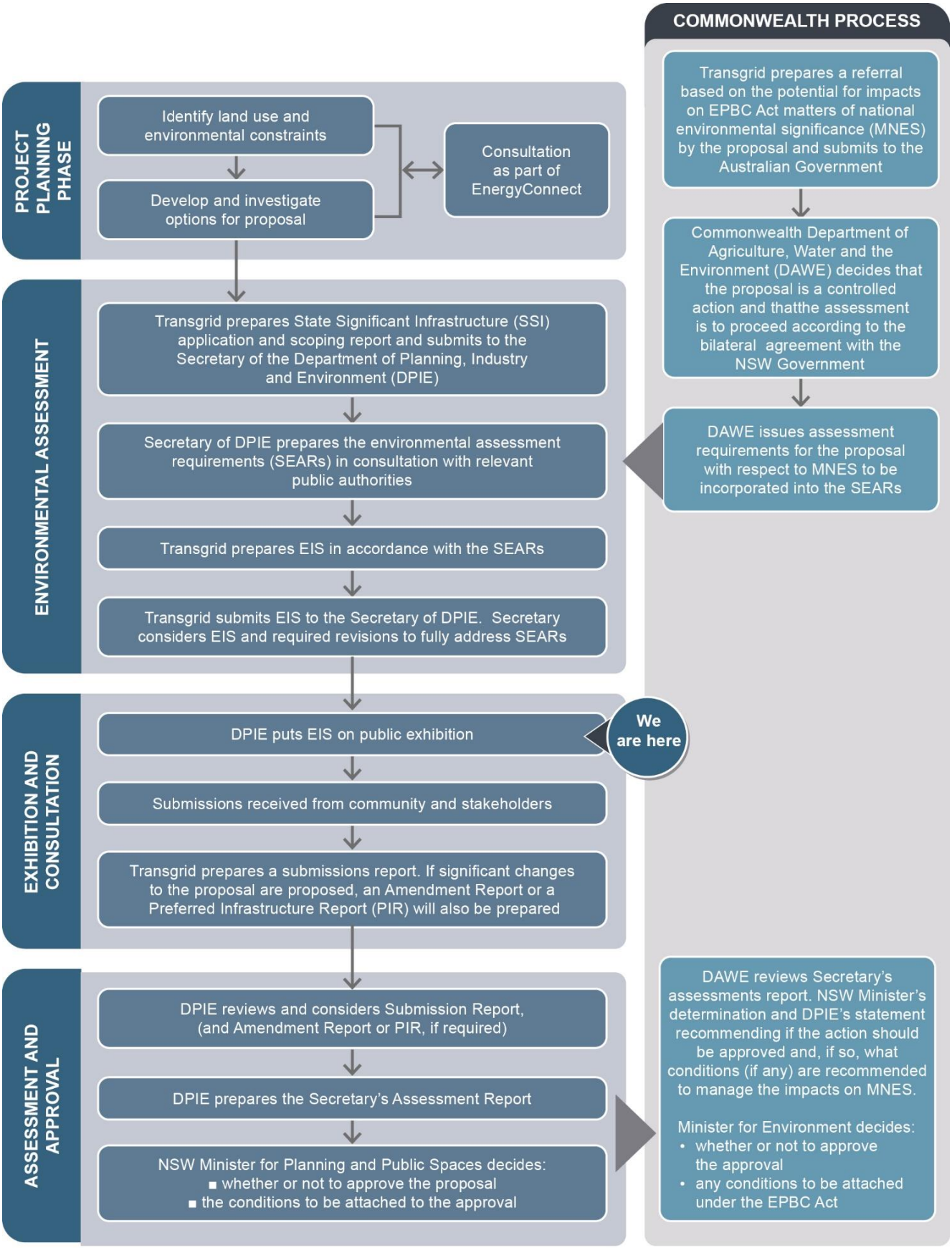


Figure 1-4 EnergyConnect planning approval process

1.5. Structure of this EIS

The main EIS (Volume 1) is structured in four main parts:

- Part A – Introduction and need:
  - an introduction to the EIS (Chapter 1)
  - an overview of the strategic context and need (Chapter 2)
- Part B – The proposal and its development:
  - the approach to design development, options assessment and corridor refinement (Chapter 3)
  - a brief overview of the proposal setting (Chapter 4)
  - a description of the key proposal components and operation (Chapter 5)
  - a description of the proposed construction methodology (Chapter 6)
  - a summary of the consultation that has occurred and is proposed in future project stages (Chapter 7)
- Part C – Environmental impact assessment:
  - an overview of the approach to the impact assessment undertaken for this EIS (Chapter 8)
  - the results of the assessment of the potential impacts of the proposal (Chapters 9 to 23)
- Part D – Management and conclusions:
  - an overview of the proposed environmental management approach and mitigation measures (Chapter 24)
  - justification and conclusion (Chapter 25)
  - list of references used in preparation of the EIS (Chapter 26).

Appendices to this report include:

- Appendix A – Secretary environmental assessment requirements cross-reference
- Appendix B – Environmental Planning and Assessment Regulation 2000 checklist
- Appendix C – Statutory planning assessment
- Appendix D – Consultation outcomes report
- Appendix E – Summary mitigation measures.

Technical papers include:

- Technical paper 1 – Biodiversity development assessment report
- Technical paper 2 – Aboriginal cultural heritage assessment
- Technical paper 3 – Historic heritage impact assessment
- Technical paper 4 – Agricultural land impact assessment
- Technical paper 5 – Visual and landscape character impact assessment
- Technical paper 6 – Social impact assessment
- Technical paper 7 – Economic impact assessment
- Technical paper 8 – Hydrology, flooding and water quality
- Technical paper 9 – Air quality impact assessment
- Technical paper 10 – Noise and vibration impact assessment
- Technical paper 11 – Traffic and transport impact assessment
- Technical paper 12 – Bushfire impact assessment
- Technical paper 13 – Electric and magnetic field study
- Technical paper 14 – Phase 1 contamination assessment
- Technical paper 15 – Groundwater impact assessment.

2. Strategic context and need

This chapter considers the context of the Australian energy environment, and the need to develop infrastructure to respond to the changing environment. This includes the development of the EnergyConnect proposal to enable a greater mix of renewable energy generators to connect into the network and increasing reliability and confidence in electricity supply.

This chapter also presents the strategic options that were considered to address these challenges, leading to the selection of the whole EnergyConnect project. It also discusses the need for and benefits of EnergyConnect. The proposal is also assessed in the context of key government strategies and policies including the 2020 ISP, *NSW Transmission Infrastructure Strategy* (2018) and *State Infrastructure Strategy* (Infrastructure NSW, 2018).

2.1. Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to strategic context and need, and where these requirements are addressed in this EIS are outlined in Table 2-1.

Table 2-1 Secretary's environmental assessment requirements – Strategic context and need

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
General requirements	The EIS must include:	
	• a summary of the background to the project, including alternatives that were considered to the project	This chapter provides a summary of the background to the proposal in context of its strategic need and implications of not proceeding with the proposal. Chapter 3 (Proposal design development) provides an overview of strategic options and alternatives that were considered to the project.
	• the relevant strategic context for the project, having regard to: - State legislation, policies and guidelines including current initiatives to improve energy security and reliability in the National Electricity Market	This chapter provides the strategic context of the proposal including consideration of relevant State and Commonwealth legislation, policies and guidelines. Further discussion regarding the legislation applicable to the proposal is provided in Appendix C.
	- any other existing, approved or proposed projects that could result in cumulative impacts with the project.	Cumulative impacts are considered in Chapter 23 (Cumulative impacts).

2.2. Why the proposal needed

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. At the same time, consumers are demanding lower power bills and more secure and reliable service. EnergyConnect will deliver the infrastructure required to support this transition by connecting the energy grids of NSW, SA and Victoria. These connections will expand the wholesale electricity market across the three states, meaning increased reliability and security of electricity supply and lower power bills.

Several factors are driving the evolution of the energy market to low-emission renewable energy, including:

- access to new generation sources as coal-fired plants close
- government commitments to reduce carbon emissions
- the potential for renewable generation to lower energy prices
- demand for a more reliable energy supply.

EnergyConnect is one of Australia's largest energy infrastructure projects and a key element of the Australian Energy Market Operator (AEMO) *2020 Integrated System Plan* (2020 ISP). The following sections provide greater detail as to the need for the proposal.

2.2.1. Need for emissions reduction

Climate change, which is linked to an increased level of greenhouse gas emissions in the atmosphere, is having worldwide impacts on society, the economy and the environment. To try and minimise the future impacts of climate change, 195 countries including Australia agreed on the United Nations Paris Agreement on climate change in December 2015 (the Paris Agreement).

This includes a global commitment to achieve net-zero greenhouse gas emissions by the second half of this century. The Australian Government has ratified the Paris Agreement and has set interim emission reduction targets, including a commitment to reduce emissions by 26 to 28 per cent below 2005 levels by 2030. Independently, every state and territory in Australia has set a goal or target to achieve net zero emissions by 2050. The Australian Government has also recently announced a target of net zero emissions by 2050 and reaffirmed interim targets to reduce emissions by between 26 and 28 per cent below 2005 levels by 2030. Preceding this, every state and territory in Australia has set a target to achieve net zero emissions by 2050.

Electricity is Australia’s largest source of emissions, accounting for around 33 per cent of Australia’s total annual emissions (Department of Industry, Science Energy and Resources, March 2021). The NEM connects the southern and eastern states and territories in Australia and delivers around 80 per cent of Australia’s electricity consumption. As such, to meet Australia’s emission reduction targets, the NEM needs to significantly transition from traditional energy sources to lower emission alternatives including renewable energy (ElectraNet, 2019a). As an owner of an electrical distribution network, Transgrid is able to facilitate the transition from traditional energy sources to lower emission alternatives, including renewable energy, through the delivery of projects such as EnergyConnect.

2.2.2. Shift towards renewable energy

The NEM is currently transitioning from a system dominated by coal-fired generation to one of diverse renewable and distributed energy generation, supported by energy storage and network solutions. To date, the pace of development in new renewable and distributed energy generation has been even faster than anticipated in the *2018 Integrated System Plan* (2018 ISP) and is predicted to continue transitioning over the next two decades (AEMO, 2020).

The 2020 ISP (AEMO, 2020) estimates that over 26 gigawatts of new grid-scale renewables is needed to replace the approximately 15 gigawatts, or 63 per cent, of Australia's coal-fired generation that will reach the end of its technical life and so likely retire by 2040. The retirement of coal generation is expected to be most rapid in NSW, with Mount Piper expected to be the sole remaining coal fired generator in NSW after the expected closure of the Eraring and Bayswater power stations by 2035. This has the potential to put pressure on the future supply of energy, particularly when considering that electricity consumption in NSW has increased consistently in recent years and is forecast to continue to increase over the next ten years (Transgrid, 2018). As such, the NEM needs to identify and connect to new low emission energy generation sources to continue to have enough energy to meet future demand, while meeting Australia's carbon emissions policy commitments (ElectraNet, 2019a).

The Clean Energy Council estimated that as of April 2020, there were 93 renewable energy projects in construction or due to start construction soon in Australia, which would generate around 10,999 megawatts (MW) of new renewable energy capacity (Clean Energy Council, 2020).

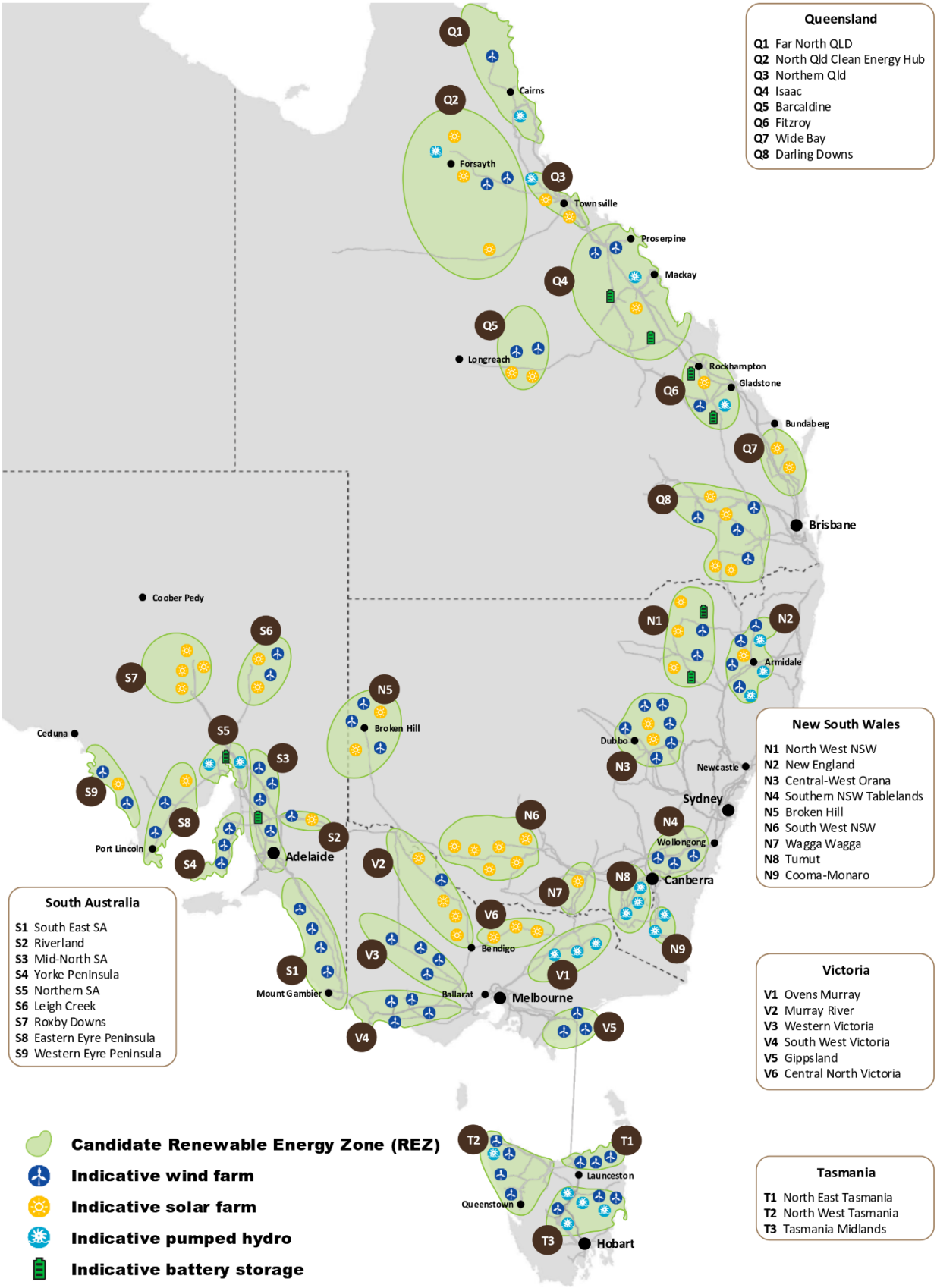
The development of EnergyConnect will provide a key electricity distribution connection within western NSW option to encourage future renewable energy providers to invest in lower emission electrical generation alternatives within this region.

2.2.3. Challenges for the National Energy Market

Current interest in new energy generation projects in the NEM exceeds the existing transmission network capacity in several locations, meaning that not all projects would be viable. The existing network is estimated to have a connection capacity of 13 gigawatts in areas with favourable renewable resources, which is significantly less than the 26 gigawatts (or more) of new grid-scale renewables required by 2040 (AEMO, 2020). For example, Transgrid has identified that the existing transmission network outside the Sydney – Wollongong – Newcastle – Hunter Valley area will reach its existing capacity to connect renewable generation in 2020 (NSW Government, 2018). In addition, although SA has among the most abundant and high-quality renewable energy resources in Australia, total renewable energy resources in SA exceed its combined minimum demand and export capability.

In response, several Renewable Energy Zones (REZs) have been identified across the NEM (refer to Figure 2-1), which are areas of high energy resource potential where strategic transmission infrastructure upgrades can connect multiple projects at lower cost (AEMO, 2020). However, the transmission grid itself needs targeted augmentation, including strategically placed large-scale interconnectors and transmission line extensions, to balance resources and unlock REZs in new regions. Of particular importance to the proposal are the South West NSW (N6), Wagga Wagga (N7), Murray River (V2) and Riverland (S2), REZs.

EnergyConnect will be crucial in meeting the requirements for the connection of the identified REZs and will assist in leveraging large scale private sector investment opportunities, boosting regional economies and building the state's resilience by ensuring there are enough new energy projects coming online to replace the retiring traditional power stations expected over the next two decades.



Source: AEMO, 2020

Figure 2-1 Identified potential REZs across the NEM

The *NSW Transmission Infrastructure Strategy* (DPE, 2018), which is discussed in more detail in Section 2.4.1, states that connection of these REZs will 'leverage massive private sector investment opportunities, boosting regional economies and building the state's resilience by ensuring there are enough new energy projects coming online to replace the retiring traditional power stations expected over the next two decades'. However, it is noted that investors in new energy projects typically will not invest unless they are sure there will be enough transmission capacity to distribute and sell their energy (NSW Government, 2018).

As described above, Australia's energy markets are undergoing rapid change as the sector transitions to generating lower carbon emissions, with a greater uptake of renewable generation and emerging technologies. These changes have created several challenges, in particular to the South Australian energy market including:

- a reliance on high-cost gas plant in SA to meet peak demand
- increased variability of demand and supply due to growth of intermittent renewable generation, both at grid-scale and due to household rooftop photovoltaic cells.

These challenges have led to periods of high wholesale electricity prices in SA and a reduction in the overall affordability of electricity for customers. In addition, the SA region is seen as continually vulnerable to extreme weather events and system disturbances.

2.3. Investment and funding

2.3.1. Regulatory investment test for transmission (RIT-T)

The Regulatory Investment Test for Transmission (RIT–T) aims to promote efficient transmission investment in the NEM by promoting greater consistency, transparency and predictability in transmission investment decision making (Australian Energy Regulator (AER), August 2020). The purpose of the RIT-T is to consider all credible options to address the identified need (including non-network options) and to ensure that the selected option maximises benefits to all those who produce, consume and transport electricity in the market.

The RIT-T for EnergyConnect was completed between November 2016 and February 2019. In January 2020 the Australian Energy Regulator (AER) determined the preferred option identified in the South Australian Energy Transformation RIT-T satisfied the requirements of the RIT-T. It identified the credible option that maximises the present value of the net economic benefit to all those who produce, consume and transport electricity (the preferred option – EnergyConnect) (AER, January 2020).

2.3.2. Clean Energy Finance Corporation

The Clean Energy Finance Corporation (CEFC) invests in clean energy technologies, projects and businesses, to accelerate Australia's transition to a low emissions economy. The CEFC has committed to an investment of $295 million to facilitate EnergyConnect. This is the largest single investment from the CEFC.

The CEFC investment strategically supports EnergyConnect's objectives of assisting to accelerate Australia's transition to a low emissions economy. The CEFC investment is an endorsement of EnergyConnect's role in delivering more renewable energy to Australian consumers and concurrently lowering power bills.

2.4. Strategic planning response

2.4.1. NSW policy context

2.4.1.1. NSW Transmission Infrastructure Strategy

The *NSW Transmission Infrastructure Strategy* (DPE, 2018) is the NSW Government's plan to unlock private sector investment in priority transmission infrastructure projects, which will deliver least-cost energy to customers through to 2040 and beyond. The Strategy forms part of the NSW Government's broader plan to make energy more affordable, secure investment in new generation sources and network infrastructure, and ensure new technologies deliver benefits for consumers. Building on existing programs to reduce household and business energy bills and secure energy supplies, the Strategy aims to:

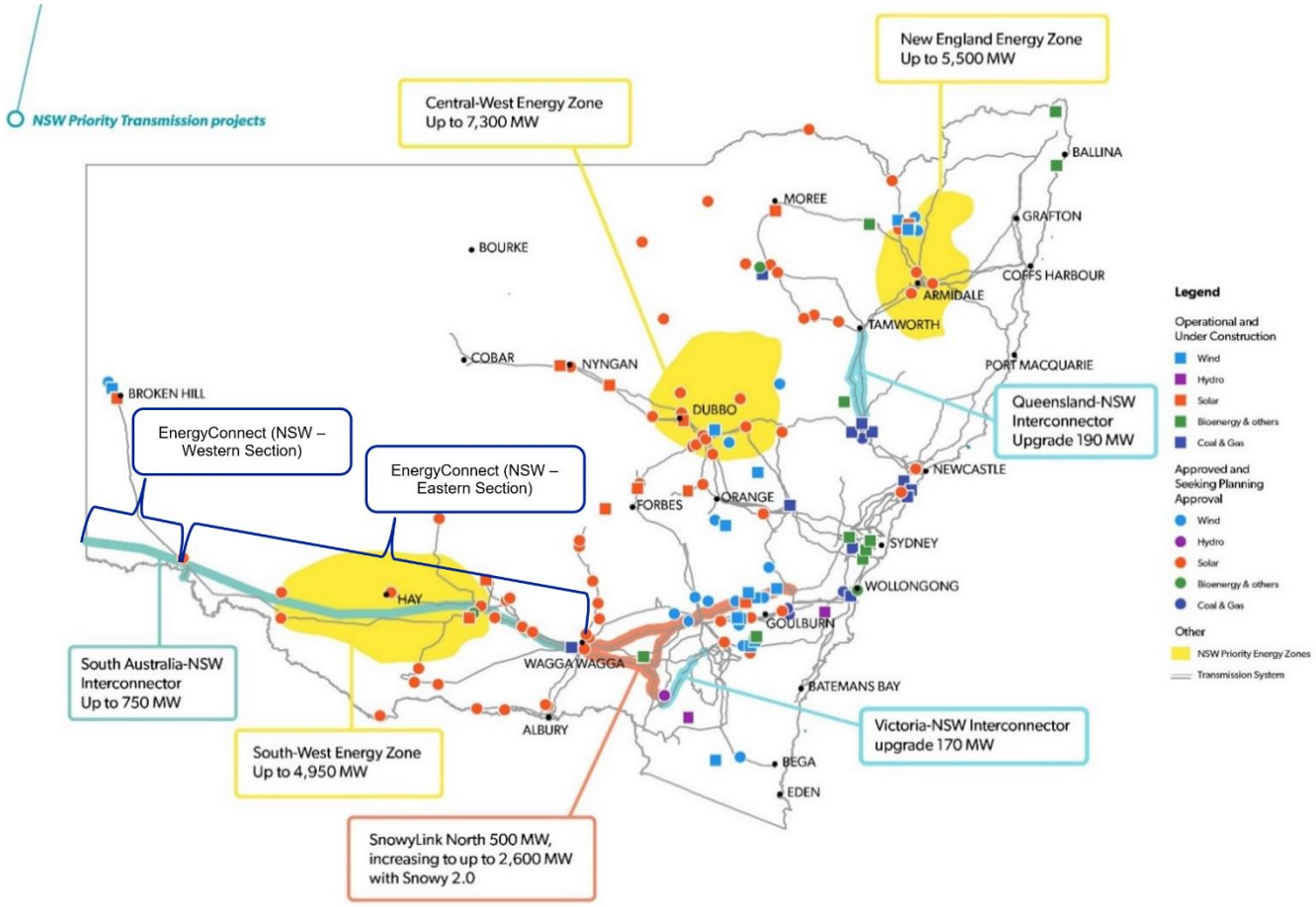
- boost interconnection between Victoria, SA and Queensland, and unlock more power from the existing Snowy Hydro Scheme
- increase NSW's energy capacity by prioritising Energy Zones in the Central West, South West and New England regions of NSW, which will become a driving force to deliver affordable energy into the future
- work with other states and regulators to streamline regulation and improve conditions for investment. By increasing transmission capacity and low-cost generation, NSW will support an orderly transition of the energy sector over the next two decades.

NSW already has a substantial investment pipeline of new wind, solar, gas and generator upgrade projects that have already received, or are currently seeking planning approval, driving the energy transformation across the state. As traditional electricity generators retire, these new projects will provide the cheapest available energy to supply households, businesses, schools and essential services. While the existing network will continue to play an important role, it will only have enough capacity to connect around one in 20 of these projects.

EnergyConnect is one of the four priority transmission projects identified in the strategy to be accelerated to access existing and committed low-cost energy supplies in other regions within the NEM. These priority projects are intended to meet energy needs prior to the retirement of existing coal-fired generation in NSW.

The strategy identifies EnergyConnect as being a catalyst for providing up to 750 MW of lower cost energy supply from SA into NSW and helping transport energy from the South-West Energy Zone to major demand centres within NSW and SA.

The strategy also identifies three Energy Zones (refer to Figure 2-2), of which EnergyConnect would help transport energy from the South-West Energy Zone to major demand centres (DPE, 2018). The three Energy Zones are areas with high energy potential where planned transmission infrastructure upgrades could allow multiple generation projects to connect to the network at lower cost. AEMO forecasts these Energy Zones will provide the bulk of the state's future energy supply, with up to 17,700 MW of new generation projects expected to connect to the grid. This could support an average of up to 2,000 construction jobs each year and inject up to $23 billion in investment into regional NSW.



Source: Adapted from DPE, 2018

Figure 2-2 NSW Priority Transmission Projects

2.4.1.2. Transition to renewable energy for lower energy prices and more reliable energy supply

The retirement of coal generation is predicted to be most rapid in NSW, with four of the State's five remaining coal-fired generators set to reach the end of their technical lives and close by 2035, starting with the Liddell Power Station in April 2023. As these generators get older, they become more fragile and more susceptible to outages, making the electricity system less reliable.

In response and to facilitate a strategic transition, the NSW Government developed the *Electricity Strategy and Electricity Infrastructure Roadmap*. These documents set out the plan to help replace the State's aging power stations with REZs, leveraging locations with high renewable energy potential, including South-West NSW. REZs will play a vital role in connecting multiple renewable energy generators and storage in the same location, capitalising on economies of scale to deliver cheap, reliable and clean electricity for homes and businesses in NSW.

The *Electricity Strategy and Electricity Infrastructure Roadmap* builds on the *NSW Transmission Infrastructure Strategy* (2018) and supports the implementation of the AEMO's 2020 ISP.

As outlined previously, EnergyConnect (including the EnergyConnect (NSW – Eastern Section) has been identified as a priority project in both AEMO's 2020 ISP and the NSW Government's *Transmission Infrastructure Strategy* (2018).

2.4.1.3. State Infrastructure Strategy 2018-2038

The *State Infrastructure Strategy 2018-2038* (Infrastructure NSW, 2018) establishes the strategic directions, projects and initiatives to meet the infrastructure needs of a growing population and a growing economy. The strategic objective for the energy sector within the strategy is to 'encourage private sector investment to deliver secure, reliable, affordable, low emissions energy supply'. In line with the identification of the proposal within the *NSW Transmission Infrastructure Strategy* (DPE, 2018), EnergyConnect is consistent with this objective. The proposal would provide the increased transmission capacity that is required to encourage private sector investment in low emission energy generation projects within the REZs in western NSW, SA and north west Victoria.

2.4.1.4. NSW Climate Change Policy Framework

The *NSW Climate Change Policy Framework* (NSW Office of Environment and Heritage (OEH), 2016) released in 2016, outlines NSW's long-term objectives to achieve net-zero emissions by 2050 and to make NSW more resilient to a changing climate. The framework is intended to (among other objectives) define the NSW Government's role in reducing carbon emissions and adapting to the impacts of climate change and set the policy directions to guide implementation of the framework. This framework guides NSW policy and programs on climate change.

The framework states that NSW will be part of the global transformation of the world's energy system and that boosting energy and resource productivity can reduce the impact of rising energy prices and the cost of transition to a net-zero emissions economy. One of the identified policy directions of the framework is to create a certain investment environment by working with the Commonwealth to manage transition (Policy direction 1).

The proposed investment in EnergyConnect is consistent with this policy direction, as it would provide a key piece of strategic transmission infrastructure that would enable the transition to a lower emissions economy. EnergyConnect would also create investment and job opportunities in emerging industries within western NSW (in particular the opportunity to connect new energy generating facilities), with reliable transmission infrastructure.

2.4.2. Australian government policy context

2.4.2.1. Integrated System Plan

Responding to a recommendation in the 2018 *Independent Review into the Future Security of the NEM* (Commonwealth of Australia, 2017a), the AEMO released the first ISP in July 2018 to deliver a strategic infrastructure development plan, based on sound engineering and economics, which can facilitate an orderly energy system transition under a range of scenarios. An updated ISP (the 2020 ISP), which builds on the initial 2018 ISP, was released by AEMO in July 2020.

A new interconnector between SA and NSW (EnergyConnect) was identified as a priority project in the 2020 ISP and as an important element of the 'roadmap for the NEM' and as one of its immediate priorities that would deliver positive net market benefit as soon as it can be built. This is because it is expected to deliver positive net market benefits and support the energy market transition to a lower carbon emissions future as soon as it can be built. AEMO estimates that the combined supply and network investments outlined in the 2020 ISP (such as EnergyConnect) would deliver $11 billion in net market benefits across the NEM.

Moreover, the 2020 ISP confirms EnergyConnect as a 'no regret' actionable ISP project as it would 'increase transfer capacity between SA and NSW by 750 MW, to achieve fuel cost savings and unlock already stranded renewable investments' (AEMO, 2020).

EnergyConnect would also complement several additional major inter-regional interconnectors that have been identified in the 2020 ISP. Together, these interconnectors would augment the national transmission grid and address cost, security and reliability issues. These complementary projects include interconnectors between Queensland and NSW (QNI Upgrade), Victoria and NSW (VNI Upgrade) as well as the Snowy Mountains within NSW (HumeLink) to access Snowy Hydro's existing and future generation capacity. The interconnector projects proposed include a combination of 330kV and 500kV transmission systems.

2.4.2.2. Climate change policy

As discussed in Section 2.2.1, on 10 November 2016, Australia ratified the Paris Agreement and the Doha Amendment to the Kyoto Protocol, representing the Australian Government's commitment to provide action on climate change, setting interim emission reduction targets, including a commitment to reduce emissions by 26 to 28 per cent below 2005 levels by 2030. In 2017, the Australian Government reviewed its climate change policies to ensure they remain effective in achieving Australia's 2030 target and Paris Agreement commitments. A final report was released on 19 December 2017 which generally indicated the Australian Government's policies were on course to meet Australia's international climate change commitments.

EnergyConnect is consistent with the Australian Government's climate change initiatives. It facilitates the longer-term transition across the NEM to low-emission energy sources by providing increased energy transmission capacity in strategic locations that are capable of unlocking REZs.

2.5. How the proposal would address the identified need

This proposal, which is an essential component of EnergyConnect, would provide a vital connection to enhance the energy transmission link between SA, NSW and Victorian transmission networks, which, when linked with the approved EnergyConnect (NSW – Western Section), would join the outreaches of the state networks at Chowilla in SA and Buronga and Wagga Wagga in NSW.

A new interconnector between SA and NSW (i.e. EnergyConnect) is needed to:

- lower dispatch costs, initially in SA, through increased access to electrical supply options across adjoining regions
- facilitate transition to a lower carbon emissions future in the NEM and promote the adoption of new technologies by improving access to high quality renewable resources across all regions of Australia
- enhance the reliability and security of electricity supply in SA and NSW, particularly as coal-fired generators begin to be retired in the near future.

By expanding, and in the case of SA and NSW establishing, power transfer capability between regions, interconnectors can enable the efficient sharing of generation resources within the NEM and can encourage more efficient investment in low-cost generation sources. This can allow overall demand and system reliability requirements to be met at the lowest cost. Allowing for a greater sharing of resources across regions would also help smooth demand and supply fluctuations, which would improve electricity security and reliability within the NEM and alleviate pressure on supply during peak demand periods.

As a result, EnergyConnect would reduce wholesale market electricity costs in SA, as soon as it can be built, by enabling electricity demand in SA to be met using low-cost generating capacity that currently exists on the east coast of Australia. This would also reduce SA's reliance on increasingly expensive gas generation, price volatility and trading risk.

In the longer term, an enhanced ability to import low-cost power from NSW, including significant high-quality renewables, provides market benefits by enabling supply in NSW to be met at a lower overall cost as existing coal-fired plants retire. This is particularly the case for the new interconnection between SA and NSW, as NSW is forecast by AEMO to experience the greatest retirement of coal plant after 2030 and would otherwise rely on higher-cost sources of generation to fill the resulting supply gap (ElectraNet, 2019a).

As discussed in Section 2.2.2, Australia's commitment to reduce carbon emissions has substantial implications for the future operation of the NEM. EnergyConnect would allow renewable energy trade between NSW, SA and Victoria to assist in meeting national carbon emission and renewable energy targets at lowest long-run cost. It would do so by relieving the transmission capacity constraints as required to encourage the development of large-scale renewable energy generation within the Murray River, Riverland and South West NSW REZs, which are priority areas to assist the NEM transition.

2.6. Key benefits of EnergyConnect

As part of the regulatory approval process, Transgrid was required to demonstrate the benefits of EnergyConnect to consumers using a three-part market benefits test. This RIT-T is the public economic cost benefit test administered by the AER on all projects with a value greater than $6 million.

Through the EnergyConnect RIT-T process, all network and non-network solution options from a technical and economic perspective were assessed by:

- informing stakeholders of investment needs and proposed options
- testing the market for alternative and more efficient solutions
- explaining to stakeholders the basis on which the preferred option was selected.

The AER approved the RIT-T in January 2020 and the rigorous assessment of the forecast project costs has helped to ensure consumers pay no more than is needed to build the new interconnector.

Subsequent to the RIT-T, a Contingent Project Application (CPA), or funding application, was submitted to the AER. The CPA is a thorough assessment of the proposed project costs to ensure they are prudent and efficient. The AER invited submissions from energy consumers and other interested parties.

The AER approved Transgrid's final CPA in May 2021.

Economic cost-benefit analysis prepared as part of the RIT-T process for the AER shows that EnergyConnect is expected to:

- deliver net market benefits of approximately $900 million over 21 years (in present value terms) including wholesale market fuel cost savings in excess of $100 million per year as soon as it is energised (primarily from avoided expensive gas-fired generation in SA)
- provide diverse low-cost renewable generation sources to help service NSW demand going forward, particularly as existing coal-fired generators retire
- avoid substantial capital costs associated with enabling greater integration of renewables in the NEM
- generate sufficient benefits to recover the proposal capital costs within nine years of completion
- reduce annual residential bills and small business customer bills in SA and NSW
- deliver flow on economic benefits to the wider economy totalling over $6 billion across SA and NSW (in present value terms)
- generate around 1,500 jobs (including up to around 300 local/regional jobs) during construction
- improve the security, reliability and resilience of the power network in SA and NSW
- improve the ability of parties to obtain hedging contracts in SA and help relieve the tight liquidity in hedging markets currently.

With regard to job creation, over the period from 2021 to 2040, it is projected that around 18,800 employee years of full time equivalent (FTE) direct and indirect jobs would be created by EnergyConnect (Acil Allen, 2019).

2.7. Implications of not proceeding with the proposal

This proposal, which is an essential component of EnergyConnect, would enhance the energy transmission link between the SA and NSW transmission networks, as it would:

- provide a vital link in the existing electrical transmission network by joining the approved component of EnergyConnect with the remaining link at Wagga Wagga
- enhance the capacity of the network to provide electricity between SA, NSW and Victoria
- enable the development of solar generation within South West NSW, in particular within the identified South West NSW and Wagga Wagga REZs.

Not proceeding with the proposal would reduce the security of the electricity supply in SA and NSW, particularly as coal-fired generators commence retirement. Not proceeding would discourage investment in energy generation and storage within the South West NSW, and Wagga Wagga REZs and the adoption of new renewable technologies in the future, which is required to support the delivery of commitments and policies at a State, Federal and international level.

Part B – The proposal and its development

3. Proposal design development

This chapter describes the approach to the refinement of the design for the whole of EnergyConnect (including the current proposal comprising the Eastern Section of EnergyConnect), including the development of design criteria and principles, the approach to the design principles and issues, design options considered and assessment against a range of criteria. The proposal may be further refined following consideration of submissions received from the community or other stakeholders as part of the exhibition of the EIS.

3.1. Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to design development of the proposal and where these requirements are addressed in this EIS are outlined in Table 3-1.

Table 3-1 Secretary's environmental assessment requirements – Proposal design development

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
General requirements	The EIS must include: • a summary of the background to the project, including alternatives that were considered to the project	Chapter 3 (Proposal design development) provides a summary of the background to the project, including alternatives that were considered to the proposal.

3.2. Strategic options assessment

Initial strategic connection options were identified to address the need for greater sharing of energy sources across the NEM. For completeness of the options assessment process, an overview of these strategic options is provided in the following section.

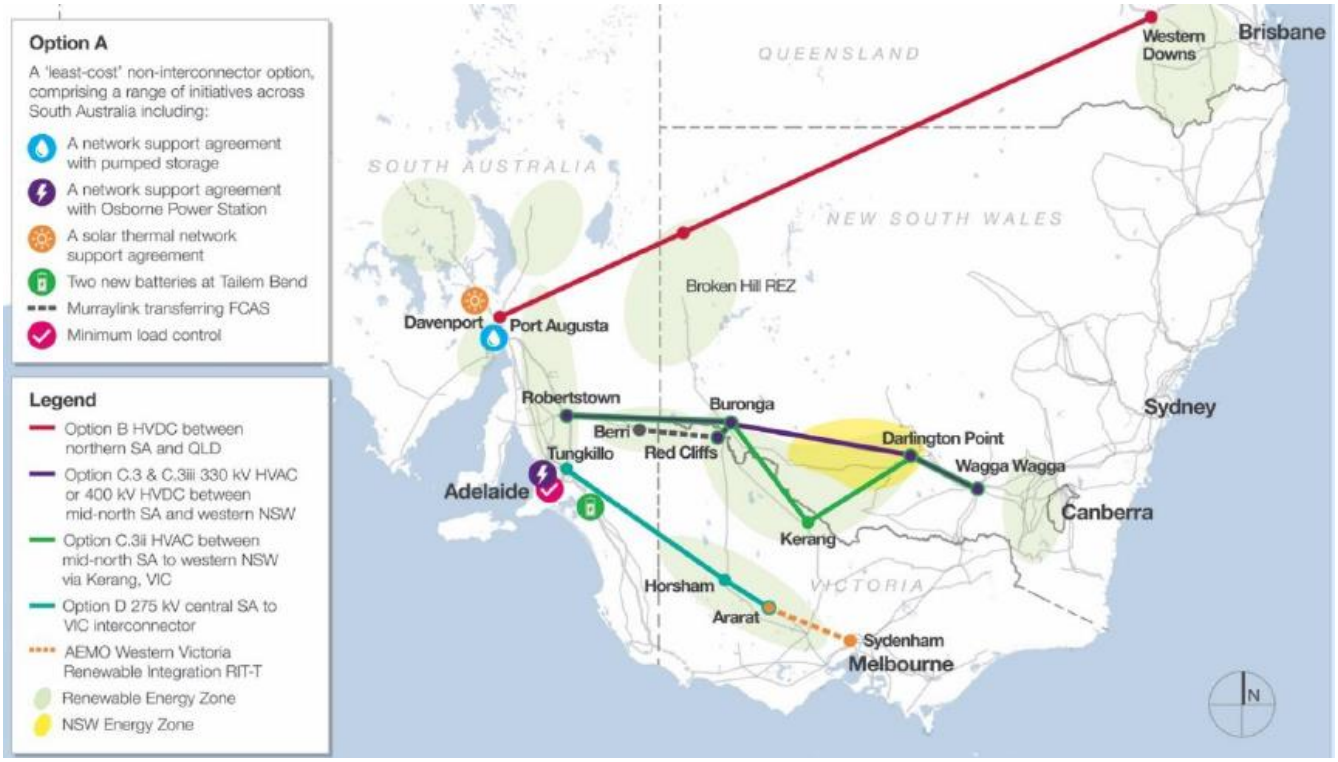
3.2.1. Initial interconnector options considered

Four main interconnector options were initially identified to meet the overarching objective of securing a new electrical transmission line between SA and the NEM (as described previously in Chapter 2). These options included a predominantly SA-centric 'no-interconnector' option (consisting of both network and non-network components) as well as a series of options involving new interconnectors to NSW, Queensland and Victoria. These options were investigated as part of the EnergyConnect RIT-T assessment process undertaken by ElectraNet and are presented in *SA Transformation RIT-T Project Assessment Conclusion Report* (ElectraNet, 2019b).

The RIT-T is an economic cost benefit test that is overseen by the Australian Energy Regulator and applies to all major network investments in the NEM to enhance transparency and consistency in investment decision making.

A summary of the options considered is provided below and shown in Figure 3-1:

- no interconnector:
  - Option A: Non-Interconnector. Consisting of a range of network support initiatives
- an interconnector to Queensland:
  - Option B: A 400kV high voltage direct current (HVDC) line between north SA and Queensland. The indicative route would be between Davenport in SA, crossing into NSW and connecting with the Queensland network at Western Downs. This path would be around 1,450 kilometres long. This option is assumed to provide 700 MW of transfer capacity
- NSW interconnector options:
  - Option C.3: A 330kV line alternating current (AC) between Robertstown in mid-north SA and Wagga Wagga in NSW, via Buronga, plus a 220kV line between Buronga and Red Cliffs, in Victoria. The indicative route would be approximately 916 kilometres in length. This option is assumed to provide 800 MW of transfer capacity
  - Option C.3ii: A 330kV line between Robertstown in mid-north SA and Wagga Wagga in NSW, via Buronga, Red Cliffs, Kerang and Darlington Point. This option is a variant of the above 330kV option that increases interconnection between Robertstown SA and Wagga Wagga in NSW via Buronga, but which is also routed via Kerang in Victoria and Darlington Point in NSW. The indicative route runs approximately 1,016 kilometres in length. This option is assumed to provide 800 MW of transfer capacity
  - Option C.3iii: A variant of Option 3, which uses a HVDC for the Robertstown – Darlington Point link
- an interconnector to Victoria:
  - Option D: A 275kV line from Tungkillo in SA to Horsham and Ararat in Victoria. This option uses a connection from Tungkillo to Horsham to strengthen SA's connection to the east coast by providing an increase in export and import capability. The indicative route runs approximately 510 kilometres in length. This option is assumed to provide 650 MW of transfer capacity.



Source: ElectraNet, 2019

Figure 3-1 Overview of the strategic options (and variations) assessed

3.2.2. Evaluation of the strategic options

The four main interconnection options (and the associated sub-options in the case of the proposed NSW interconnector) were evaluated as part of the RIT-T (ElectraNet, 2019b). This evaluation included a range of considerations including:

- ability of the options to contribute to meeting the identified need
- estimating net market benefits
- scenario analysis and sensitivity testing
- consideration of cost (including consideration of capital investment value and net present value scenarios).

3.2.3. Identification of the preferred strategic option

The RIT-T concluded that of all options considered, a new 330kV interconnector between Robertstown in mid-north SA and Wagga Wagga in NSW, via Buronga and with an augmentation between Buronga and Red Cliffs (referred to as Option C.3), is expected to deliver the highest net market benefits and is therefore the current preferred strategic option.

As part of the 2020 ISP, consideration of a broader network alongside the options presented above has also been identified. Additional interconnector opportunities consisting of transmission systems with a minimum 330kV are identified, with two possible routes into NSW from Victoria (via Kerang or via Shepparton) which would interact with components of EnergyConnect.

The transmission system voltage configuration for Energy Connect (NSW – Eastern Section) would have a minimum 330kV. The section from the proposed Dinawan 330kV substation east to the Wagga Wagga substation would initially be operated at 300kV but would be provisioned for future operation at 500kV (i.e. built now with the infrastructure components required to enable 500kV operating capacity).

This 500kV section of EnergyConnect, to be underwritten by the Federal Government, will allow for future-proofing of the transmission network. This is critical for the development of the planned South West Renewable Energy Zone, and it will enable the full benefits of Snowy 2.0.

Delivering infrastructure capable of being operated at the 500kV now as part of EnergyConnect would avoid future additional investments of approximately $600 million to build a new connection. Furthermore, disruption to landholders and additional environmental impacts would be avoided by removing the need for future infrastructure construction.

3.3. Identification and refinement of the proposal corridor

Following identification of the preferred strategic option to provide a new 330kV interconnector between Robertstown in SA and Wagga Wagga in NSW, the corridor for this interconnector was then considered. For the NSW component of the interconnector, this included:

- identification of an initial, wider proposal corridor (preliminary corridor alignment)
- refinement of the preliminary corridor to a reduced, preferred corridor.

Each of these stages of refinement are described in the following sections.

3.3.1. Overview of the corridor assessment process

The identification of the preferred corridor for EnergyConnect between the SA/NSW border and Wagga Wagga was based on the analysis of extensive geospatial data, preliminary environmental survey and stakeholder engagement undertaken between November 2018 and February 2020. The assessment of corridor options was generally progressed as two separate sections between:

- the SA/NSW border and Buronga, including Red Cliffs (subject to separate planning approval as part of EnergyConnect (NSW – Western Section)
- Buronga and Wagga Wagga (the current proposal).

An overview of the corridor selection process that was undertaken for the proposal is summarised in the following sections.

3.3.1.1. Corridor selection methodology

While the most cost-effective option for linear infrastructure projects is to take a straight-line approach from point to point, this option is not generally feasible due to a range of environmental, social, land use and engineering constraints. As such, the corridor selection assessment methodology for the proposal considered a broad ‘hierarchy of constraints’ which were developed to inform the preliminary alignment corridor and to allow for route narrowing and eventual selection of the preferred corridor for the proposed transmission line.

The overall methodology for the corridor selection process included consideration of a corridor that:

- minimised environmental and social impacts and maximised the use of previously disturbed areas wherever possible, including:
  - avoiding areas of particular environmental sensitivity where obtaining planning approvals and access were considered unlikely
  - maximising distances to dwellings, inhabited areas and other sensitive land uses
  - preferencing areas of existing disturbance (e.g. transmission line or utility easements, roads, tracks, fence lines and cadastral boundaries) and targeting narrow crossing points of waterways and flood out areas (and their associated riparian habitats such as around the Murrumbidgee River, the Coleambally irrigation channels, Yanco Creek, Columbo Creek and Lake Cullivel)
- enabled the use of current and available technology for transmission line construction
- enabled the transmission line to be accessed and maintained safely
- was broadly acceptable to landholders and key stakeholders
- provided a cost effective and best value for money option.

The identification of constraints used to consider potential options was also informed by engagement with the community and the incorporation of their feedback. This included:

- engagement with local and regional communities
- targeted engagement with key stakeholders including local government, State and Commonwealth government agencies, landholders, Traditional Owner groups and other directly affected parties.

An overview of the corridor selection process used for the identification of the preliminary corridor alignment is summarised in Figure 3-2.

3.3.1.2. Hierarchy of constraints and opportunities

A range of primary constraints and opportunities were identified and considered during the identification of the preliminary alignment corridor, and the eventual selection of the refined preferred corridor. These were categorised into the following four key hierarchy elements:

- No-Go (Tier 1 constraints): Areas where the proposal cannot be located including:
  - Ramsar Wetlands
  - World Heritage Properties
  - Defence Land and other relevant exclusion zones
  - built up areas (townships and residential zoning)
  - licensed Airstrips/certified aerodromes
- Avoid (Tier 2 constraints): Areas that are to be avoided wherever possible including:
  - ecological constraints such as:
    - > National Parks, ecological conservation areas (including flora reserves, state conservation areas, Biodiversity Stewardship Sites, Biobanks; wilderness protection areas)
    - > EPBC Threatened ecological communities
    - > serious and irreversible impacts (SAII) ecological communities and species
    - > other Important Wetlands and Water sources for migratory birds protected by international agreements

- heritage conservation areas

- land uses including:

  > Commonwealth Land
  > exclusive Native Title Determination sites
  > freehold land granted under NSW Aboriginal Land Rights Act.
  > intensive agricultural activities and horticultural use
  > active mining

- areas with engineering and constructability challenges

- Minimise (Tier 3 constraints): Areas where impacts should be minimised and mitigated including:

  - ecological constraints such as:

    > threatened species (flora/fauna) – other non-SAII threatened flora fauna records
    > large, contiguous/intact areas of moderate or better-quality woodland vegetation
    > threatened ecological communities listed under the (NSW) *Biodiversity Conservation Act 2016* (BC Act) (non-SAII)
    > key fish habitat
    > riparian corridors within two kilometres of existing alignment for additional context

  - heritage constraints such as:

    > known/recorded sites and places of Aboriginal and non-Aboriginal heritage significance
    > areas of Aboriginal cultural significance (ceremonial sites, etc)
    > sites on the Aboriginal heritage information management system (AHIMS) and recorded conservation sites
    > State heritage items

  - main channels of rivers and tributaries

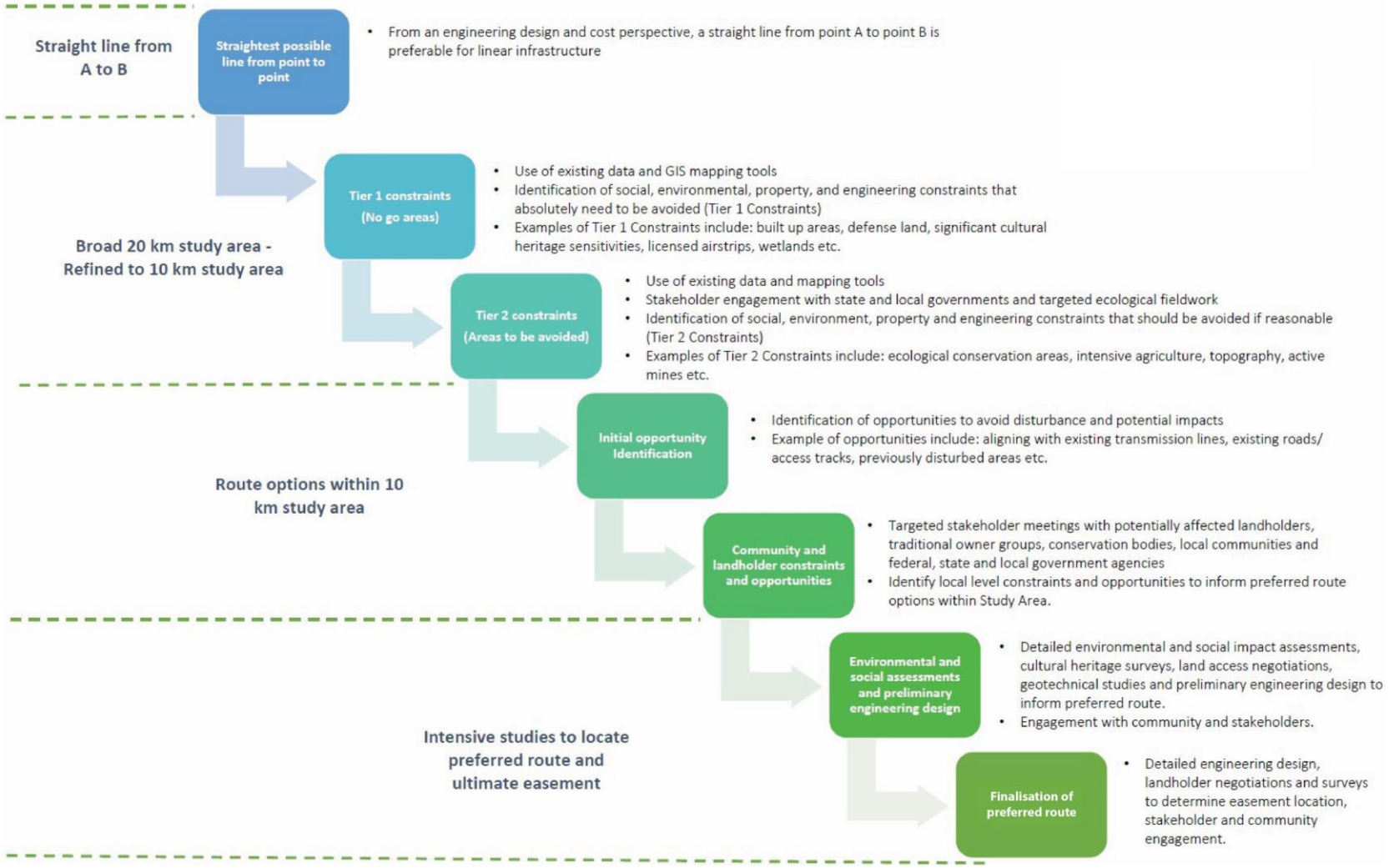
  - flood-prone land

  - homesteads/dwellings/structures (including agricultural structures)

- Opportunities: Areas that improve/benefit the proposal outcomes including:

  - areas of existing and permanent disturbance (e.g. existing roads and tracks, utility easements, fence lines, cadastral boundaries, biosphere, degraded grazing lands)

  - existing crossings/access (including bridges) across or narrow sections of the permanent/semi-permanent watercourses.



Source: Transgrid

Figure 3-2 Overview of the corridor selection process

3.3.2. Identification of a preliminary alignment corridor

For the preliminary alignment corridor, existing start and end points were already established due to the nature of the connection required to occur (i.e. the overarching need for the proposal provide to a connection between the existing Buronga substation and the existing Wagga Wagga substation).

Using existing, publicly available datasets for the tiered constraints and opportunities listed in Section 3.3.1, together with the feedback received from early stakeholder engagement activities, an initial set of five 20-kilometre wide study areas were defined between the Buronga substation and Wagga Wagga.

The options were identified by seeking to maximise the use of opportunity areas/features as well as avoiding Tier 1 constraints and minimising impacts to Tier 2 constraints. Given the broad nature of the corridors, Tier 3 constraints were not considered as part of this initial corridor identification.

Table 3-2 and Figure 3-3 show the options developed for the corridor workshop. Figure 3-3 also shows the identified Tier 1 and Tier 2 constraints identified.

Table 3-2 Description of the corridor alignment options

Option	Description of option
Option 1	This option would consist of a new transmission line running parallel to the existing 330kV transmission line between Buronga and Wagga Wagga, via Darlington Point. This is represented on Figure 3-3 as the existing transmission line alignment.
Option 2	This option would provide a predominantly east-west alignment between Buronga and a point north west of Griffith, traversing a narrow point of the Mungo National Park. At this point, the corridor would turn south towards the existing transmission line alignment. From this point, the corridor would connect to Darlington Point and follow the same corridor as Option 1.
Option 3	This option would provide a similar alignment to Option 2, however would traverse in an east-west alignment between 25 and 35 kilometres south of Option 1. This option would turn south towards the existing transmission line alignment at a point to the west of Griffith. From this point, the corridor would connect to Darlington Point and follow the same corridor as Option 1.
Option 4	This option would provide an alternative alignment which would allow for a potential corridor to the north of Mungo National Park. At the point west of Griffith the alignment would follow a similar corridor to Option 2 to Darlington Point and Wagga Wagga.
Option 5	This option would provide an alternative sub-option for each of the options 2, 3 and 4. The sub-option would traverse to the north of Griffith, connecting with the existing transmission line to the east of Darlington Point. The corridor would then branch to both Darlington Point to the west and Wagga Wagga to the east.

3.3.2.1. Corridor workshop

Following identification of the initial corridor alignments, a workshop was held with representatives from Transgrid and WSP in May 2019. This workshop included presentation and discussion of the corridor options which had been identified (Figure 3-3).

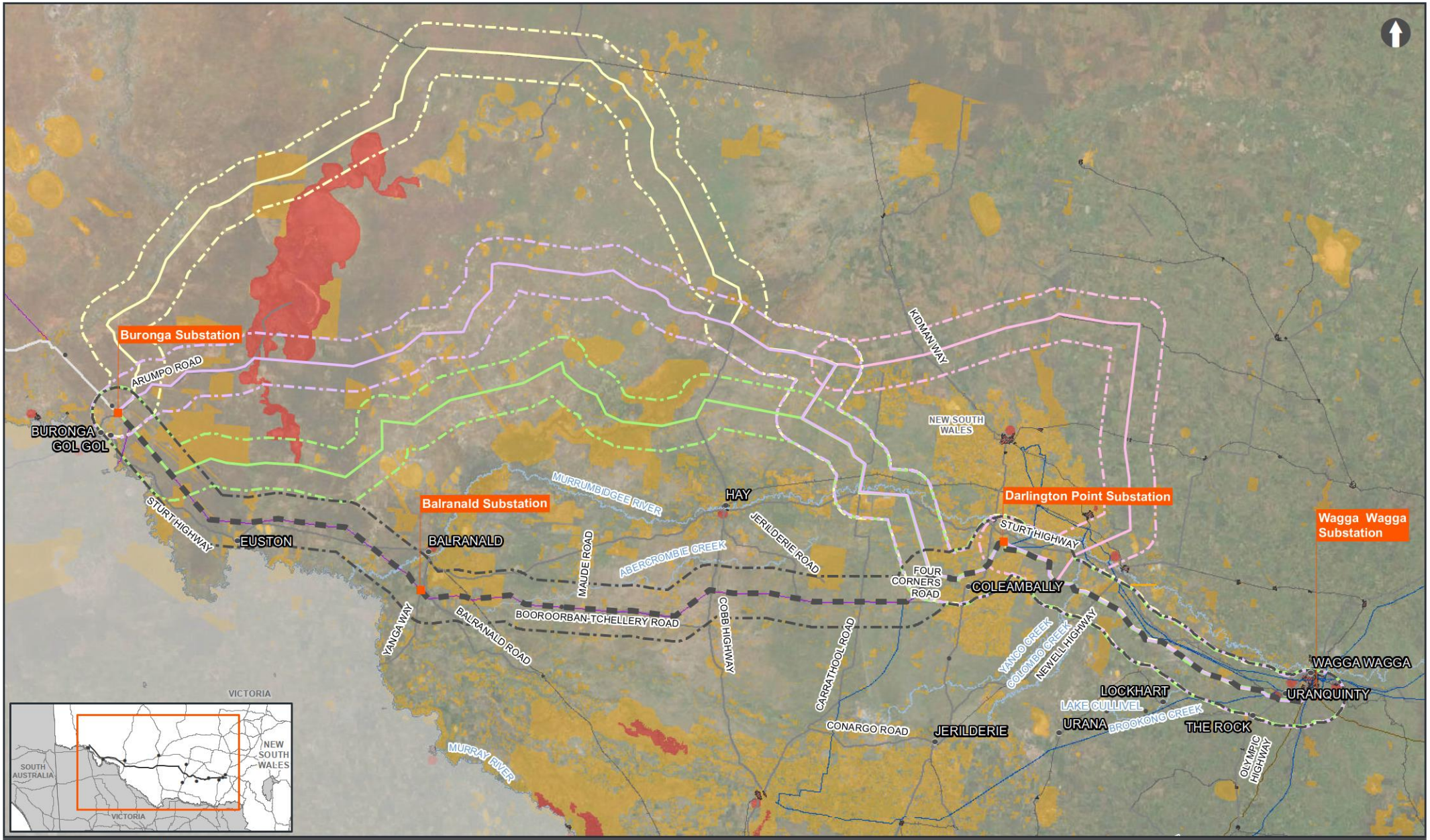


Figure 3-3

Initial corridor alignment options

EnergyConnect (NSW - Western Section)
Roads
Existing Railway
Built Up Areas
Waterbody
Watercourse

Constraint areas
Tier 1 constraint areas
Tier 2 constraint areas

Existing Transgrid Infrastructure
132 kV transmission line
220 kV transmission line
330 kV transmission line
Existing Substation

Option alignments
Option 1
Northern Option 2
Northern Option 3
Northern Option 4
Northern Option 5

Option corridors
Option 1 - 10km Buffer
North Option 2 - 10km Buffer
North Option 3 - 10km Buffer
North Option 4 - 10km Buffer
North Option 5 - 10km Buffer

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\01_EIS\Chapter03_OptionsAssessment\PS117658_EIS_0303_NorthernCorridorAlignment_r1v5.mxd

Source: NSWSS, ESRI, Transgrid, WSP

3.3.2.2. Consideration of feasible corridor options

Following the workshop, the five corridor options were considered against a range of differentiators, predominantly focussing on environmental factors including:

- length of each alignment
- overlap and connection with the two identified REZs (as identified by the AEMO and the *NSW Transmission Infrastructure Strategy* (2018)) (refer to Figure 3-5)
- impacts on Tier 1 constraints
- impacts on Tier 2 constraints
- potential planning approval risks.

For a majority of the constraints, a 10-kilometre buffer from the centreline of the corridor (20-kilometre wide study area) was used. For the vegetation area impact calculations, a refined buffer of one kilometre was utilised from this centreline (to provide a more reasonable assessment of potential impacts for consideration).

A summary of the consideration of each option against the above differentiators and how each option performed in comparison to the other options is shown in Figure 3-4.

	Option 1	Option 2	Option 3	Option 4	Option 5
Approximate length (km)					
Connection with identified renewable energy zones					
Tier 1					
Ecology (Ramsar wetlands)					
Heritage (World heritage areas)					
Land tenure (Defence land)					
Land use - Built up areas					
Land use - Certified aerodromes					
Tier 2					
Ecology - Threatened fauna records					
Ecology - Threatened flora records					
Ecology - State Forests					
Ecology - NPWS Reserves					
Ecology - Protected areas					
Ecology - Migratory bird flight path protection areas					
Ecology - Natural water body crossings					
Ecology - Threatened Ecological Communities records (EPBC)					
Ecology - Threatened Ecological Communities records (SAII)					
Heritage - Heritage conservation zones					
Land tenure - Commonwealth Land sites					
Land tenure - Native title sites					
Land tenure - Declared Aboriginal Places					
Land use - Intensive and irrigated horticultural areas					
Land use - Current mining titles					
Planning approval risk(s)					

Key: Positive outcome compared to other options; Neutral outcome compared to other options; Adverse outcome compared to other options

Figure 3-4 Consideration of feasible corridor options – Buronga to Wagga Wagga

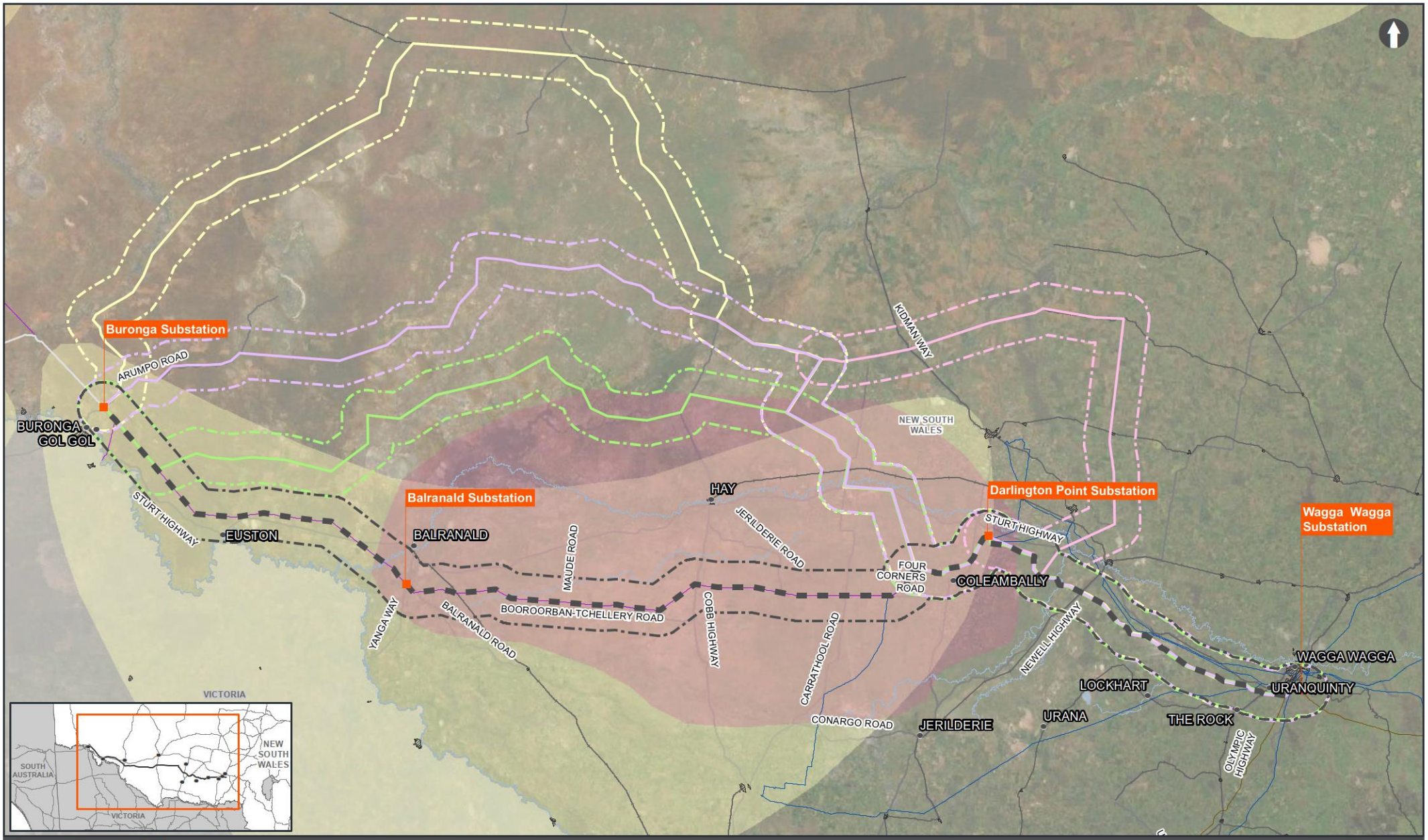


Figure 3-5

Renewable energy zones within the vicinity of the identified corridor options

- EnergyConnect (NSW - Western Section)
- Roads
- Existing Railway
- Built Up Areas
- Waterbody
- Watercourse
- Renewable Energy Zones - NSW Transmission Infrastructure Strategy
- Renewable Energy Zones - AEMO

Existing Transgrid Infrastructure

- 132 kV transmission line
- 220 kV transmission line
- 330 kV transmission line
- Existing Substation

Option alignments

- Option 1
- Northern Option 2
- Northern Option 3
- Northern Option 4
- Northern Option 5

Option corridors

- Option 1 - 10km Buffer
- North Option 2 - 10km Buffer
- North Option 3 - 10km Buffer
- North Option 4 - 10km Buffer
- North Option 5 - 10km Buffer

Source: NSWSS, ESRI, Transgrid, WSP

3.3.2.3. Identification of the preferred corridor between Buronga and Wagga Wagga

Based on consideration of the identified constraints, Option 1 (a corridor alignment that would parallel the existing transmission line between Buronga and Wagga Wagga via Darlington Point) was identified as the preferred corridor for further investigation. This option was considered to be preferred compared to the other options considered as it:

- allowed for a reduced overall length compared to each of the other options
- would allow for improved overall opportunities to connect with identified REZ's compared to the other options
- minimise impacts on World Heritage areas, in particular compared to Option 2 and Option 5 which would each potentially impact the Lake Mungo World Heritage Area
- typically had similar Tier 2 constraints (within a 10 kilometre buffer) as the other options
- potentially presented a more straightforward planning approval pathway (i.e. avoiding potential approvals for impacts to World Heritage Area(s).

The corridor for Option 1 was therefore taken forward as the preferred corridor for further refinement.

3.3.2.4. Refinement of the corridor between Four Corners and Wagga Wagga (Southern options)

Following identification of a preferred corridor between Buronga and Wagga Wagga, further design development, consideration of existing constraints and additional stakeholder engagement was undertaken. This identified a range of additional constraints on the approaches to and immediately surrounding the Darlington Point substation. In particular, the identification of a feasible alignment between Four Corners and Darlington Point was determined to be a substantial constraint, primarily due to predicted impacts to existing irrigated agricultural land and other sensitive land uses. An additional consideration was how EnergyConnect could best support the orderly development of the southwest REZ identified in the *NSW Transmission Infrastructure Strategy* (DPE, 2018) and meet the NSW Large-Scale Solar Energy Guideline.

Existing land uses around Darlington Point include irrigated agriculture (such as rice and cotton), poultry farming and current and proposed renewable energy projects. These high value, intensive industries presented challenges to the development of new transmission line infrastructure within a narrow easement corridor and where development may encroach up to easement boundaries. Generally speaking, conflict with these high value land uses would have the potential to:

- substantially increase construction costs
- substantially increase land compensation/business interruption costs
- require expensive and technically challenging consolidation/optimisation of existing transmission lines to 'make space' for EnergyConnect, which would increase stakeholder risk (i.e. farmers, irrigators and renewables operators).

Further, given the premium placed on land in close proximity to substations, the expansion of Darlington Point was considered likely to encourage further renewable development in the area that may further limit expansion and network optimisation and increase stakeholder risk due to the perception that EnergyConnect would facilitate the development of incompatible land uses and sterilisation of high value farm lands. For example, the recently constructed the Darlington Point Solar Project immediately north, east and south of the existing substation. This has the immediate effect of restricting how the existing network and easements (including EnergyConnect) are expanded or optimised to accommodate future network development.

Based on the additional constraints identified, three additional corridor options which provided a route to the south of Darlington Point and the existing transmission line were considered. These options generally considered the section between a point around 10 kilometres west of the Cobb Highway and Wagga Wagga.

Refined corridor identification

Table 3-3 and Figure 3-6 show the additional corridor options (referred to as the southern options). Figure 3-7 also shows the additional corridor options against known Tier 1 and Tier 2 constraints.

Each option consisted of a common alignment (running parallel to the existing 330kV transmission line between Buronga and the deviation point around 10 kilometres west of the Cobb Highway) with each of the options generally deviating from this point (with the exception of Southern Option 1 which provided an option that deviated closer to Darlington Point).

Table 3-3 Description of the corridor alignment options – Four Corners to Wagga Wagga (southern options)

Option	Description of option
Preferred corridor between Buronga and Wagga Wagga	This option would consist of a new transmission line running parallel to the existing 330kV transmission line between Buronga and Wagga Wagga, via Darlington Point. This is represented on Figure 3-6 as the existing transmission line alignment.
Southern Option 1	From the point of deviation, this option would continue along the existing transmission line corridor for around 95 kilometres. At this point, the corridor would continue in a predominantly east-west alignment towards the existing transmission line corridor at a point to the north of Buckingbong State Forest. From this point, the corridor would generally travel parallel to the existing transmission line to Wagga Wagga.
Southern Option 2	From the point of deviation, this option would continue in a predominantly east-west alignment towards the existing transmission line corridor, travelling to the south of the Buckingbong State Forest. From this point, the corridor would generally travel parallel to the existing transmission line to Wagga Wagga.
Southern Option 3	This option would provide a similar alignment to Southern Option 2, however would traverse a more southern alignment around 10 kilometres south of Southern Option 2 to a point south of Darlington Point. From this point, the corridor would travel in a similar alignment to Southern Option 2.

Consideration of feasible corridors for the southern option

The three additional corridor options were considered against the same range of project differentiators as the previous options assessment, in addition to potential impacts on Tier 3 constraints. Given the more refined nature of the corridors, Tier 3 constraints were considered as part of this assessment to provide an additional level of differentiation between the identified corridor options.

Similar to the previous options assessment, a majority of the constraints were assessed against a 10-kilometre buffer (with the exception of vegetation area impact calculations which used a one-kilometre buffer either side of the centreline of each corridor).

A summary of the consideration of each corridor option against the above differentiators is shown in Figure 3-8.

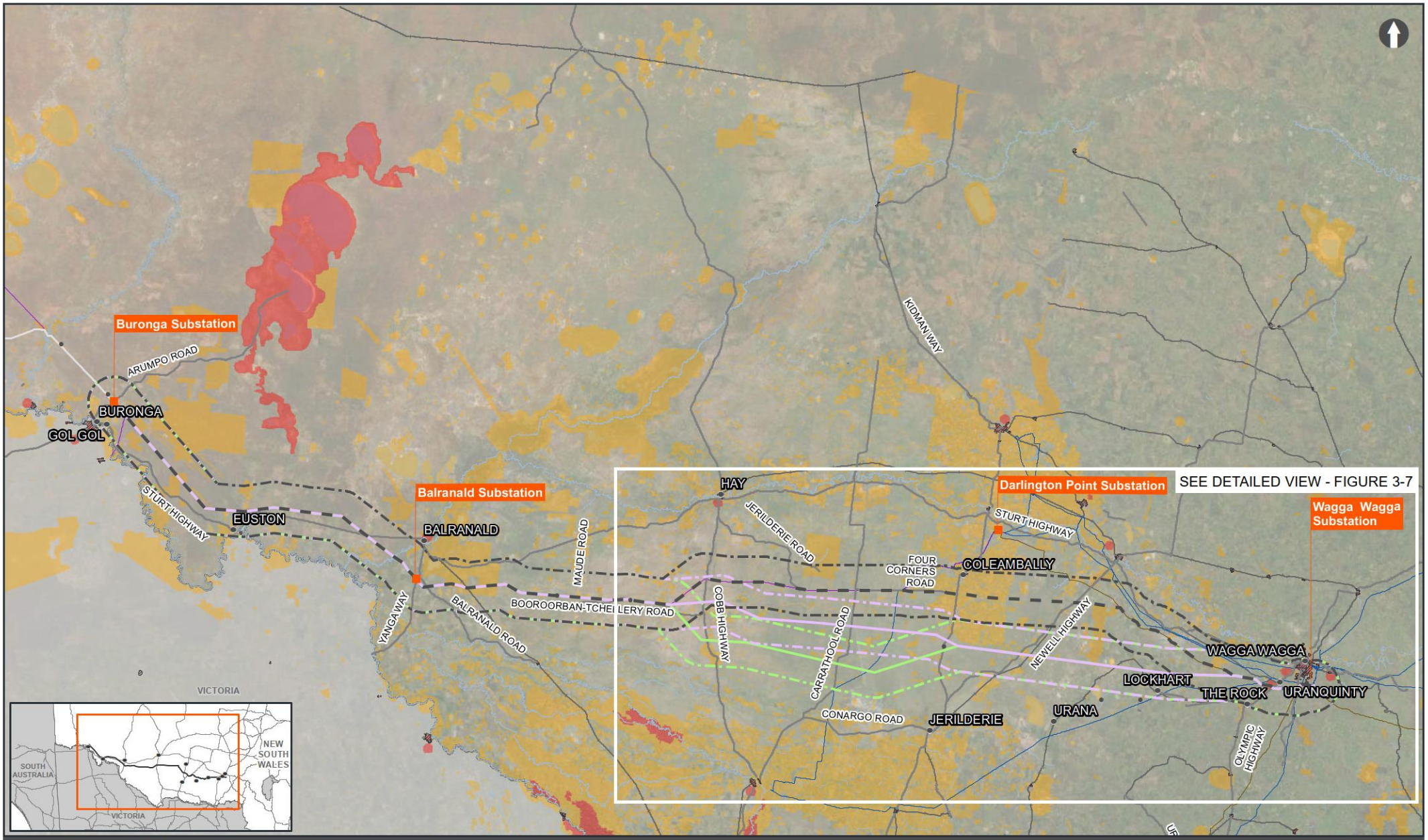


Figure 3-6

Potential southern corridor alignment options – overview of alignment

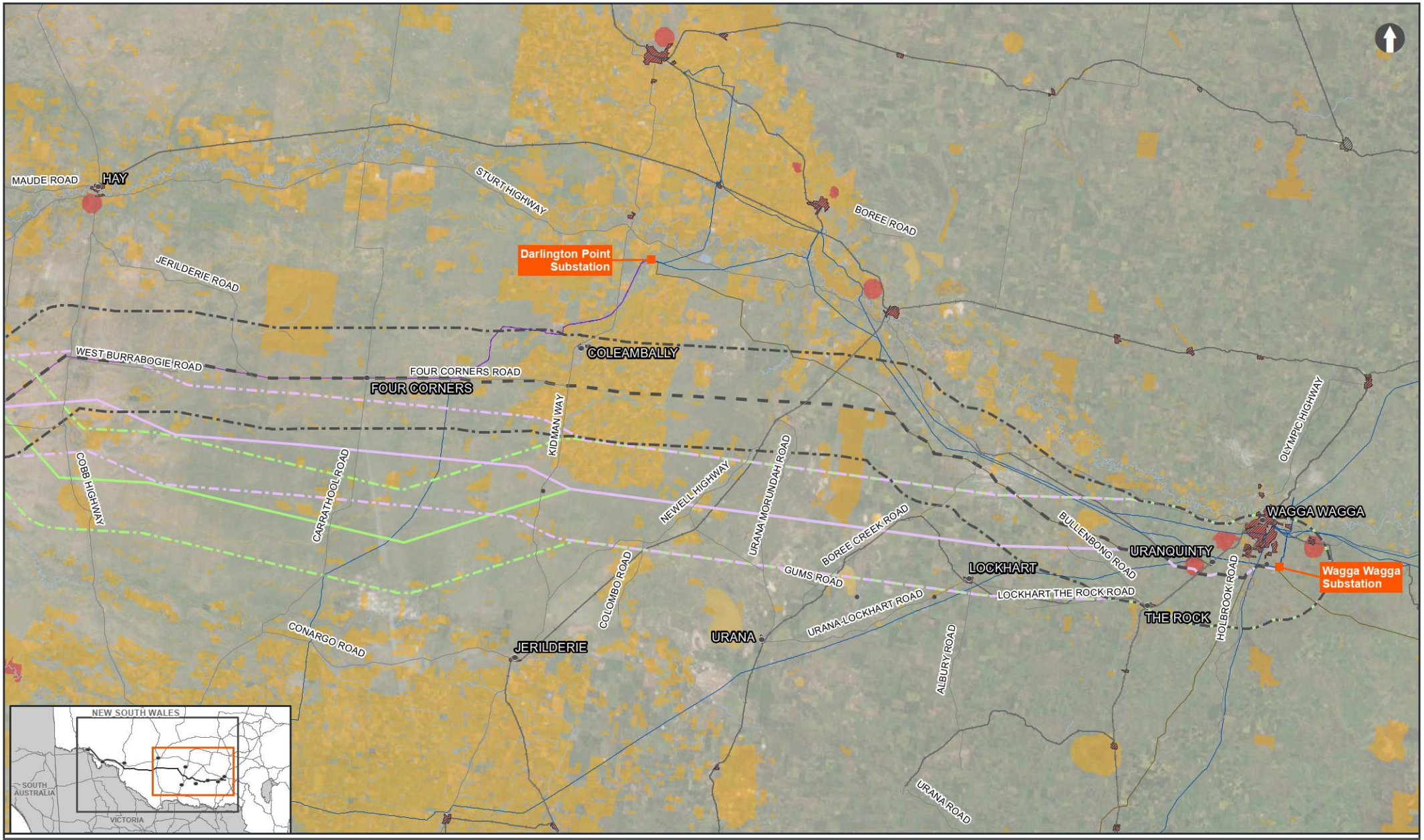


Figure 3-7

Potential southern corridor alignment options – potential tier 1 and tier 2 constraints

	Preferred Corridor (Buronga to Wagga Wagga)	Southern Option 1	Southern Option 2	Southern Option 3
Approximate length (km)				
Connection with identified renewable energy zones				
Tier 1				
Ecology (Ramsar wetlands)				
Heritage (World heritage areas)				
Land tenure (Defence land)				
Land use - Built up areas				
Land use - Certified aerodromes				
Tier 2				
Ecology - Threatened fauna records				
Ecology - Threatened flora records				
Ecology - State Forests				
Ecology - NPWS Reserves				
Ecology - Protected areas				
Ecology - Migratory bird flight path protection areas				
Ecology - Natural water body crossings				
Ecology - Threatened Ecological Communities records (EPBC)				
Ecology - Threatened Ecological Communities records (SAII)				
Heritage - Heritage conservation zones				
Land tenure - Commonwealth Land sites				
Land tenure - Native title sites				
Land tenure - Declared Aboriginal Places				
Land use - Intensive and irrigated horticultural areas				
Land use - Current mining titles				
Tier 2				
Ecology - Threatened fauna records (non-SAII)				
Ecology - Threatened flora records (non-SAII)				
Ecology - Locations of woodland vegetation patches > 5 hectares				
Ecology - Key fish habitats				
Ecology - Riparian corridors				
Heritage - Recorded Aboriginal sites				
Heritage - Recorded State heritage sites				
Floodplain hydrology - Drainage line crossings				
Floodplain hydrology - Hectares of flood prone land				
Land use and property (number of buildings)				
Planning approval risk(s)				

Key: Positive outcome compared to other options; Neutral outcome compared to other options; Adverse outcome compared to other options

Figure 3-8 Consideration of feasible corridor options – Southern alignment options

Identification of the southern option

Based on consideration of the identified constraints, Southern Option 2 was identified as the preferred southern option to progress further for ongoing refinement. This option was considered to be preferable compared to the other options considered as it:

- allowed for a reduced overall length compared to each of the other options
- had comparable impacts on all Tier 1 constraints compared to each of the other options
- would provide a comparably better overall option with respect to Tier 2 and Tier 3 constraints, in particular with respect to potential impacts on mapped ecology.

As identified in Figure 3-8, Southern Option 3 performed similarly across each of the Tier 1, Tier 2 and Tier 3 categories, however, given the shorter overall length of Southern Option 2, it was considered to be the preferred option to take forward for further refinement.

Further refinement of southern option

Following determination of Southern Option 2 as the preferred revised corridor, two areas of further refinement were undertaken in order to optimise this corridor.

The corridor was refined to provide an additional section of corridor that would be located parallel to the existing transmission line up to Four Corners. This refinement was determined to better take advantage of the opportunity to be parallel to an existing transmission line. From a point along Four Corners Road, the corridor would deviate south to connect back to the previously identified Southern Option 2 corridor.

Further investigation during the alignment options process identified an additional constraint to the west of Lockhart being the Morundah Receiver Station (defence communications receiver facility). This site includes a 22-kilometre radius buffer surrounding the Morundah site. Under the Urana and Lockhart Local Environmental Plans (LEPs), developments within this buffer that include of transmission lines of 66kV (or above) are prohibited without the consent of the Secretary of the Department of Defence. The Southern Option 2 corridor was identified as encroaching the southern portion of this buffer.

Advice from initial consultation with the Department of Defence noted that the Morundah Receiver Station is required to receive signals at very low power levels and therefore the signals are very susceptible to outside Radio Frequency Interference (RFI) resulting from local background electromagnetic radiation. The Morundah site was specifically selected to ensure the amount of RFI is not excessive and therefore the level of the noise is low. In order to minimise interference, it is therefore preferable that new projects try to limit interference by complying with the identified exclusion zones to ensure that the level of background radio frequency noise remains appropriately low.

The Southern Option 2 corridor was therefore refined to avoid impacts on this facility (and its buffer zone). This refined corridor is shown in Figure 3-9.

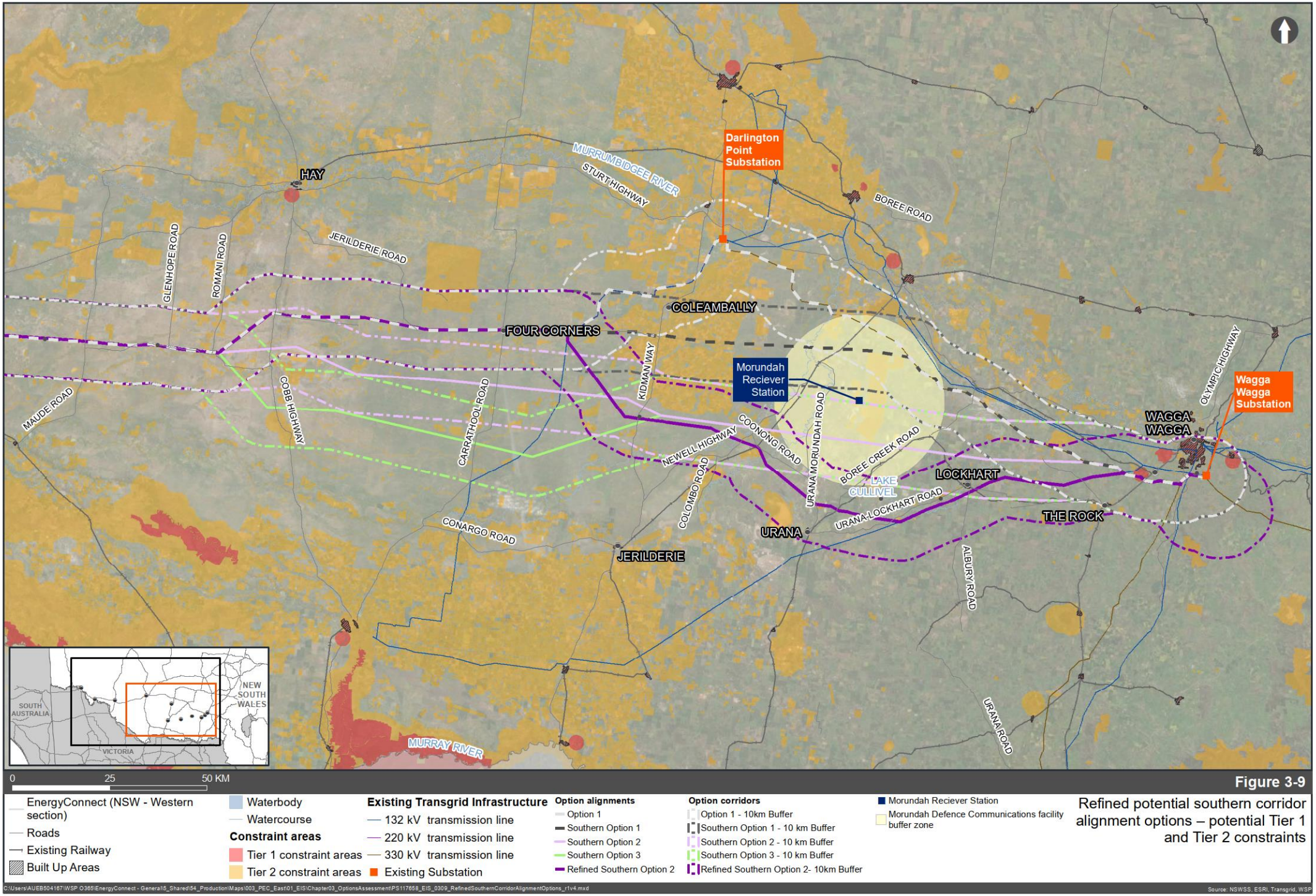


Figure 3-9

Refined potential southern corridor alignment options – potential Tier 1 and Tier 2 constraints

3.3.3. Preferred corridor identification and ongoing refinement

Based on the various options assessment undertaken between November 2018 and February 2020, a preferred corridor was identified between the Buronga and Wagga Wagga.

Following identification of the preferred corridor option components, Transgrid has continued to refine the broad corridor study area (i.e. the 10-kilometre buffer) to develop a more refined, narrower study area for more detailed field investigations to be used as the basis for the environmental assessment of the proposal. This refinement process involved:

- further consideration of key environmental constraints including some field-based survey work to validate assumptions made around the extent and quality of key biodiversity features
- commencement of direct engagement with potentially affected stakeholders and landholders in order to:
  - collect feedback on the methodology used to identify the preliminary alignment corridor including the section criteria and tiered constraints/opportunities (landscape level)
  - collect additional information on constraints and opportunities (at a local property level)
  - seek preferences as to where new transmission infrastructure may be located
- reviewing opportunities to reduce potential impacts at a local level including use of:
  - existing utility easements
  - roads and access tracks
  - cleared fence lines and cadastral boundaries
  - areas of degraded vegetation
  - narrow sections of waterways and their associated flood zones.

As a result of the above process, the preliminary corridor between the Buronga and Four Corners was first refined to a narrower 500 metre buffer (one-kilometre overall corridor) and then further reduced to a 100 metre buffer (200 metre overall corridor) study area within which the proposed transmission line and associated easement would be located. This corridor would be located parallel to the existing 220kV transmission line easement between Buronga and Four Corners Road. In addition, consideration of the alignment to the east of Lockhart also resulted in the reduction of the proposal corridor to a 50 metre buffer (100 metre overall corridor), located parallel to existing transmission line easements in this area. These corridors avoided key environmental constraints and were confirmed as generally suitable through extensive landholder engagement.

Due to the complex nature and number of constraints, the process for refinement for the section of the proposal between Four Corners and Lockhart continued to be progressed, with this area representing a substantive section of the transmission line corridor where no existing transmission lines presently exist (i.e. ‘greenfield’ transmission line corridor). An overview of the corridor and alignment refinement undertaken for the section of the proposal between Four Corners and Lockhart is provided below.

3.3.3.1. Corridor refinements – Four Corners and Lockhart

In October 2020, an options assessment was undertaken to refine the preferred corridor between Four Corners and Lockhart. This section of the corridor was considered as three separate sections to better assess the specific constraints of each (refer to Figure 3-10). Route options for each section were identified and assessed as detailed in the following sections.

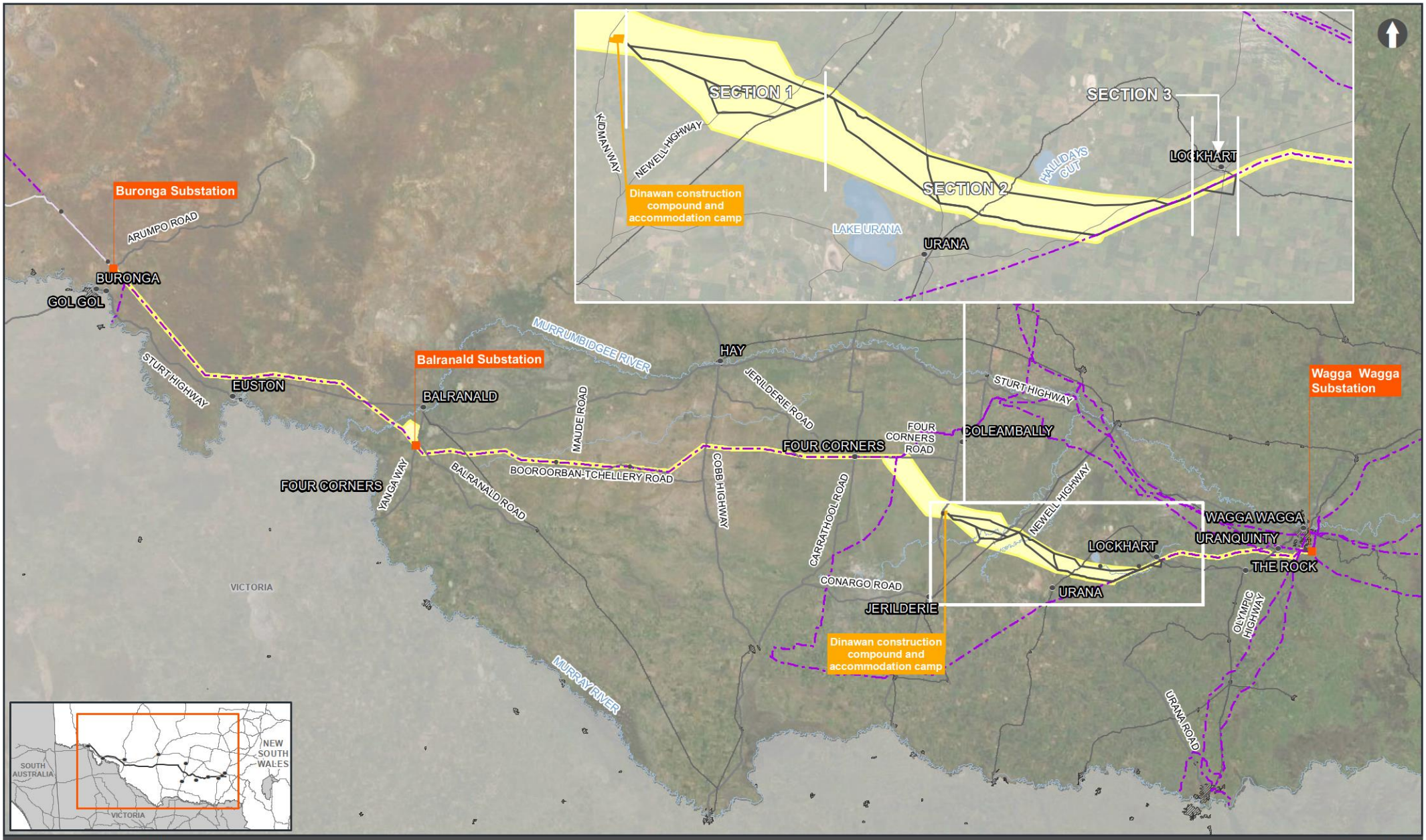


Figure 3-10

Consideration of alignment options between Four Corners and Lockhart

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\01_EIS\Chapter03_OptionsAssessment\PS117658_EIS_0310_AlignmentOptions_r1v5.mxd

Source: NSWSS, ESRI, Transgrid, WSP

Route options identified

Section 1 – Dinawan 330kV substation to Coonong Road

Section 1 would be around 30 kilometres in length between the proposed Dinawan 330kV substation and Morundah, around four kilometres east of the Newell Highway. Section 1 options are shown in Figure 3-11 and described below:

- Option 1a would run south-east from the proposed Dinawan 330kV substation before deviating south to cross Yanco Creek adjacent to Thurrowa Road. Turning east then northeast, Option 1a would follow the Newell Highway and the (former) Narrandera Tocumwal Railway before reaching the Coonong Road. Option 1a would have a total length of around 33.6 kilometres.

- Option 1b would run south-east from the proposed Dinawan 330kV substation before deviating to the east around Thurrowa Road, crossing Yanco Creek and Newell Highway to the (former) Narrandera Tocumwal Railway line. Turning north-east, Option 1b would run parallel to the railway easement before reaching Coonong Road. Option 1b would have a total length of around 30.8 kilometres.

- Option 1c would run east from the proposed Dinawan 330kV substation and would follow an existing fence line and cadastral boundaries deviating slightly south-east before crossing Yanco Creek and the Newell Highway before reaching Coonong Road. Option 1c would have a total length of around 29.7 kilometres.

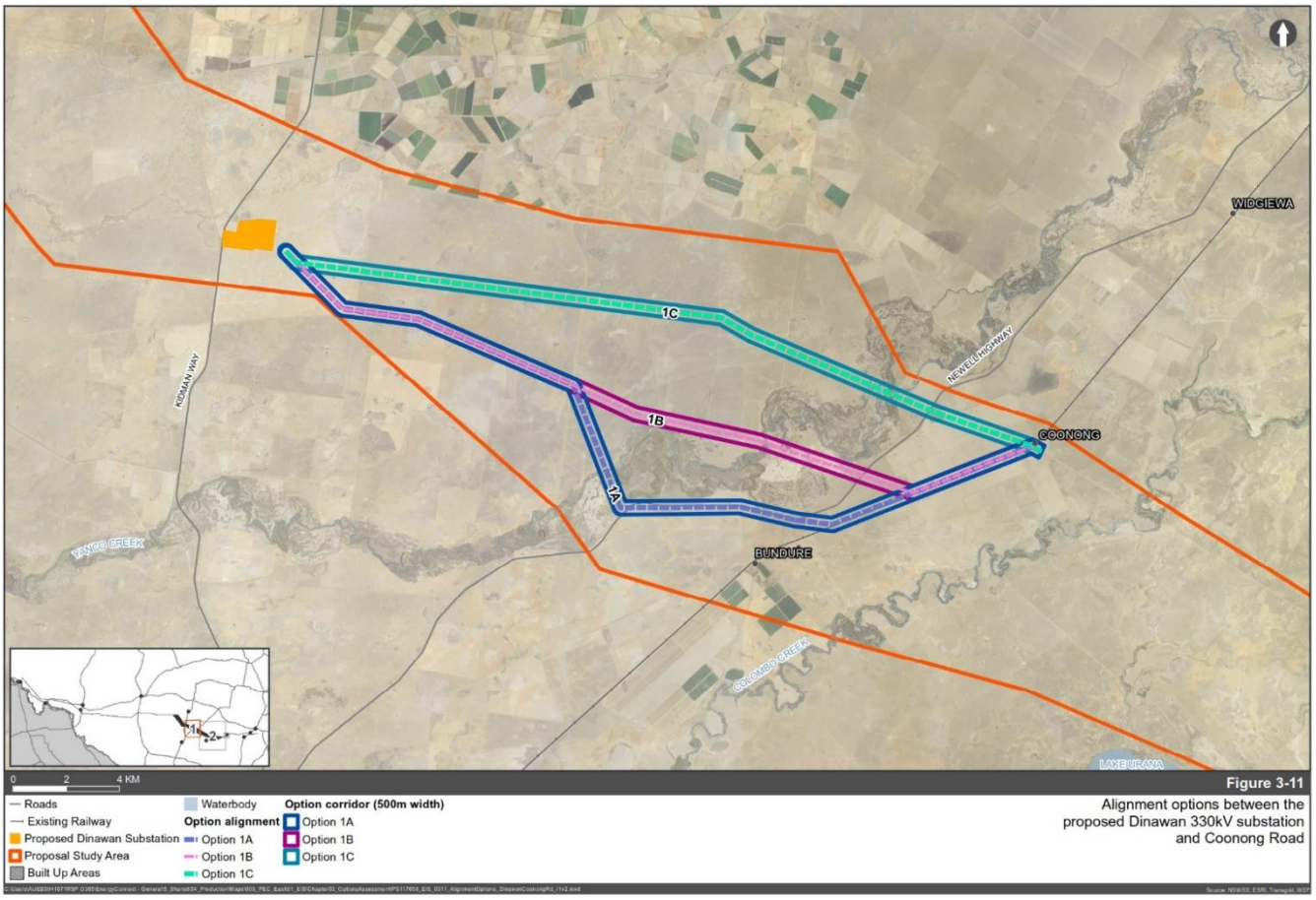


Figure 3-11 Alignment options between the proposed Dinawan 330kV substation and Coonong Road

Section 2 – Coonong Road to transmission line 99A

Section 2 would be around 60 kilometres in length between the Section 1 eastern connection at Morundah and a location around three kilometres south-west of the township of Lockhart. Section 2 options are shown in Figure 3-12 and are described below:

- Option 2a would run south-east from Coonong Road to Federation Way, north-east of Lake Urana. The alignment would continue east, traversing farmland and various local roads before reaching the existing transmission line 99A and turning north-east towards Lockhart to the common termination point located to the south-west of Lockhart. Option 2a would have a total length of around 59.8 kilometres.

- Option 2b would run parallel to Coonong Road towards Federation Way, before deviating to the south to run parallel to Federation Way towards the Urana township. Option 2b would then follow the Option 2a alignment from Federation Way until the common termination point located to the south-west of Lockhart. Option 2b would have a total length of around 60.9 kilometres.

- Option 2c would run parallel to Coonong Road until it reaches Federation Way. Option 2c would continue east at this point and would run parallel to Gums Road until Urana-Boree Creek Road. At this point, the option would continue east and to the south of Lake Cullivel to the Urana-Lockhart Road and the common termination point located to the south-west of Lockhart. Option 2c would have a total length of around 56.2 kilometres.

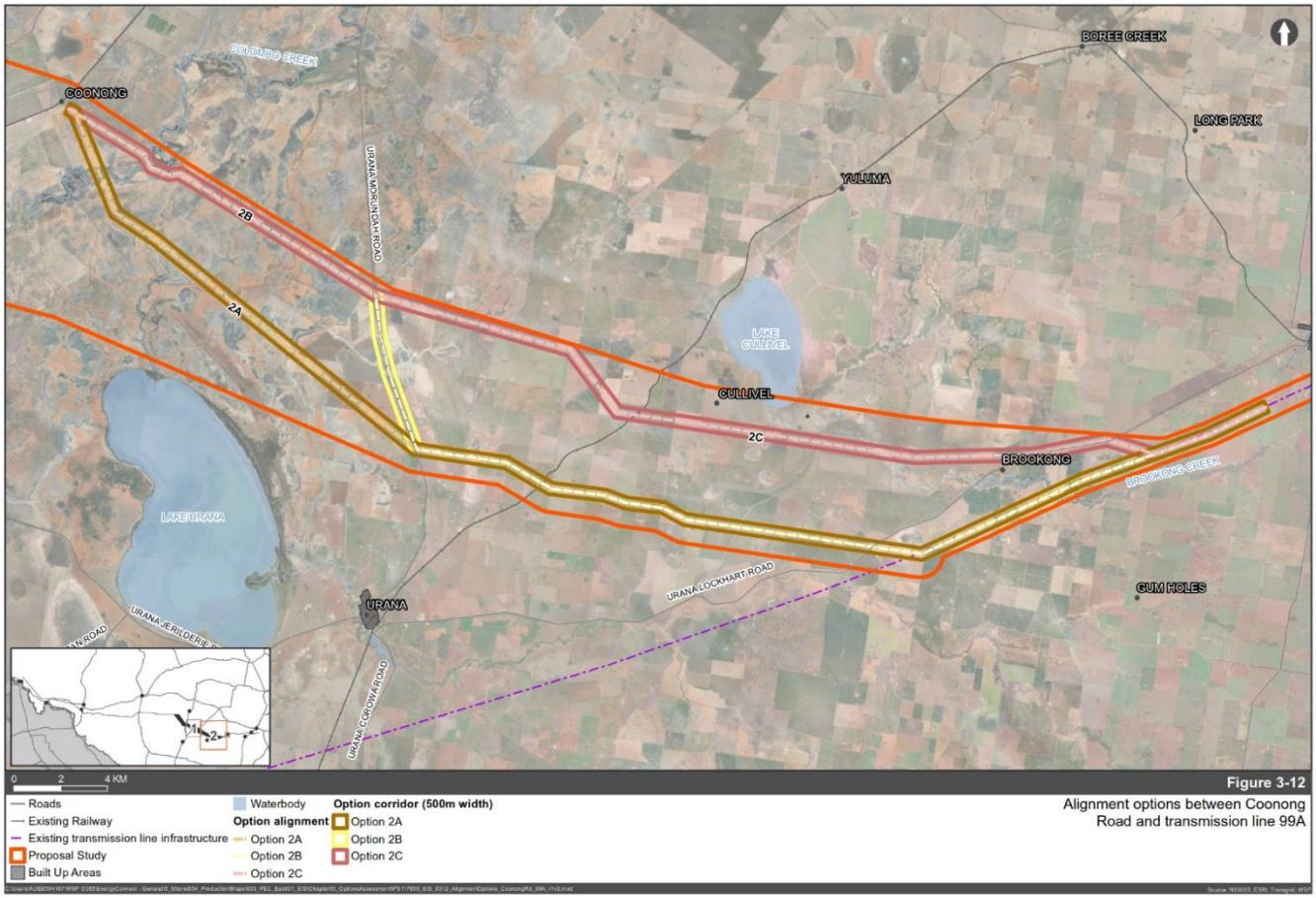


Figure 3-12 Alignment options between Coonong Road and transmission line 99A

Section 3 – Transmission line 99A to Lockhart

Section 3 options would be within the immediate area around the township of Lockhart from Tenison Lane to Lockhart-The Rock Road. Section 3 route options are shown in Figure 3-13 and described below:

- Option 3a would travel parallel to the existing 99A transmission line for about five kilometres between Tenison Road and Lockhart-The Rock Road.

- Option 3b would deviate from the existing 99A transmission line eastwards, paralleling Tenison Road for 4.1 kilometres, past Albury Road before heading north along an existing property boundary towards Napier Road and Lockhart-The Rock Road before re-joining the existing 99A transmission line to the east of Lockhart.

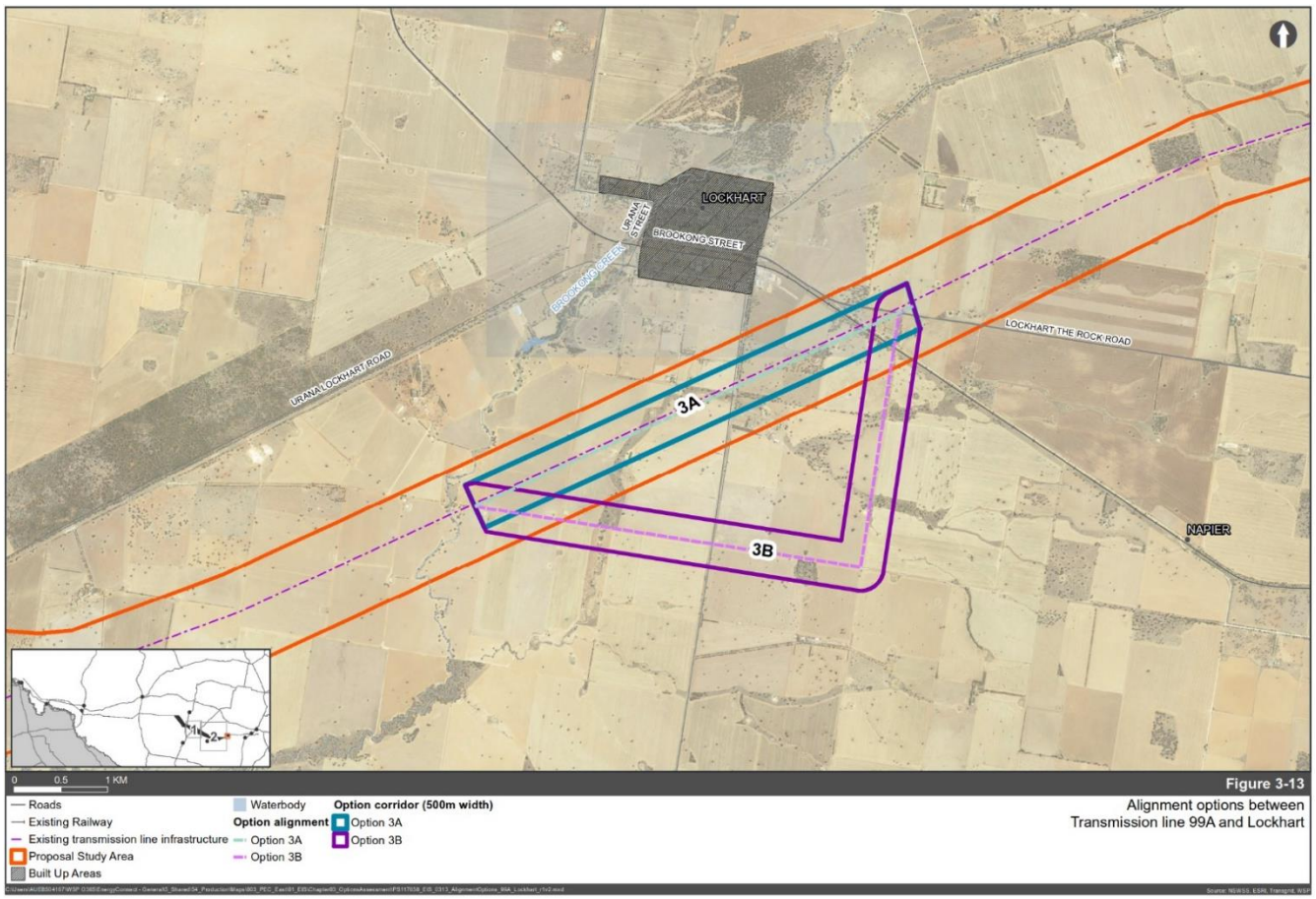


Figure 3-13 Alignment options between Transmission line 99A and Lockhart

Options evaluation criteria

The option analysis for the three sections used the evaluation criteria shown in Table 3-4 for the assessment of each option.

Table 3-4 Options evaluation criteria – Dinawan to Lockhart

Criteria	Description of criteria
Efficiency	The programme impacts and constructability of each option. This includes technical and engineering constraints, network constraints, waterway crossings and hydrological and flooding risks.
Capital cost	The difference in cost for each option.
Property impacts	The extent to which each option minimises impacts on property acquisition and adjacent properties.
Stakeholder impacts	The degree to which each option affects stakeholders and community, bearing in mind Transgrid's objective to preserve social licence through a safe, environmentally sustainable and culturally respectful approach.
Environmental and planning impacts	The extent to which each option minimises impacts on the environment and thereby planning approvals (including Tier 1, Tier 2 and Tier 3 constraints).

Options evaluation

Section 1 – Dinawan 330kV substation to Coonong Road

A summary of the options assessment for the proposed Dinawan 330kV substation to Coonong Road section is provided in Figure 3-14.

Figure 3-14 Options evaluation – proposed Dinawan 330kV substation to Coonong Road

Option 1a was identified as the preferred option across three of the five evaluation criteria, including potential property impacts, stakeholder impacts and cost. Option 1a was identified as having a somewhat higher impact from an environmental perspective than Option 1c, due to factors such as the increase area of impact around the riparian areas of Yanco Creek. However, the overall benefits across all of the identified criteria were considered to be superior for Option 1a.

Section 2 – Coonong Road to transmission line 99A

A summary of the options assessment for the Coonong Road to transmission line 99A section is provided in Figure 3-15.

Criteria	Option 2a	Option 2b	Option 2c
Efficiency	Medium impact	Medium impact	Low/negligible impact
Capital cost	High impact	Medium impact	Low/negligible impact
Property impacts	Medium impact	Medium impact	Low/negligible impact
Stakeholder impacts	Medium impact	Medium impact	Medium impact
Environmental and planning impacts	Medium impact	Medium impact	Medium impact

Key: High impact · Medium impact · Low/negligible impact

Figure 3-15 Options evaluation – Coonong Road to transmission line 99A

Option 2c was considered to be the preferred option (or present a neutral impact compared to the other options) in all criteria. It was estimated to cost significantly less than the other options and would make best use of existing opportunities such as roads and disturbed corridors to minimise impacts to agricultural operations.

Section 3 – Transmission line 99A to Lockhart

A summary of the options assessment for the Transmission line 99A to Lockhart section is provided in Figure 3-16.

Criteria	Option 3a	Option 3b
Efficiency	Low/negligible impact	Medium impact
Capital cost	Low/negligible impact	Medium impact
Property impacts	Medium impact	Low/negligible impact
Stakeholder impacts	High impact	Low/negligible impact
Environmental and planning impacts	Medium impact	Low/negligible impact

Key: High impact · Medium impact · Low/negligible impact

Figure 3-16 Options evaluation – Transmission line 99A to Lockhart

Following ongoing interaction and consultation with the local community, Option 3b was considered to be the preferred option. Option 3b was considered to address the two key elements of stakeholder feedback received for this section of the alignment being to:

- minimise negative impacts of locating an additional high voltage power line close to the Lockhart town centre
- minimise impacts to the proposed area of future land release/residential expansion to the south of the current town centre.

Option 3b would also avoid the future residential development area that is proposed to be developed by Lockhart Shire Council to the south of Lockhart.

3.3.4. Proposal easement and ongoing refinements

Based on each of the various levels of corridor refinement and options evaluation for each section of the proposal between Buronga and Wagga Wagga, a final proposal easement has been identified. This proposal easement is the basis of the transmission line alignment described in Chapter 5 of this EIS.

Ongoing refinements based on ongoing landholder discussions following the identification of the proposal corridor alignment in October 2020 have continued to influence limited sections of the proposal easement. These have included refinement of the alignment:

- to the north of Yanco Creek within the vicinity of Thurrowa Road to accommodate landholder feedback on their property
- within the vicinity of the Newell Highway at Bundure to avoid impacts to Plains Wanderer habitat as far as practicably possible
- to the east and south of Lake Cullivel to accommodate landholder feedback regarding potential impacts to their property and farming operations
- to avoid identified areas of Potential Archaeological Deposits (PADs) based on ongoing heritage investigations
- to minimise potential tower siting within the vicinity of water crossings and other water bodies.

These refinements have been captured as part of the description provided in Chapter 5.

3.4. Substation options

3.4.1. Dinawan 330kV substation

3.4.1.1. Substation location criteria

Following the determination of a preferred corridor that did not travel through Darlington Point (and therefore removing the opportunity for the proposal to connect to the existing Darlington Point 330kV substation), an alternative mid-point substation was required.

A series of criteria were developed for defining the location of options for the proposed new 330kV substation. These criteria included:

- the study area in which potential sites are to be investigated should:
  - recognise the requirements of the NSW transmission infrastructure strategy, the south-west REZ and the other identified priority projects listed in the *Draft 2020 ISP* (AEMO, December 2019)
  - from a system/network planning perspective optimally be located between around 150 and 175 kilometres west of the existing Wagga Wagga substation
- the proposed locations should:
  - allow sufficient space for future expansion, renewables connections and battery storage
  - consider opportunities for co-locating with existing transmission easements
  - consider existing constrained lands such as those associated with existing irrigation schemes and intensive/sensitive land uses
  - consider proximity to good quality road transportation
  - be large enough to provide an adequate setback from sensitive viewpoints and receivers (i.e. existing homes, regional roads, etc)
  - consider the relevant hierarchy of environmental constraints (previously outlined in Section 3.3.1).

3.4.1.2. Study area identification

The geographical extent of the study area for the new substation was determined from a review of existing mapping, other publicly available information and the location criteria identified above. The study area was around 105 kilometres wide (west to east) and 30 kilometres wide (north-south) and bounded by:

- the Cobb Highway to the west
- Kidman Way to the east
- the existing 220kV transmission line linking Balranald and Darlington Point substations to the north
- a nominal southern boundary consistent with the broader corridor option through this area.

Figure 3-17 provides an overview of the extent of the proposed Dinawan 330kV substation location study area.

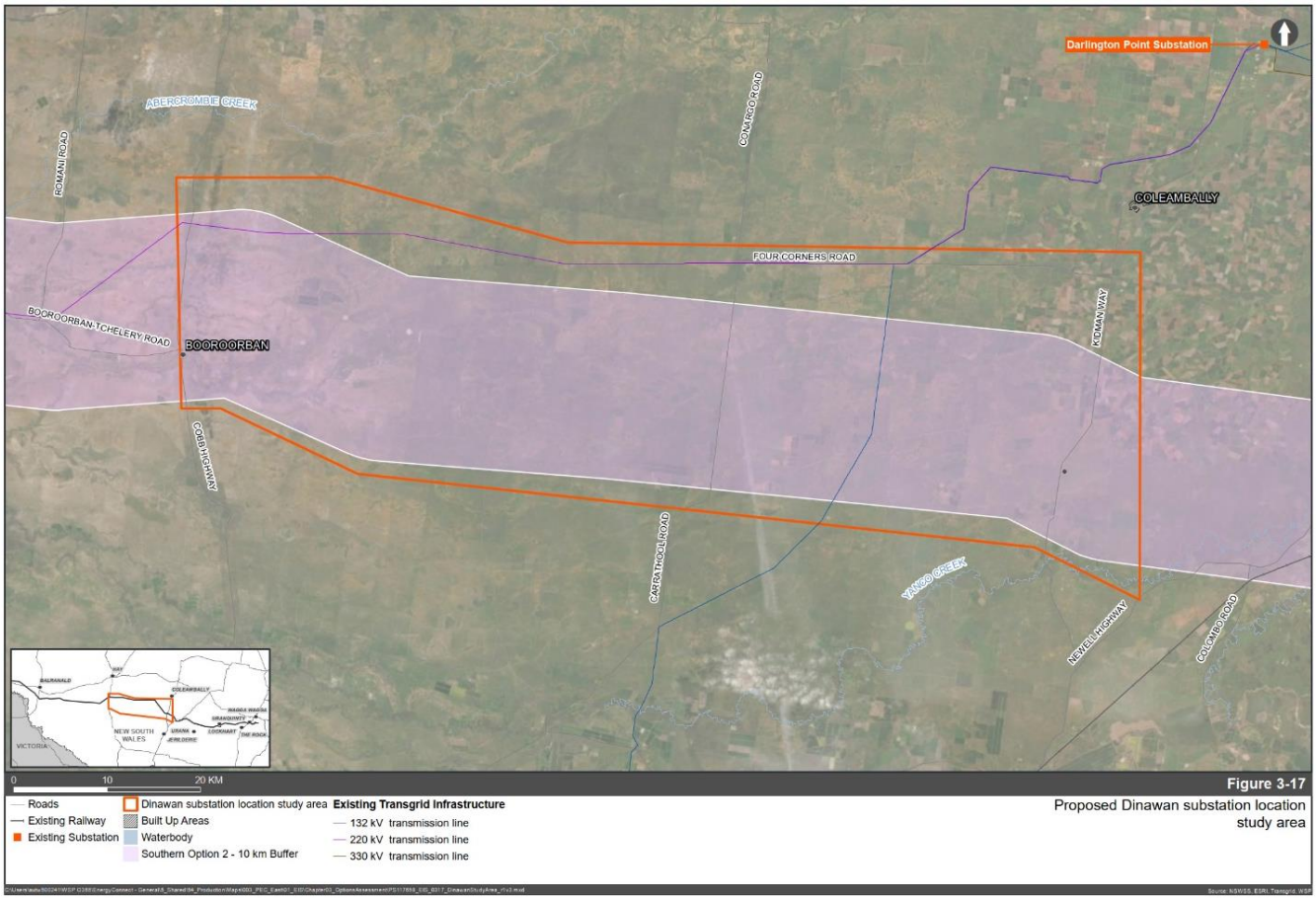


Figure 3-17 Proposed Dinawan 330kV substation location study area

3.4.1.3. Initial options identification

Following identification of a broad study area, an initial list of 24 preliminary options were identified. A series of site selection criteria were developed to assess the initial, long-list of potential sites. Table 3-5 summarises the selection criteria identified.

Table 3-5 Long-list options identification criteria

Criteria	Description
Property • existing land uses • land parcel sizes • extent of inhabitation • impacts to potential land use, developments and land use severance	• avoids known land use conflicts • considers proximity to residences • unlikely to affect existing land uses or influence the development of surrounding lands for current and similar purposes • a land parcel(s) of sufficient size to accommodate current and future needs (minimum 250 to 500 hectares) • a land parcel that can accommodate a buffer area that restricts encroachment from other land use development including renewables development • provides efficient access to the identified Renewable Energy Zone(s).
Environmental	• considers local environmental constraints: - potential/actual contamination - landform/topography - recorded sites and places of Aboriginal heritage significance - known/recorded flora/fauna and extent of vegetation coverage - potential noise impacts (distance to sensitive receivers) - potential visual impacts - flood potential.
Delivery/constructability • distance to existing sealed roads/ • length of new road access required • estimated earthworks.	• considers length and quality of existing road access • length of new roads required for upgrade • estimated cut/fill volumes • proximity to townships • distance to airports.
Network planning • distance to adjoining substation(s).	• for optimum network planning, without the need to substantially upgrade additional substation equipment, the new substation should be between around 150 and 175 kilometres west of the existing Wagga Wagga substation.

An initial review of a range of identified options using the criteria identified in Table 3-5 resulted in the shortlisting of a series of options within six general locations for further evaluation. Figure 3-18 shows the initial sites identified as well as the short-listed options that were considered further.

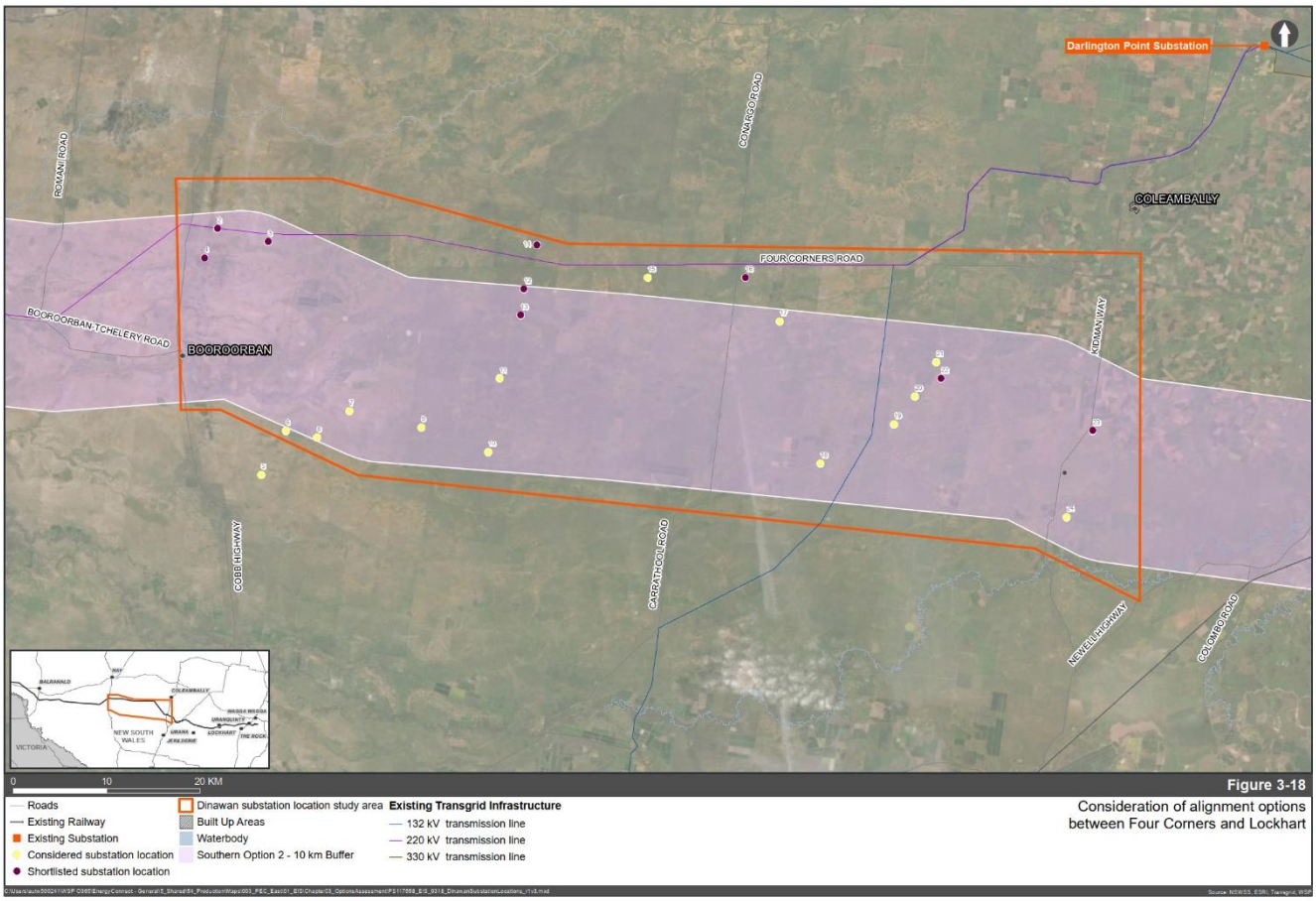


Figure 3-18 Long list of proposed Dinawan 330kV substation locations

A detailed evaluation of the short-listed options was conducted in November 2019. This evaluation determined:

- each of the short-listed parcels were suitably sized to meet the operational requirements of the proposal (i.e. minimum lot size required to accommodate the proposed infrastructure)
- options located in the central section and some options within the eastern section of the study area presented various constructability issues including:
  - no existing/established road network
  - cost implications of building long access roads
  - distance to regional centres
- options in the far eastern section of the study area were assessed as offering a greater potential to meet the long-list options identification criteria identified in Table 3-5
- a series of sites that provided location opportunities based on initial landholder engagement and feedback.

3.4.1.4. Revised shortlisted options

Following the evaluation of the short-listed options, it was recommended that further investigation of the options in the eastern section of the study area towards Kidman Way (sites 22A and 23A) be undertaken. Additionally, as part of the focus on the eastern section of the substation study area, two additional sites (Options 26 and 28) were added to the previously evaluated options based on landholder engagement and feedback opportunities, resulting in a total of four shortlisted options. The shortlisted options for further consideration area shown in Figure 3-19.

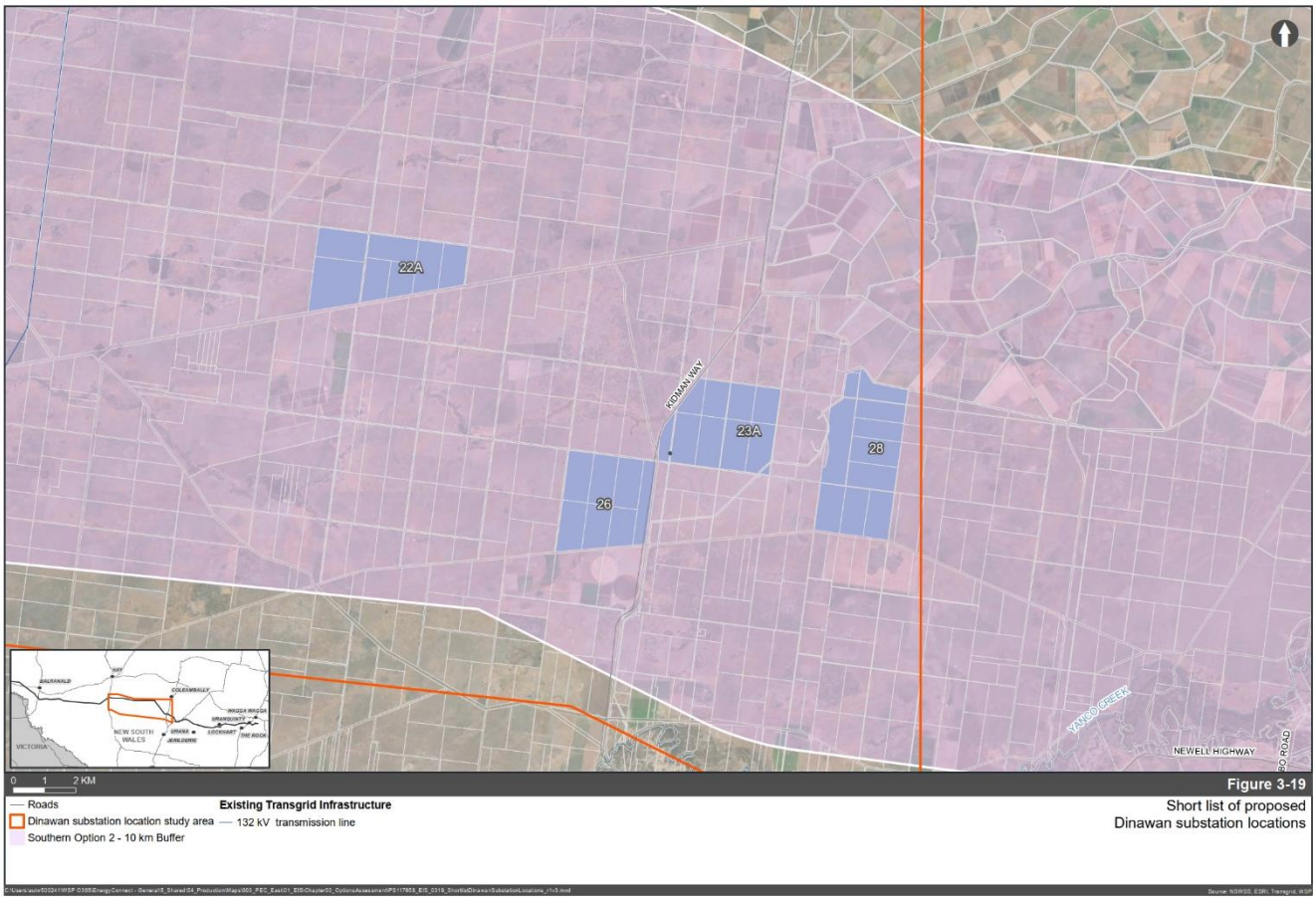


Figure 3-19 Short list of proposed Dinawan 330kV substation locations

Further evaluation of each of the four short-listed properties identified that each site presented similar environmental constraints such as impacts on biodiversity, heritage, land use, likelihood of contamination, however Option 23A was identified as the preferred option for the following reasons:

- minimal environmental constraints
- close proximity to a key transport route (Kidman Way)
- substantial distance from identified sensitive receivers
- the network planning criteria of being within up to 170 kilometres of the existing Wagga Wagga substation
- positive landholder feedback regarding the potential to site the substation on their property.

3.4.1.5. Consideration for future expansion to accommodate 500kV substation

Following the determination to construct the section of transmission line between the proposed Dinawan 330kV substation and the existing Wagga Wagga substation to allow for future transmission up to 500kV, the preferred substation site also considered the potential space requirements to accommodate a 500kV substation component.

While the current substation is proposed to be constructed to allow for operation at 330kV, the preferred substation site and design was confirmed as being sufficient in size (land area) to accommodate additional 500kV substation infrastructure (should this be required in the future) without the need to acquire additional land. The expansion of the proposed Dinawan 330kV substation to accommodate additional 500kV infrastructure would be subject to separate environmental approval and is not considered as part of the current proposal.

3.4.2. Wagga Wagga substation upgrade and expansion

The existing Wagga Wagga substation is located at the corner of Ashfords Road and Boiling Down Road, Gregadoo. The site for the upgrade and expansion is a generally open area within the existing substation site.

Given the need to connect the proposal to the existing substation to meet the operational requirements of EnergyConnect as a whole, no alternative connection locations outside the Wagga Wagga substation were considered. However, the position of the upgrade and expansion has been located in an area of the existing substation site that has been previously disturbed and that would limit the extent of alterations required to infrastructure.

3.5. Main construction compounds and accommodation camps

In addition to the transmission line corridor, several main construction compounds and accommodation camps would be required along the corridor to support construction. The primary objective for locating these sites was to minimise environmental and community impacts, while addressing landholder requirements and being suitably located at key strategic locations to support construction activities across the transmission line corridor.

Key factors applied to the identification of potential main construction compounds and accommodation camps included:

- being in areas which have previously been disturbed, or would already require disturbance as part of the construction of the proposal
- no impacts to threatened species (or their habitats) or threatened ecological communities (within the meaning of the BC Act or the EPBC Act)
- being located on sites of identified lower ecological and heritage value
- being located an appropriate distance from watercourses (i.e. locations greater than 200 metres away)
- being located an appropriate distance from sensitive receivers to minimise potential impacts (i.e. enabling adequate separate from residential buildings) with consideration of matters such as compliance with the *Interim Construction Noise Guideline* (ICNG) (DECCW, 2009), traffic, transport and access impacts, dust impacts, and visual (including light spill) impacts
- sites being of relatively level ground to minimise earthwork requirements and offsite drainage risks
- of minimal environmental impact with respect to flooding

- proximity to key construction activities to minimise durations of travel for workforce and transport of materials and equipment including generally even spacing along the alignment to minimise travel
- easily accessible for heavy vehicle construction traffic (including deliveries).

Details of the proposed main construction compounds and accommodation camp sites along the alignment of the proposal are provided in Section 6.7.1 of this EIS.

For two of the main construction compounds and accommodation camp sites, options for the final site have been considered as part of this EIS. These consist of:

- two alternative locations for the proposed Balranald site (including a separated construction compound and accommodation camp option and a combined option)
- two alternative locations for the combined construction compound and accommodation camp at Lockhart including one to the west of Lockhart and one to the north east).

The additional site locations have been included to enable further landholder engagement and environmental investigation of the construction compounds and accommodation camp sites prior to identification of the final preferred location.

4. Proposal setting

This chapter describes the location and setting of the proposal for the purpose of the EIS. It provides a summary of the key environmental features and the broader setting for the proposal.

4.1. Location

The proposal spans from the western region of NSW at Buronga to the southern-central portion of NSW at Wagga Wagga. The proposal is around 540 kilometres in length and runs in a generally east-west orientation from the existing Buronga substation on the northern outskirts of Buronga to the existing Wagga Wagga substation around 10 kilometres south of Wagga Wagga, NSW.

The proposal is located across a number of LGAs including:

- western portion of the proposal:
  - Wentworth
  - Balranald
  - Edward River
- central portion of the proposal:
  - Hay
  - Murrumbidgee
- eastern portion of the proposal
  - Federation
  - Lockhart
  - Wagga Wagga.

The proposal also spans several Local Aboriginal Land Councils (LALCs), including the following:

- western portion of the proposal
  - Dareton LALC
  - Balranald LALC
- central portion of the proposal
  - Hay LALC
  - Deniliquin LALC
  - Cummeragunja LALC
- eastern portion of the proposal
  - Griffith LALC
  - Narrandera LALC
  - Wagga Wagga LALC.

The proposal would be located predominantly within rural and regional areas of western NSW. Key population and service centres located within the broader vicinity of the proposal would include Buronga, Gol Gol, Euston, Balranald, Hay, Coleambally, Jerilderie, Urana, Lockhart, The Rock, Uranquinty and Wagga Wagga.

A majority of the area in which the proposal would be located is predominantly flat with some more pronounced greater topography changes towards the Wagga Wagga end of the proposal. Overall, the sections of the proposal study area can be categorised as follows:

- western portion – This section is generally flat with minimal undulating elevations. Land is predominantly used for grazing with some cropping areas

- central portion – This section of the alignment consists of generally flat areas minimal elevations changes. The elevation is generally rising when moving towards the eastern side of the section. Land in this area is predominantly used for grazing, cropping and irrigated cropping. The proposal would cross a number of major roadways in this area including the Sturt Highway, Cobb Way, Kidman Way, Federation Way and Newell Way. The proposed Dinawan 330kV substation is also located within this section

- eastern portion – This section of the alignment consists of some slightly undulated terrain as well as low hills and undulating terrain, primarily east of The Rock. Land in this area is predominantly used for grazing and cropping (including irrigated cropping). The proposal would cross Olympic Highway in the section.

An overview of the alignment of the proposal is shown in Figure 4-1. A detailed description of the alignment of the proposal is provided in Section 5.3 of this EIS. Photographs generally showing an overview of the various existing land uses and environment within and surrounding the proposal, are provided as Photo 4-1 to Photo 4-22. An overview of the locations of the photos is also shown on Figure 4-1 (photo reference numbers are attached to each photo).

Figure 4-1

Site location photographs

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Source: NSWSS, ESRI, Transgrid, WSP

Photo 4-1 Photograph 1 | Photograph of the existing Buronga substation and surrounding environment

Photo 4-2 Photograph 2 | Photograph of the existing transmission line easement south of Buronga

Photo 4-3 Photograph 3 | Photograph of the existing easement north of Euston

Photo 4-4 Photograph 4 | Photograph of the existing easement west of Euston

Photo 4-5 Photograph 5 | Photograph looking south of the existing at the crossing point with Sturt Highway, west of Balranald

Photo 4-6 Photograph 6 | Photograph looking north of the existing at the crossing point with Sturt Highway, west of Balranald

Photo 4-7 **Photograph 7 | Photograph of the existing easement and agricultural fields looking from Windomal Road, south east of Balranald**

Photo 4-8 **Photograph 8 | Photograph of the existing Balranald substation, Balranald**

Photo 4-9 **Photograph 9 | Photograph of the existing easement and agricultural fields opposite the Balranald substation, Balranald**

Photo 4-10 Photograph 10 | Photograph of an existing access track off Maude Road south east of Keri Keri

Photo 4-11 Photograph 11 | Photograph of the existing easement along the Booroorban-Tchelery Road, east of Maud Road

Photo 4-12 Photograph 12 | Photograph of the existing easement within the Hay Plains region, south of Hay

Photo 4-13 Photograph 13 | Photograph of the existing easement and alignment of Four Corners Road, Mabins Well

Photo 4-14 Photograph 14 | Photograph of the proposed Dinawan 330kV substation site, south of Coleambally

Photo 4-15 Photograph 15 | Photograph of the existing vegetation within the vicinity of Yanco Creek, Bundure

Photo 4-16 Photograph 16 | Photograph of the (former) Narrandera Tocumwal Railway at the crossing point of Colombo Road, Bundure

Photo 4-17 Photograph 17 | Photograph of Gums Road looking, north of Urana

Photo 4-18 Photograph 18 | Photograph of the existing Brookong State Forest, south of Lockhart

Photo 4-19 Photograph 19 | Photograph of the existing easement, looking east from Bullenbong Road, The Rock

Photo 4-20 Photograph 20 | Photograph of the existing easement, looking east along Olympic Highway, south of Uranquinty

Photo 4-21 Photograph 21 | Photograph of the existing easement along Boiling Down Road, west of the existing Wagga Wagga substation

Photo 4-22 Photograph 22 | Photograph of the existing Wagga Wagga substation and surrounding landscape looking north from Boiling Down Road

4.2. Future setting

Generally, the typically agricultural setting of the region is not expected to substantially change from its current nature.

As discussed in Section 2.2.3, several REZs have been identified across the NEM. In the vicinity of EnergyConnect (including the proposal) these include the South West NSW, Wagga Wagga, Murray River and Riverland REZs (refer to Figure 4-2). These REZs are currently starting to augment some elements of the existing setting such as the ongoing development of recent solar farms at the Limondale Solar Farm to the west of the existing Balranald substation.

The setting of the far western end of the proposal will also be affected by the approved upgrade and expansion of the existing Buronga substation (as approved as part of EnergyConnect (NSW – Western Section).

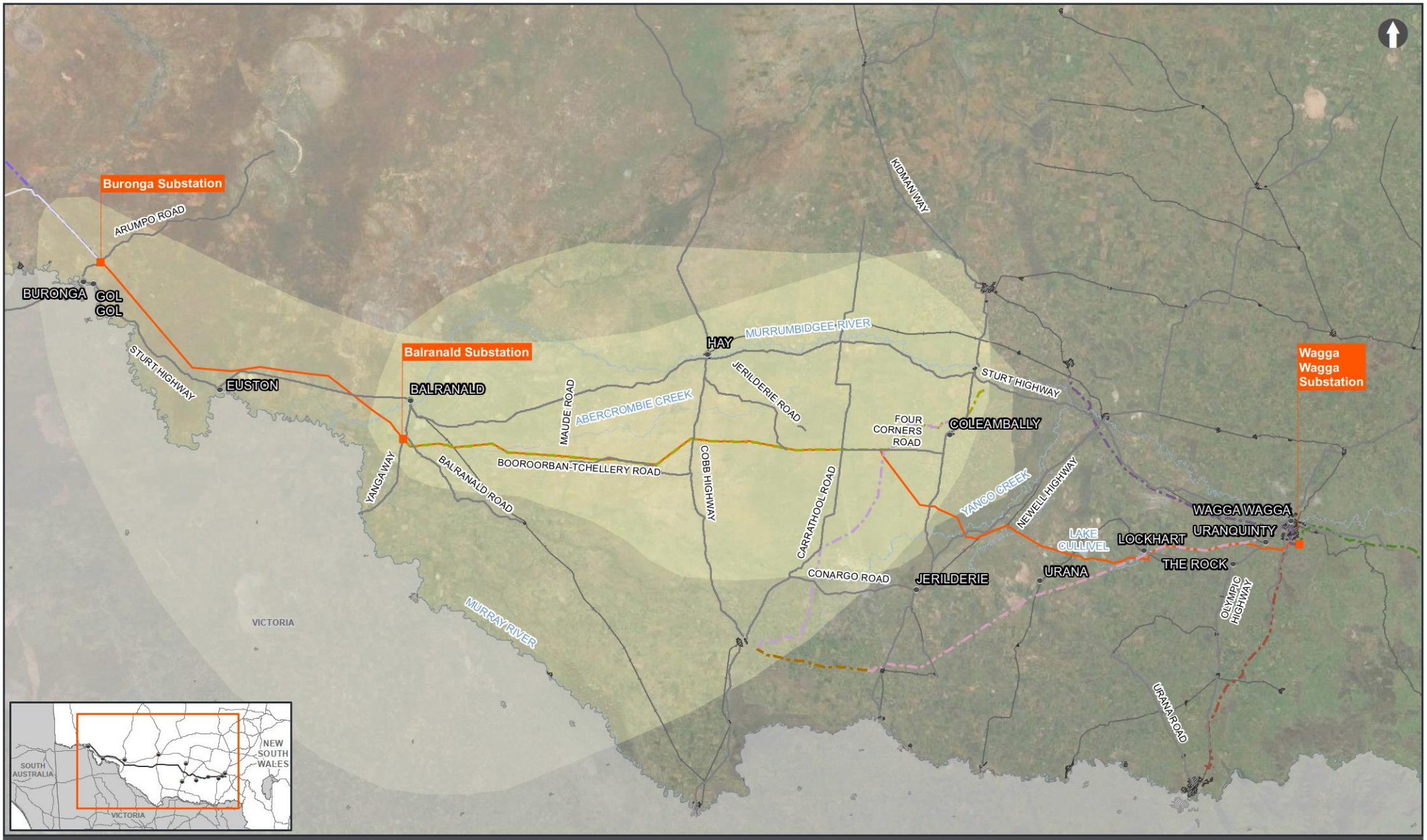


Figure 4-2

Identified REZ along the alignment

4.3. Sensitive receivers

Sensitive receivers include both human related and environment related receivers. Sensitive receivers for the purposes of this EIS included locations where people are likely to reside or work and in include dwellings, schools, hospitals, offices or public recreational areas. To identify the potential sensitive receivers within the vicinity of the proposal, a review of the available aerial photography was undertaken and where possible, field validated through on-site confirmation. No residential buildings have been identified directly within the project easement or within the identified construction impact area.

At a broad scale, the proposal would only impact on a small number of sensitive receivers for a majority of the alignment between Buronga and the proposed Dinawan substation. East of the proposed Dinawan substation, there would be smaller areas of more densely located sensitive receivers, typically around the following:

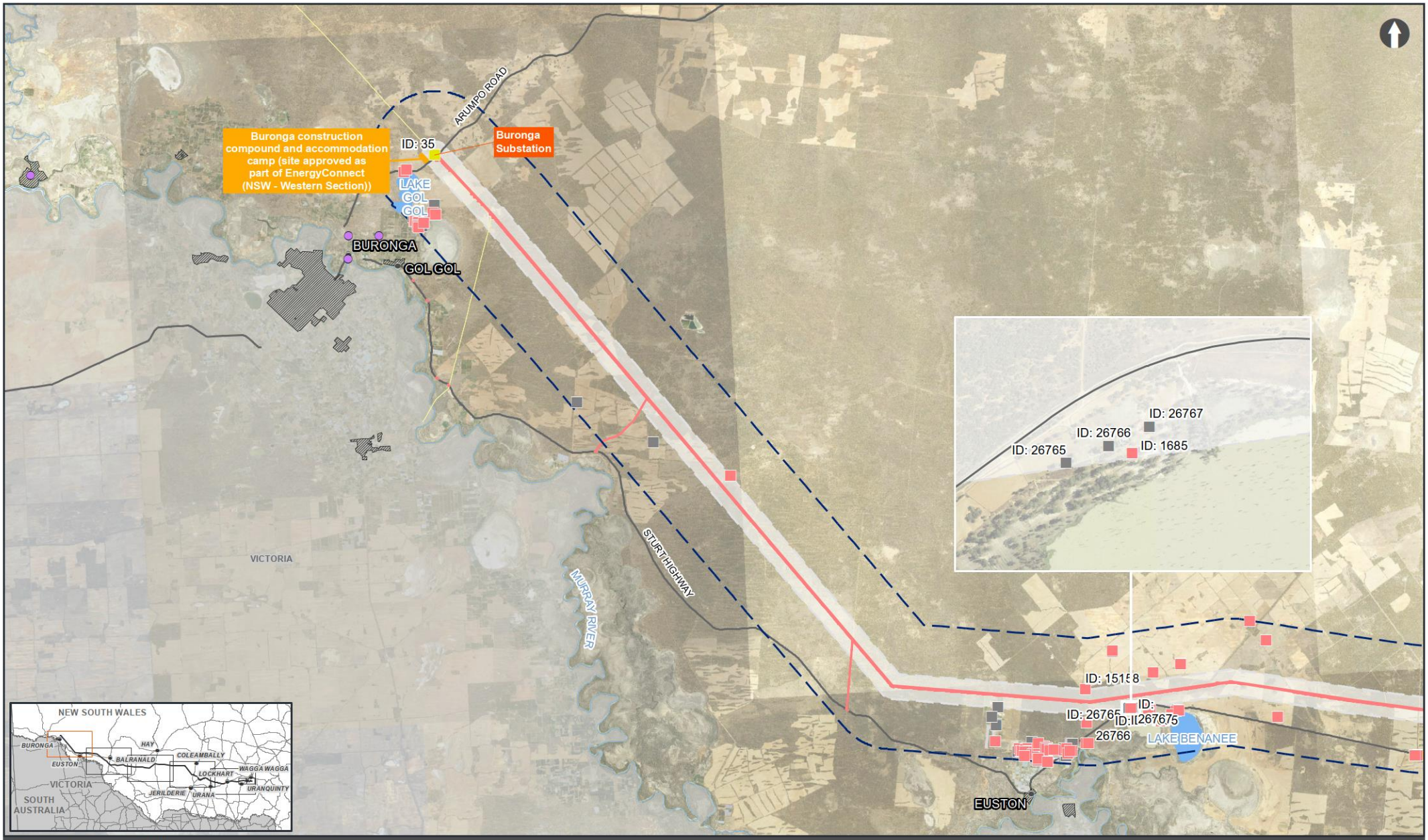
- the townships of Lockhart, Uranquinty and Wagga Wagga
- a small cluster of receivers within the vicinity of Lake Benanee
- a cluster of receivers to the west of Lake Cullivel.

The closest individual sensitive receiver to the proposed operational infrastructure is located about 50 metres from the transmission lines at Cullivel. However, most identified sensitive receivers are located more than 100 metres from the proposal. The nearest sensitive receiver to the proposed Dinawan 330kV substation site is located about 4.5 kilometres from the site.

Within the vicinity of the proposed operational infrastructure, the following number of sensitive receivers have been identified:

- 11 total receivers within 200 metres of the proposal
- 56 total receivers within 500 metres of the proposal
- 152 total receivers within one kilometre of the proposal
- 641 total receivers within two kilometre of the proposal
- 5,875 total receivers within five kilometre of the proposal.

All identified sensitive receivers located within five kilometres of the proposal have been mapped and shown on Figure 4-3. Additionally, sensitive receivers which are located within one kilometre of the proposal have also been identified with specific building reference numbers.



Project Components
- Construction Impact Area
- Water Fill Point
- Within 1km of the Proposal
- Within 5km of the Proposal
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Built Up Areas
- Waterbody

Sensitive Receptors
- Residential dwelling
- Community facility
- Industry facility
- Utility facility

Figure 4-3
Sensitive Receptors (Within 5km of Alignment)

Note: ID numbers have been included for receivers within 1 kilometre of the proposal

Sheet 1 of 7

Source: NSWSS, ESRI, Transgrid, WSP

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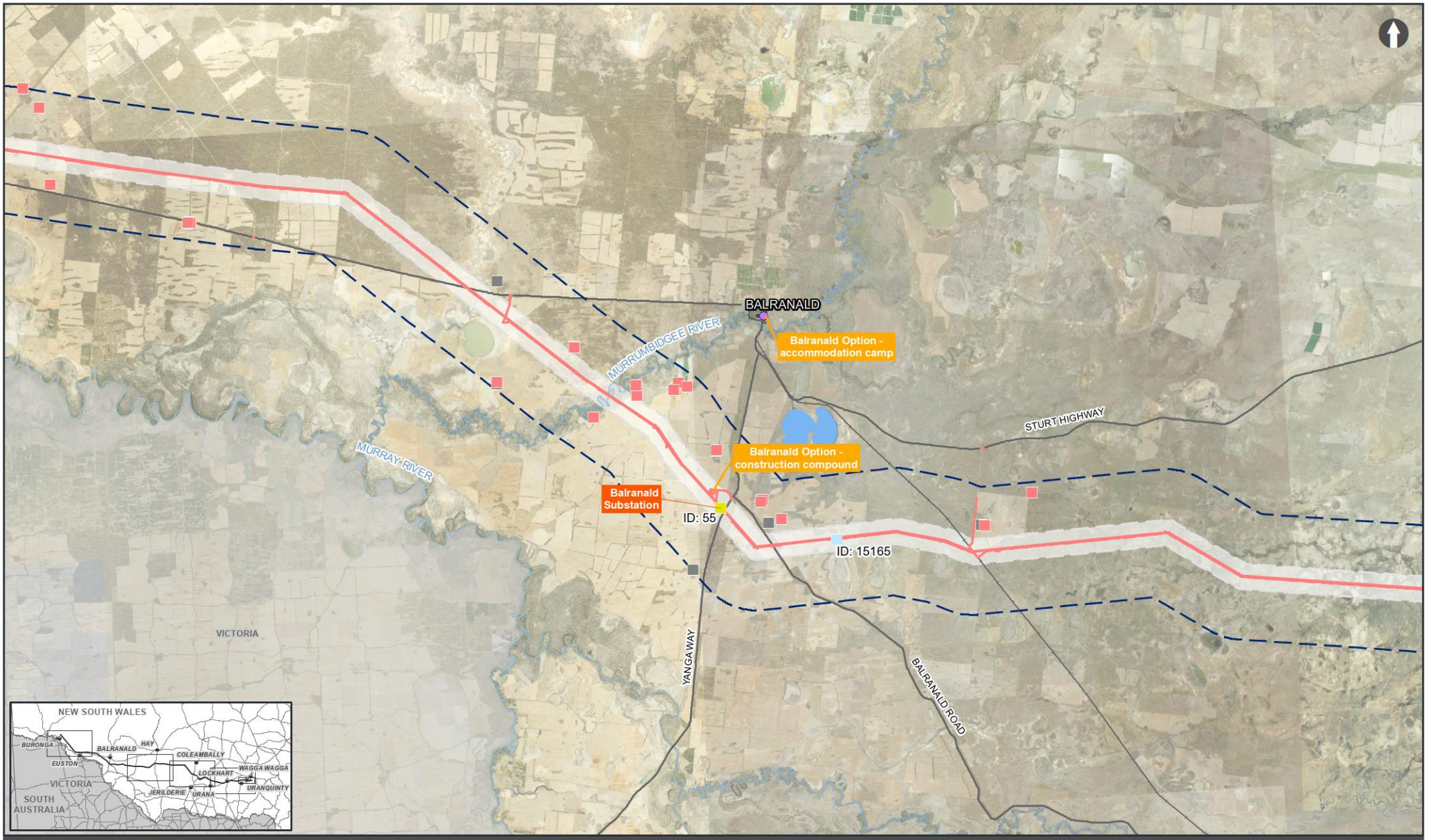

Figure 4-3
Sensitive Receptors (Within 5km of Alignment)

Project Components
- Construction Impact Area
- Water Fill Point
- Within 1km of the Proposal
- Within 5km of the Proposal
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Built Up Areas
- Waterbody

Sensitive Receptors
- Residential dwelling
- Community facility
- Industry facility
- Shed
- Utility facility

Note: ID numbers have been included for receivers within 1 kilometre of the proposal

Source: NSWSS, ESRI, Transgrid, WSP

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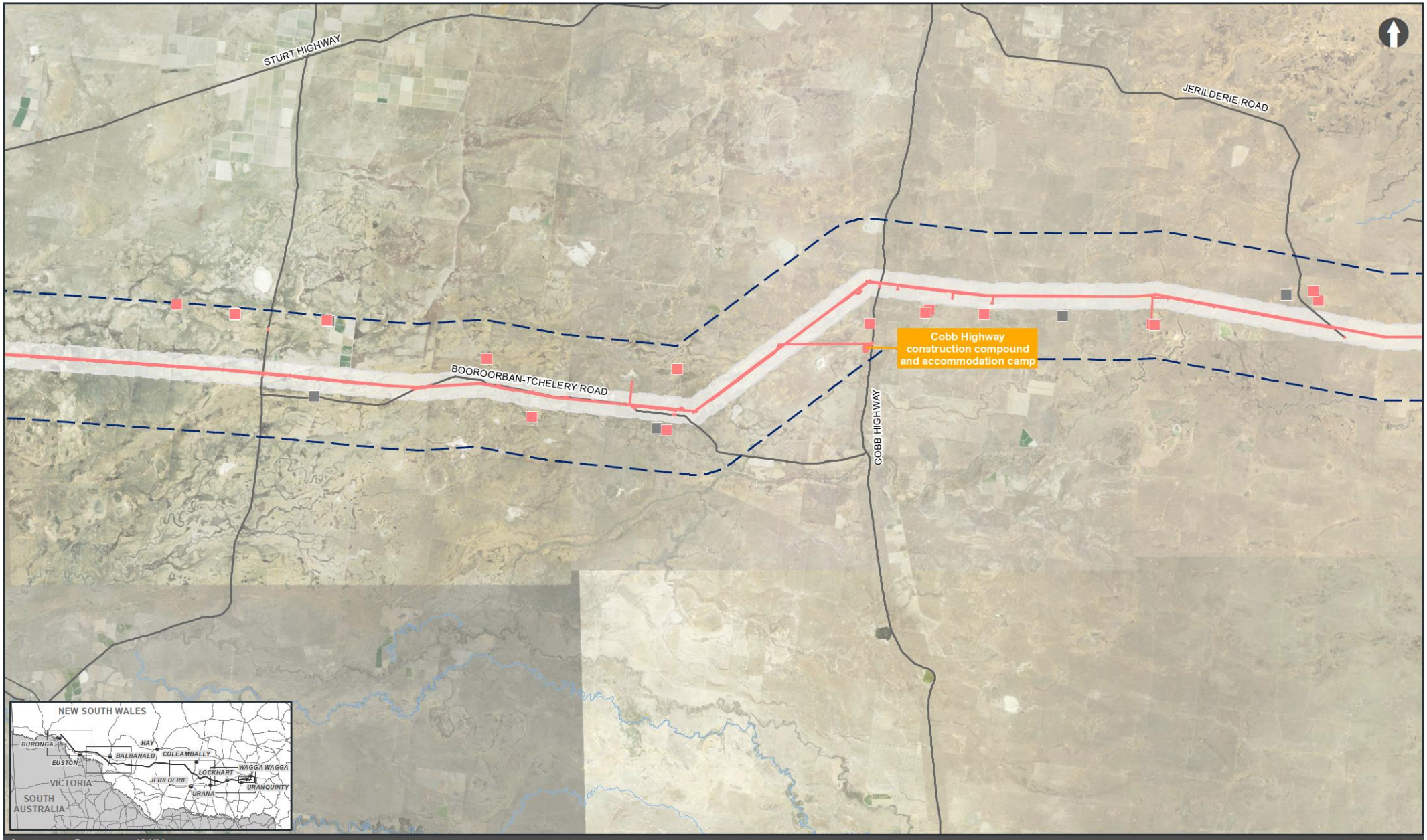

Project Components

- Construction Impact Area
- Water Fill Point
- Within 1km of the Proposal
- Within 5km of the Proposal
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Built Up Areas
- Waterbody

Sensitive Receptors

- Residential dwelling
- Industry facility

Figure 4-3

Sensitive Receptors (Within 5km of Alignment)

Note: ID numbers have been included for receivers within 1 kilometre of the proposal

Sheet 3 of 7

Source: NSWSS, ESRI, Transgrid, WSP

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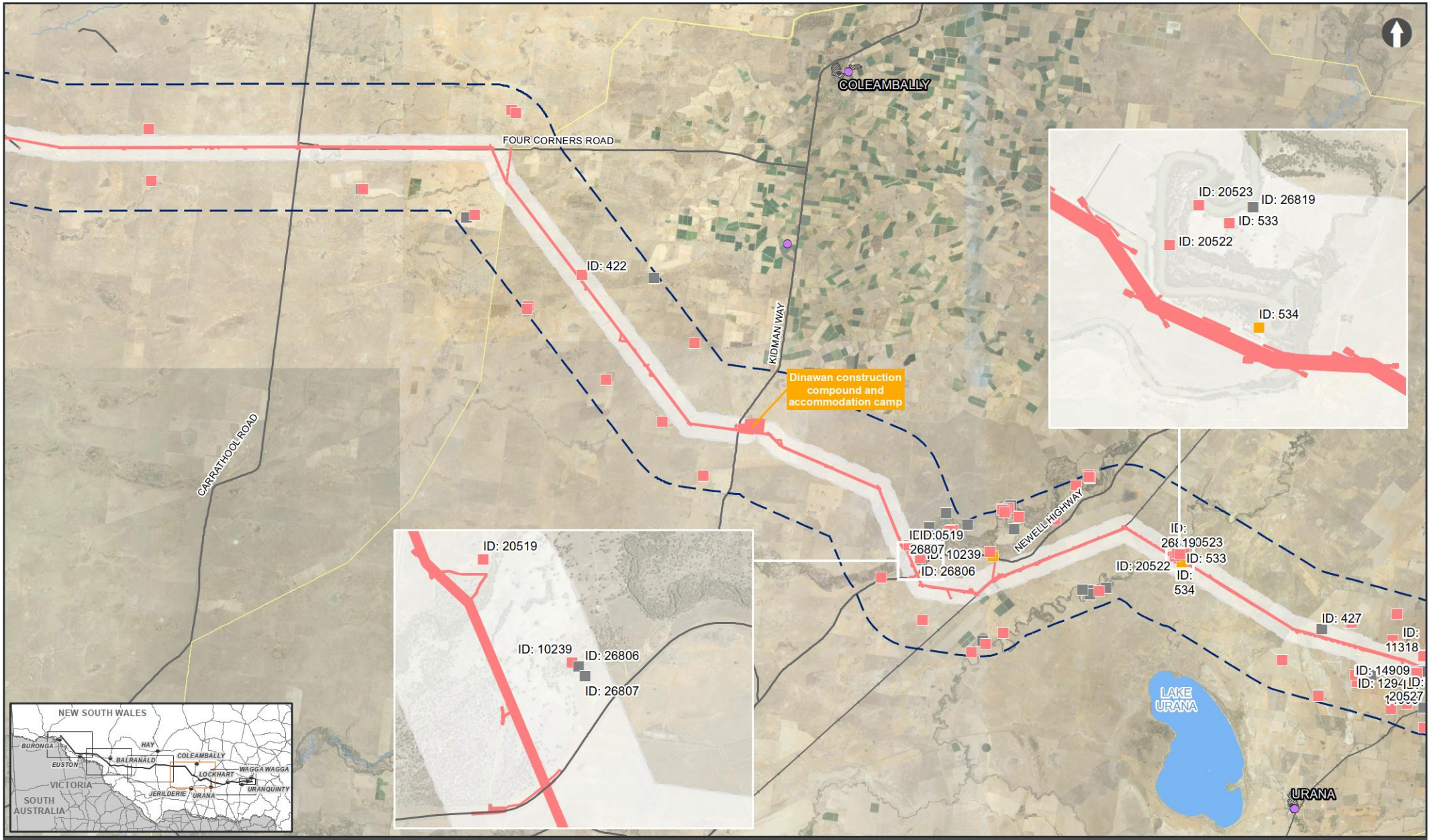

Project Components

- Construction Impact Area
- Water Fill Point
- Within 1km of the Proposal Alignment
- Within 5km of the Proposal Alignment
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Built Up Areas
- Waterbody

Sensitive Receptors

- Residential dwelling
- Community facility
- Industry facility

Figure 4-3

Sensitive Receptors (Within 5km of Alignment)

Note: ID numbers have been included for receivers within 1 kilometre of the proposal

Source: NSWSS, ESRI, Transgrid, WSP

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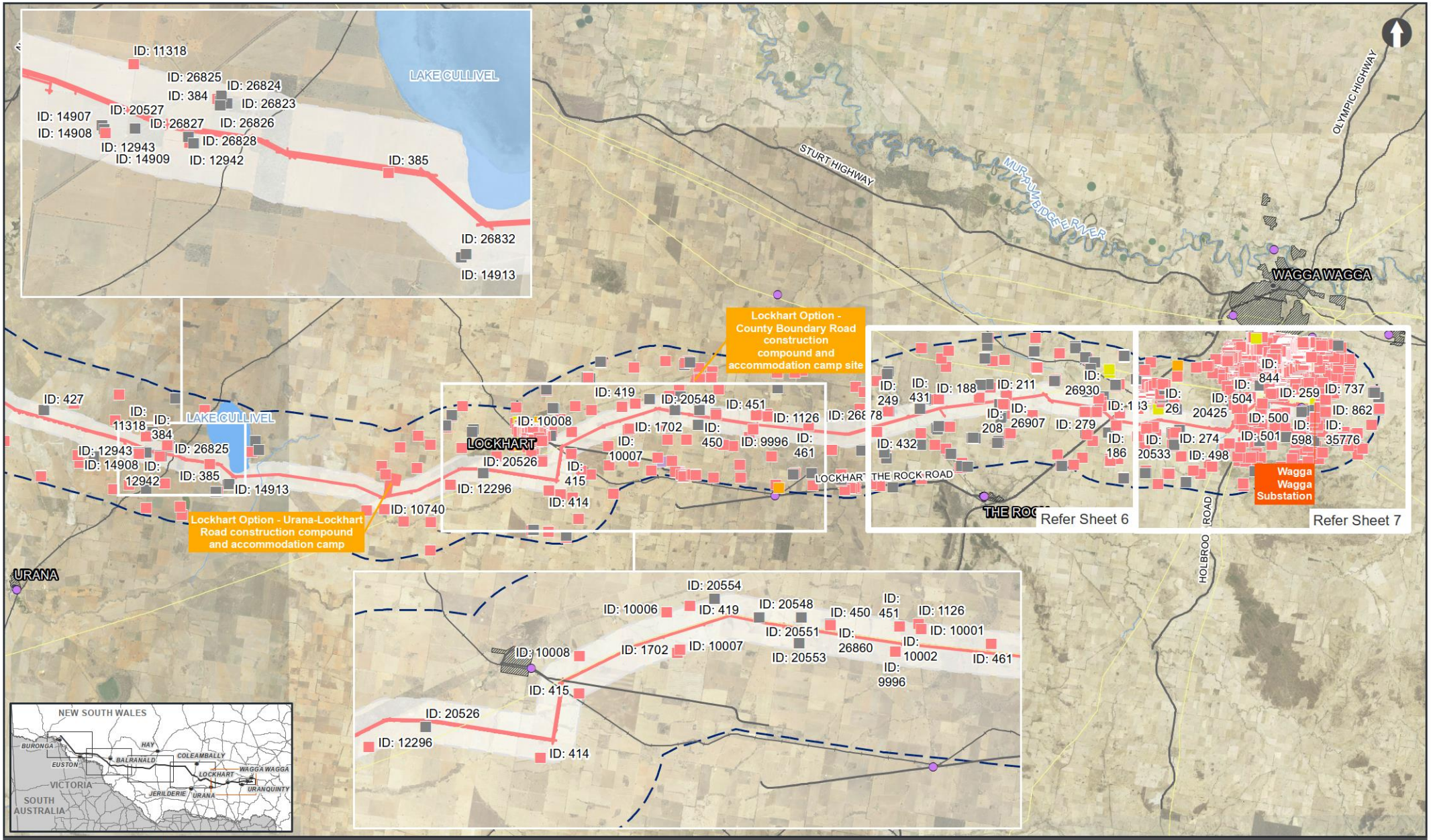

Figure 4-3

Sensitive Receptors (Within 5km of Alignment)

Project Components
- Construction Impact Area
- Water Fill Point
- Within 1km of the Proposal Alignment
- Within 5km of the Proposal Alignment
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Built Up Areas
- Waterbody

Sensitive Receptors
- Residential dwelling
- Community facility
- Education facility
- Industry facility
- Recreation facility
- Religious facility
- Utility facility

Note: ID numbers have been included for receivers within 1 kilometre of the proposal

Source: NSWSS, ESRI, Transgrid, WSP

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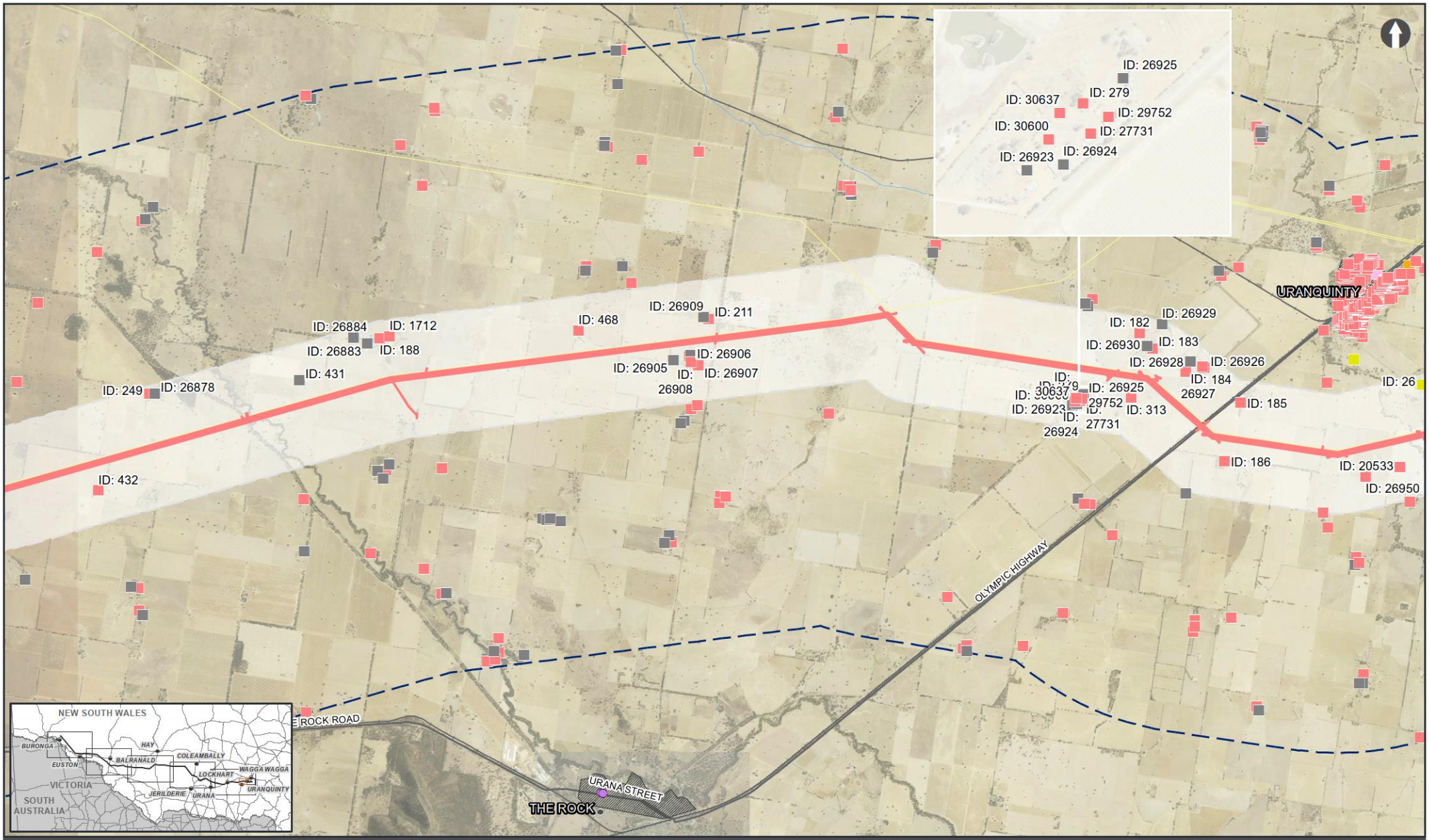

Figure 4-3

Sensitive Receptors (Within 5km of Alignment)

Project Components
- Construction Impact Area
- Water Fill Point
- Within 1km of the Proposal
- Within 5km of the Proposal
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Built Up Areas
- Waterbody

Sensitive Receptors
- Residential dwelling
- Community facility
- Education facility
- Industry facility
- Utility facility

Note: ID numbers have been included for receivers within 1 kilometre of the proposal

Source: NSWSS, ESRI, Transgrid, WSP

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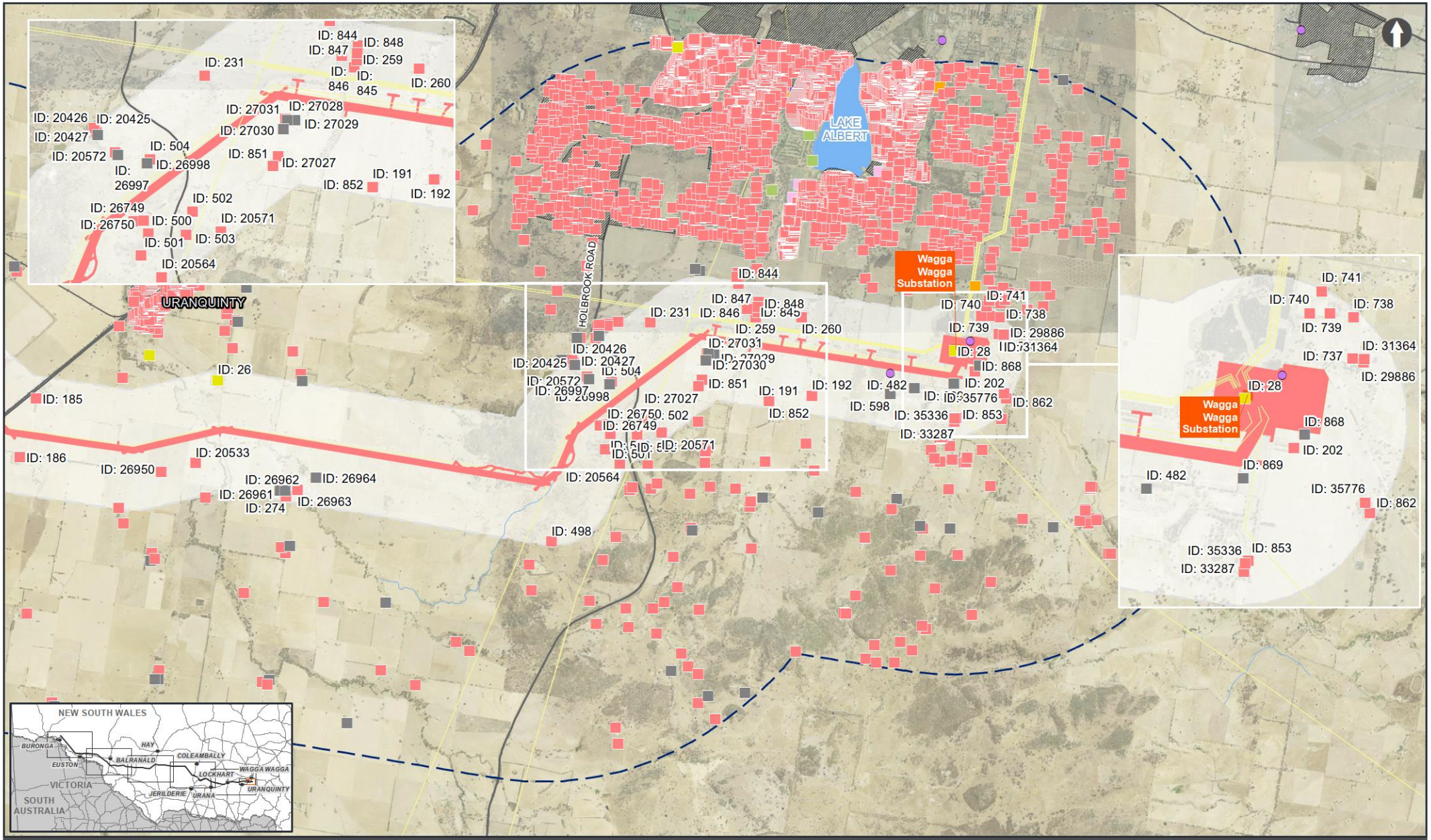

Project Components
- Construction Impact Area
- Water Fill Point
- Within 1km of the Proposal
- Within 5km of the Proposal
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Built Up Areas
- Waterbody

Sensitive Receptors
- Residential dwelling
- Community facility
- Education facility
- Industry facility
- Recreation facility
- Utility facility

Figure 4-3
Sensitive Receptors (Within 5km of Alignment)

Note: ID numbers have been included for receivers within 1 kilometre of the proposal

Source: NSWSS, ESRI, Transgrid, WSP

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5. Proposal infrastructure and operation

This chapter provides a description of the key elements of the proposal, including the proposed transmission lines, proposed Dinawan 330kV substation and works associated with the upgrade and expansion of the Wagga Wagga substation. This chapter also outlines how the proposal would operate and be maintained. A description of how the proposal would be constructed is provided in Chapter 6 (Proposal construction).

The description of the proposal components presented in this chapter is based on the current design. Some elements of the final proposal infrastructure location may continue to be refined as part of the finalisation of the design. For this EIS, a proposed operational easement has been defined within which the proposal would be operated following construction.

5.1. Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to description of the proposal and where these requirements are addressed in this EIS are outlined in Table 5-1.

Table 5-1 Secretary's environmental assessment requirements – Proposal infrastructure and operation

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
General requirements	The EIS must include:	
	• a full description of the project, accompanied by suitable maps and plans, including the:	This chapter provides an operational description of the proposal, and is supported by maps and figures throughout the chapter.
	- disturbance area	The construction impact area for the proposal is described in Section 6.4. A more defined disturbance area for the biodiversity and heritage assessments is described in Section 8.1.1).
	- physical layout of the project over time, including sections of key components	The transmission line easement is shown in Figure 5-2a to Figure 5-2e, with typical arrangement of each transmission line tower in Figure 5-3 (330kV towers) and Figure 5-4 (500kV towers) The typical design for the proposed Dinawan 330kV substation is shown in Figure 5-5 and Figure 5-6. The typical design for the upgrade and expansion of the Wagga Wagga substation is shown in Figure 5-7.
	- key uses and activities to be carried out on site;	This chapter provides a description of the key uses and activities to be carried out, including an outline of the operational components of the proposal in Section 5.4. A description of construction activities is provided in Chapter 6 (Proposal construction).

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
	- likely timing of the project including any stages, the key phases within each stage (site preparation, construction, commissioning, operation, decommissioning and rehabilitation) and the sequencing of these stages and phases;	Refer to Chapter 6 (Proposal construction).

5.2. Proposal overview

An overview of the key components of the proposal is provided in Table 5-2 and shown on Figure 5-1. Section 5.3 provides a greater level of detail about each of the key components of the proposal and Section 5.4 provides the operational and maintenance aspects of the proposal.

Table 5-2 Project summary table – operations

Proposal element	Summary of the proposal	Figure reference
Project location	The proposal would extend from the existing Buronga substation to the existing Wagga Wagga substation. The proposal would be located across a number of LGAs being the Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart and Wagga Wagga LGAs.	Figure 5-1
Transmission lines	The key components of the transmission line works would include: • about 375 kilometres of new 330kV double circuit transmission line and associated infrastructure between the Buronga substation and the proposed Dinawan 330kV substation • connection of the proposed transmission lines to the existing Buronga substation • connection of the proposed transmission lines to the proposed Dinawan 330kV substation • about 162 kilometres of new 500kV double circuit transmission line and associated infrastructure between the proposed Dinawan 330kV substation and the existing Wagga Wagga substation at Wagga Wagga, NSW.	Figure 5-1 to Figure 5-4 and Appendix F
Substations	The key components of the substation works would include: • construction of a new 330kV substation around 30 kilometres south of Coleambally, referred to as the proposed Dinawan 330kV substation • upgrade and expansion of the Wagga Wagga substation to accommodate the new transmission line connections including the installation of new line bays, relocation and upgrade of existing bays and associated electrical and civil works (road, kerb, gutter, drainage works and earthworks)	Figure 5-5 to Figure 5-7

Proposal element	Summary of the proposal	Figure reference
Ancillary facilities	The ancillary facilities would include: • provision of three optical repeater structures and associated connections to existing local electrical supplies • new/and or upgrade of access tracks as required.	Figure 5-8 to Figure 5-9
Operational footprint	The transmission line between the Buronga substation and Wagga Wagga substation would be located within an easement up to 80 metres wide. This easement would provide a right of access to construct, maintain and operate the transmission line and other operational assets associated with the line. The total operational footprint of the project would be around 4,481 hectares comprising: • transmission line easement: around 4,298 hectares • permanent operational footprint of the proposed Dinawan substation site: around 8.4 hectares • permanent operational footprint of the proposed Wagga Wagga substation site: around 13 hectares (noting this is an existing substation with all works to be undertaken within the current substation boundary).	–
Creek crossings	The proposed transmission line would require crossing (spanning) of a series of watercourses and adjoining riparian areas including the Murrumbidgee River at Balranald; Abercrombie Creek; Yanco Creek; the Coleambally Outfall Drain, Colombo Creek; Halliday's Cut (at Lake Cullivel); Burkes Creek (The Rock) and several other smaller creek crossings.	Figure 5-1
Operational maintenance	Regular maintenance activities would be required for the transmission lines during its operation. Likely maintenance activities would include: • regular inspection and maintenance of transmission lines, towers and poles • ad hoc fault and emergency fly over(s) to assess infrastructure condition should an unplanned outage occur • vegetation removal required to maintain appropriate clearances between ground vegetation and transmission lines Maintenance at the substations would typically include ad-hoc attendance (up to three times a week) of one or two switching operators to undertake planned and unplanned switching of equipment.	Figure 5-10 and Figure 5-11
Commencement of operation	August 2024	–
Capital investment	Approximately $1.08 billion	–
Operational workforce	Around 5 workers	–

The location for the transmission line tower infrastructure would continue to be refined as part of the finalisation of the design. These elements would be located within the transmission line easement as shown in Figure 5-1.

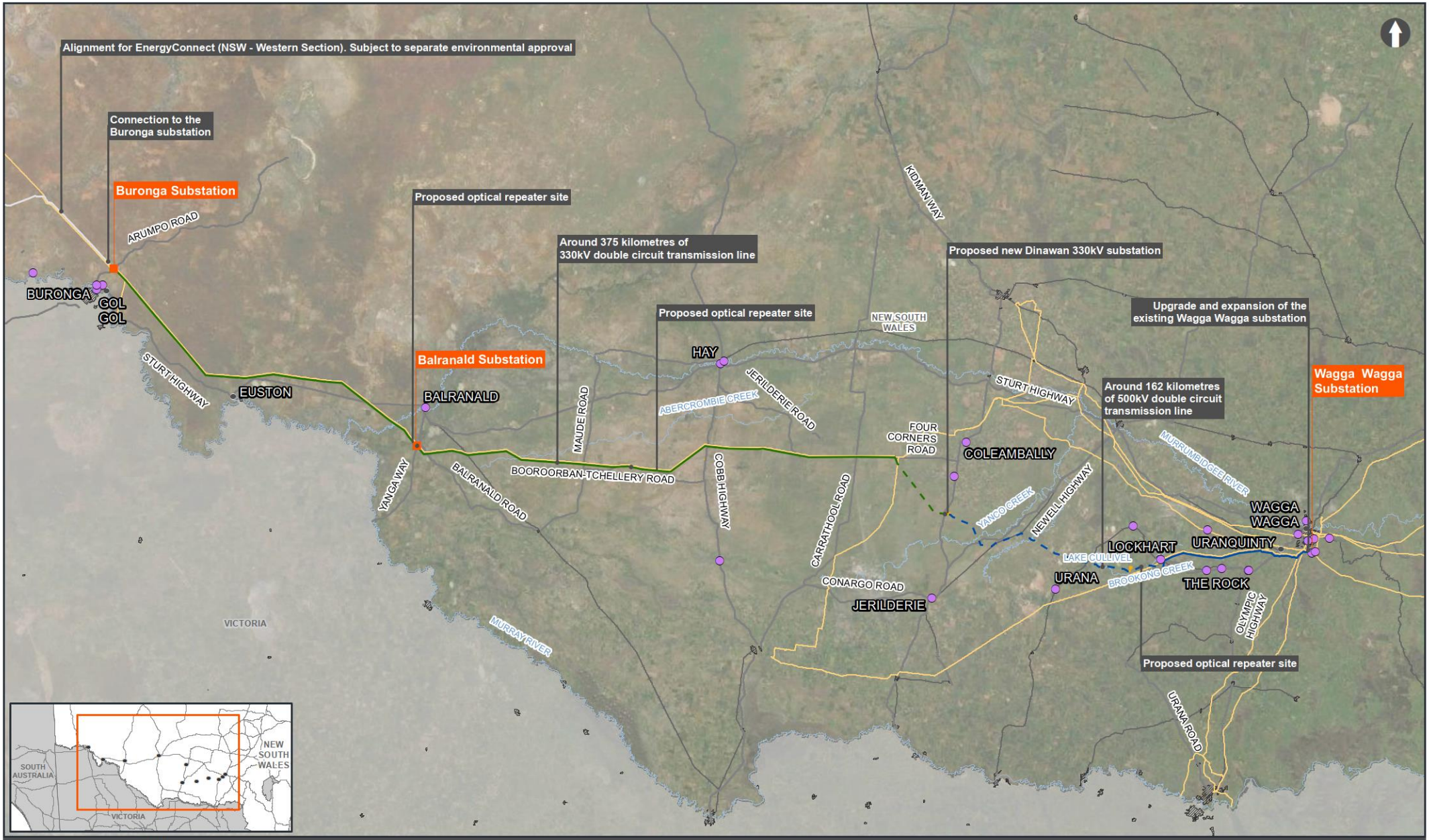

Figure 5-1

Key proposal features

- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Greenfield)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Greenfield)
- EnergyConnect (NSW - Western Section)
- Main Construction Compounds and Accomodation Sites
- Water Fill Point
- Existing Substation
- Built Up Areas
- Waterbody
- Existing Transmission Line

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Source: NSWSS, ESRI, Transgrid, WSP

5.3. Components of the proposal

5.3.1. Transmission line alignment

5.3.1.1. 330kV transmission line between the Buronga substation and proposed Dinawan 330kV substation

This component of the proposal comprises of a new double circuit 330kV transmission line from the existing Buronga substation (as proposed to be upgraded by the approved EnergyConnect (NSW – Western Section) project) to a proposed new Dinawan 330kV substation located along Kidman Way, around halfway between Coleambally and Jerilderie. The nominal distance of this line would be about 375 kilometres.

From the existing 330kV Buronga substation, the transmission line would run parallel to the existing 220kV transmission line (on the northern side of existing easement) for about 55 kilometres in a generally south-east direction (the first 6.5 kilometres of which are proposed to be upgraded as part of EnergyConnect (NSW – Western Section). At this point the alignment would continue in a parallel alignment in a predominantly east-west direction for a further 66 kilometres. At this point the alignment would cross the Sturt Highway and then continue in a south-east direction parallel to the existing 220kV transmission line towards the existing Balranald substation (a distance of around 27 kilometres). It is not proposed to connect the transmission line to the existing 220kV Balranald substation.

From the 220kV Balranald substation, the transmission line would continue in a generally east-west alignment (parallel on the northern side of the existing 220kV transmission line) for around 196 kilometres to a point along Four Corners Road at Mabins Well (around 25 kilometres to the east of the road's intersection with Kidman Way). This section of the alignment would cross and/or be located parallel to a number of key north-south roadways including Yanga Way; Balranald Road; Maude Road; Booroorban-Tchelery Road; the Cobb Highway; Jerilderie Road; Carathool and Conargo Roads and Four Corners Road.

From the point along Four Corners Road, the alignment would deviate from a parallel alignment to the existing transmission line infrastructure and would continue in a generally south-east alignment for around 31 kilometres towards Kidman Way. At this point, the alignment would cross Kidman Way and connect to the proposed Dinawan 330kV substation (refer to Section 5.3.4).

5.3.1.2. 500kV transmission line between the proposed Dinawan 330kV substation and the Wagga Wagga substation

This component of the proposal comprises of a new double circuit 500kV transmission line from the proposed Dinawan 330kV substation to the existing Wagga Wagga substation. The nominal distance of this line would be about 162 kilometres.

This section of line would initially only be operated at a 330kV capacity and not the full 500kV capacity. In the future – once other network upgrades and their associated planning approvals are completed (including potentially the upgrade of the Dinawan 330kV substation to a 500kV facility) – this line would operate at its 500kV capacity. This section of line is being proposed to be built now with the physical infrastructure components required for a future 500kV operating capacity. This will allow for future proofing of this section of the network and prevent any future disruptions and impacts to landholders by removing the need for additional future construction activities (post EnergyConnect (NSW – Eastern Section)).

The impacts associated with the construction of the required infrastructure and operating parameters of the full 500kV capacity line are presented in this EIS and the associated planning approval sought for them now.

From the proposed Dinawan 330kV substation, the alignment would travel in a typically south-east direction for around 19 kilometres, generally following the alignments of Bundure Road and Thurrowa Road to a crossing point with the Newell Highway.

From this point, the alignment would have a generally east-west alignment for around 45 kilometres, generally following the alignments of a section of transmission line parallel to the existing (disused) Narrandera-Tocumwal Railway (a distance of around 10.5 kilometres); Coonong Road, West Gums Road and Gums Road to Boree Creek Road, west of Lake Cullivel.

From Boree Creek Road, the alignment would be located to the south of Lake Cullivel through to Urana-Lockhart Road. At this point, the alignment would generally follow the alignments of Urana-Lockhart Road, Tenison Lane and Kings Lane to the Lockhart–The Rock Road. This alignment would be located to the south of the township of Lockhart. The distance of this section of the transmission line would be around 36 kilometres.

The sections of transmission line between the proposed Dinawan 330kV substation and the Lockhart–The Rock Road would be located within a new transmission line easement and would not be parallel to any existing high voltage electrical infrastructure.

From the point at which the transmission line crosses the Lockhart–The Rock Road, the alignment would be located parallel to an existing 132kV transmission line for around 39 kilometres (south side of existing easement). This section of the alignment would cross a series of key roadways including: County-Boundary Road, Bullenbong Road and The Rock-Collingullie Road.

At this point, the alignment would continue parallel (south side of existing easement) to an existing 330kV transmission line for around 24 kilometres to connect with the existing Wagga Wagga substation.

An overview of the proposed transmission line is shown in Figure 5-2a to Figure 5-2e.

Figure 5-2a

Detailed proposal transmission line arrangement

Sheet 1 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

Figure 5-2b

Detailed proposal transmission line arrangement

Sheet 2 of 5

Figure 5-2c

Detailed proposal transmission line arrangement

Sheet 3 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

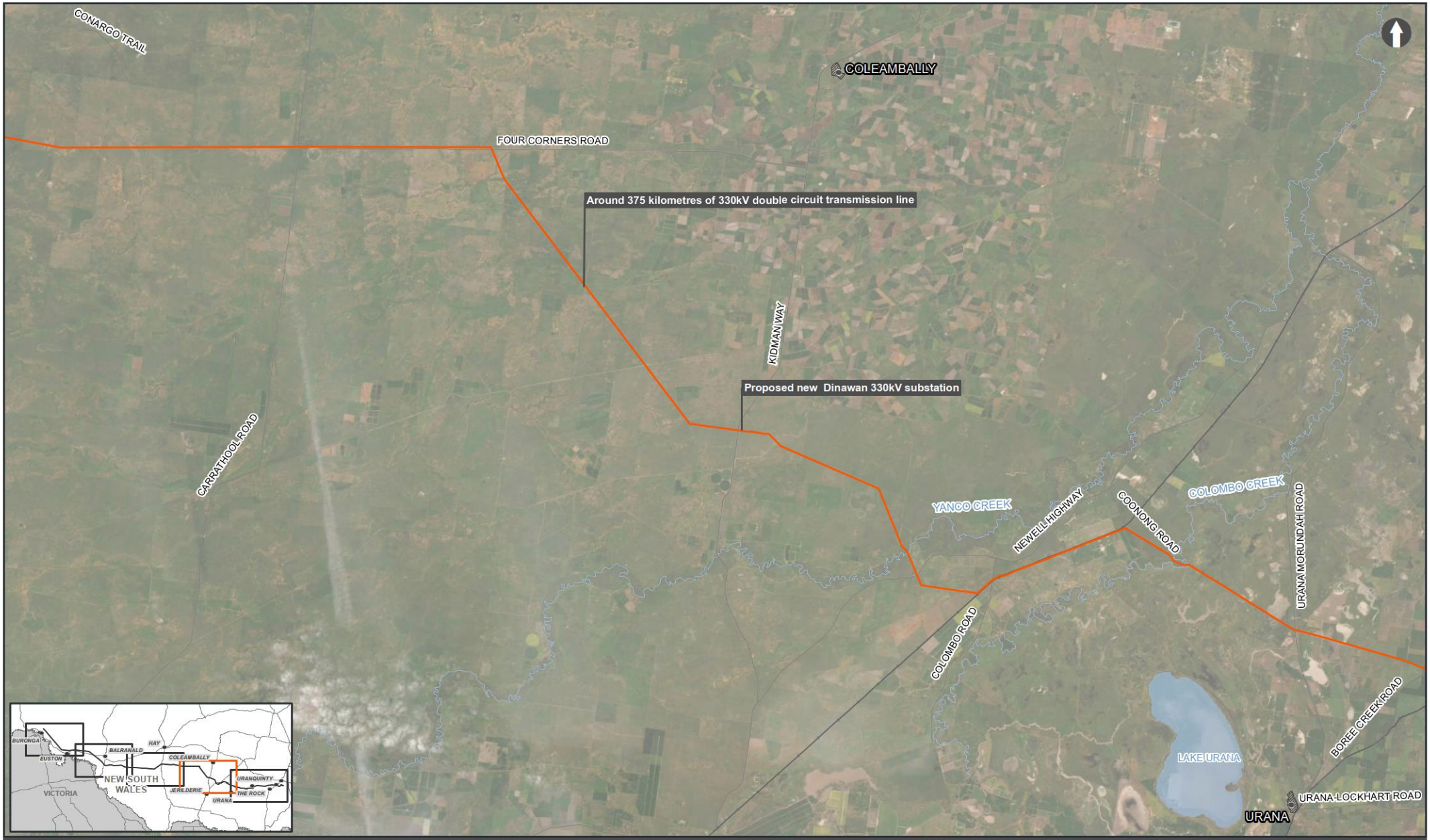

Figure 5-2d

Detailed proposal transmission line arrangement

Sheet 4 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

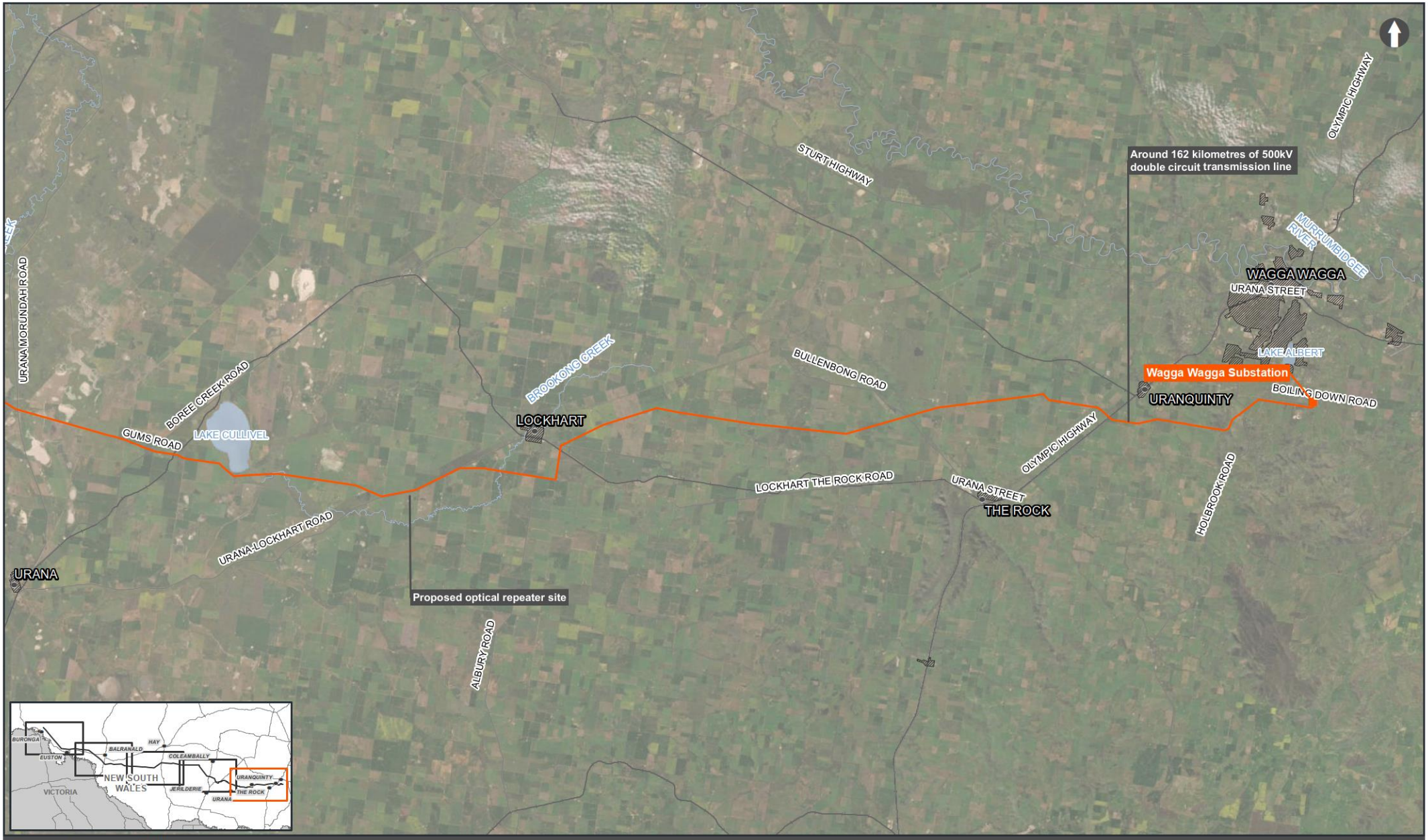

Figure 5-2e

Detailed proposal transmission line arrangement

Sheet 5 of 5

- EnergyConnect (NSW - Eastern Section)
- EnergyConnect (NSW - Western Section)
- Roads
- Existing Railway
- Existing Substation
- Built Up Areas
- Waterbody
- Watercourse

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Source: NSWSS, ESRI, Transgrid, WSP

5.3.2. Transmission line towers

The proposed transmission line would be supported on a series of transmission line towers. The final location and specification of each tower would be dependent on a range of factors such as distance between each tower, local geotechnical conditions, local environmental constraints (for example the need to avoid specific areas of biodiversity). The type and arrangement of the towers would continue to be refined (micro-sited) as part of the finalisation of the infrastructure location with a view to further minimising environmental impacts, within the identified transmission line easement, wherever practicable.

For simplicity, all transmission line towers (guyed, suspension, strain, etc) along this corridor are referred to as transmission line towers within this EIS. A summary of the typical transmission line towers for the various anticipated voltages expected to be used for the proposal are outlined below.

5.3.2.1. 330kV transmission line towers

The 330kV transmission line towers would be typically spaced between 450 and 600 metres apart, however shorter distances may be required in limited circumstances. The number and exact type of each towers required would be confirmed as part of the finalisation of the proposed infrastructure locations.

The tower types for this section would consist of (refer to Figure 5-3):

- suspension towers for intermediate/straight sections of the transmission line, comprised of either:
  - a guyed steel tower – which consist of a thinner tower design with guy wires and ground anchors attached to provide stability. Typical height would be between around 40 and 60 metres. These tower types would have a typical permanent base footprint area of around 48 metres by 51 metres (or around 2,448 square metres) including the area to the guywire extents, noting that not all of this area would be directly impacted/require clearing. Only a radial area of around 20 metre around the guy pole and a radial area of around five metres around each guywire extent would be required to be cleared of vegetation)
  - as free-standing tower (also referred to a suspension towers) – which consist of a wider base and are self-supporting (that is, the tower does not require other supporting infrastructure such as guy wires). A typical height would be between around 40 and 60 metres. These tower types would have a typical permanent base footprint area of around 14 metres by 14 metres (or around 196 square metres). A radial area of around 20 metre from the structure would also be required for vegetation clearing.
- strain towers – which consist of a wider base and are self-supporting. This type of tower is used for the first and last tower of the transmission line, at major road or river crossings, and where there is a change in direction. This type of tower can also be used for structural reasons to break up long runs of suspension towers. Typical height would be between around 40 and 65 metres. These tower types would have a typical permanent base footprint area of between around 24 metres by 24 metres (576 square metres). A radial area of around 20 metre from the structure would also be required for vegetation clearing.

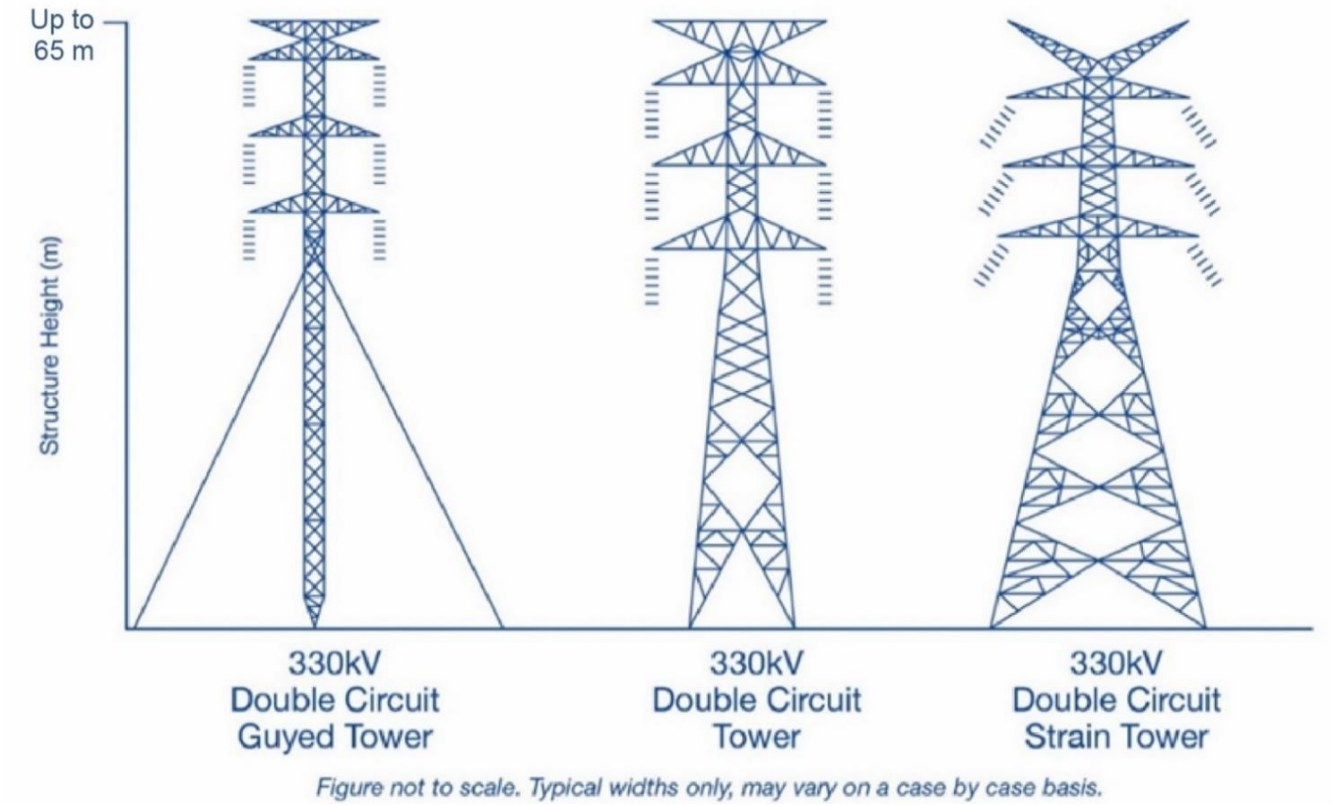


Figure 5-3 Proposed concept design for the transmission line towers on the 330kV line

The permanent disturbance footprint for each of the 330kV transmission line tower would also include a 20 metre vegetation cleared area around each tower.

5.3.2.2. 500kV transmission line tower

Similar to the 330kV line, the 500kV transmission line would be supported on a series of transmission line towers. These would be typically spaced between 450 and 600 metres apart, however shorter distances may be required in limited circumstances. The number and exact type of each towers required would be confirmed as part of the finalisation of the proposed infrastructure locations.

The tower types for this section would consist of

- suspension towers – This type of tower is used for the intermediate/straight sections of the transmission line and are self-supporting. Typical height would be between around 40 and 65 metres. These tower types would have a typical base footprint of around 22 metres by 22 metres (or around 484 square metres). A radial area of around 20 metre from the structure would also be required for vegetation clearing
- strain towers – which consist of a wider base and are self-supporting. This type of tower is used for the first and last tower of the transmission line, at major road or river crossings, and where there is a change in direction. This type of tower can also be used for structural reasons to break up long runs of suspension towers. Typical height would be between around 40 and 65 metres. These tower types would have a typical base footprint of around 26 metres by 26 metres (or 676 square metres). A radial area of around 20 metre from the structure would also be required for vegetation clearing.

Depending on local circumstances, the tower heights for both forms of towers could be up to 65 metres (refer to Figure 5-4).

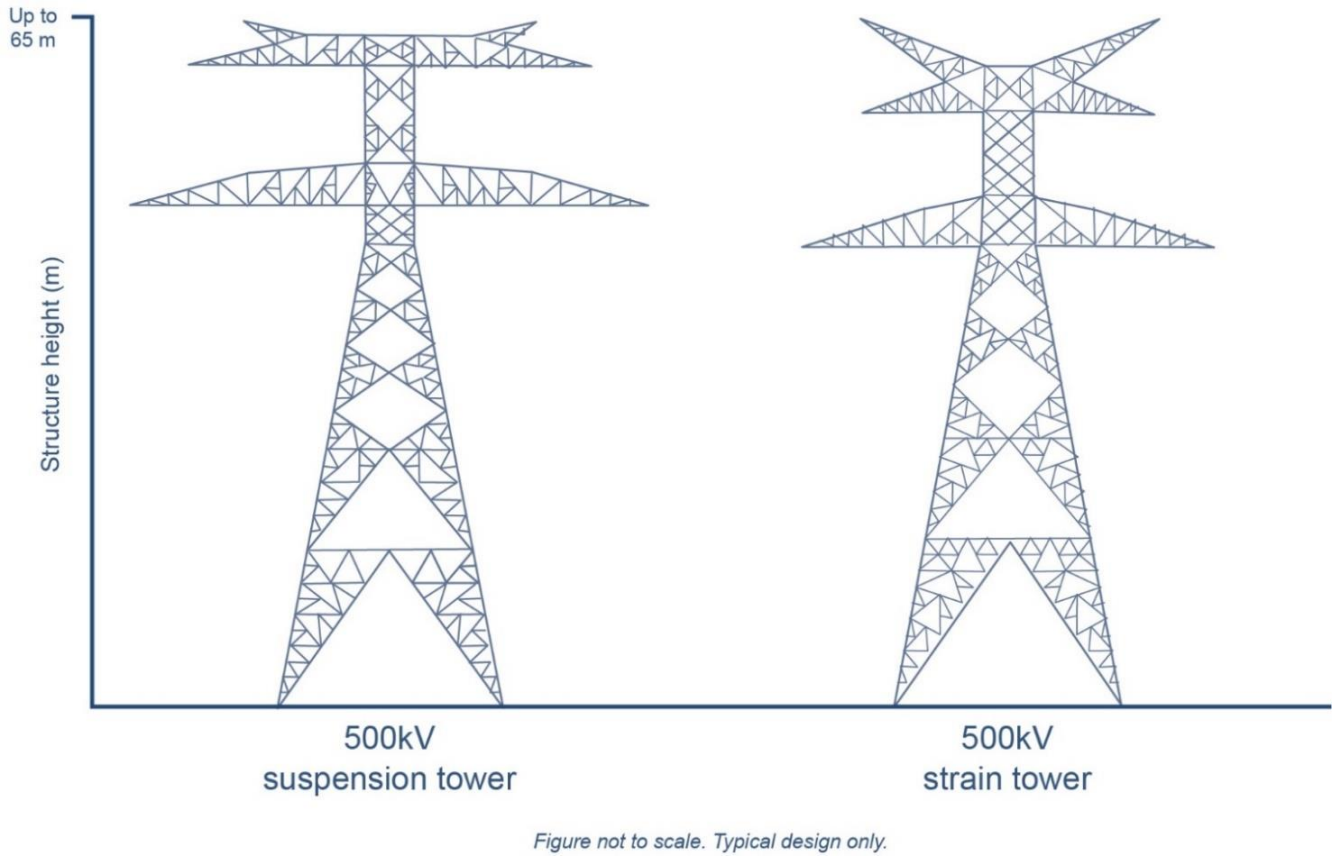


Figure 5-4 Proposed concept design for the transmission line towers on the 500kV line

The permanent disturbance footprint for each of the 500kV transmission line tower would also include a 20 metre vegetation cleared area around each tower (from the extents of the corner of the tower base).

5.3.3. Transmission line access

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

5.3.4. Proposed Dinawan 330kV substation

To provide a connection point between the existing Buronga and Wagga Wagga substation, a new 330kV substation would be constructed. The new substation, referred to as the proposed Dinawan 330kV substation, would be located along Kidman Way, around halfway between Coleambally and Jerilderie. A summary of the works associated with the proposed Dinawan 330kV substation site are described in the following sections.

While the current substation is proposed to be constructed to allow for operation at 330kV, the proposed substation site and design has been future proofed to allow for expansion of the site to accommodate additional 500kV substation infrastructure should this be required in the future. The expansion of the proposed Dinawan 330kV substation to accommodate additional 500kV infrastructure would be subject to separate environmental approval and is not considered as part of the current proposal.

5.3.4.1. Built form and layout

The proposed Dinawan 330kV substation would be located approximately 500 to 700 metres east of Kidman Way and accessed via a newly constructed access road. The area of the proposed substation would be around 84,000 square metres (inclusive of the required buffer zone surrounding the site – refer to Figure 5-5). The final area required would be confirmed as part of the finalisation of the proposed infrastructure location.

The typical infrastructure and equipment that would be installed for the new substation would include:

- two line bays installed at the western end of the substation to provide a connection to the 330kV Buronga substation associated with two 60 mega volt ampere of reactive power (MVAr) Shunt Reactors and two line bays installed at the eastern end of the substation to provide a connection to the Wagga Wagga substation associated with two 50 MVAr Shunt Reactors
- two capacitor banks rated about 50 MVAr
- two 100 MVAr synchronous condensers (with 200 MVAr capability for 10 seconds), together with associated 330kV transformers. The transformers would also provide connection for auxiliary transformers which would provide low voltage AC for all switching station and synchronous condenser auxiliary loads
- a range of supporting 330kV electrical components including shunt reactors, overhead conductors, busbars and gantries
- 330kV circuit breaker switchgear equipment.

Other key features of the proposed substation would include:

- construction of up to three secondary system control buildings to accommodate protection for new switchgear and fixed portions of secondary system (such as fire protection, security system, air conditioning etc.) and 125 volt (V) direct current (DC) and 50V DC battery system
- control and protection systems (including relays, metering, disturbance recorder, etc.)
- 125V DC and 400V AC electrical distribution system
- lighting and lighting mast(s)
- oil containment system (including bunding and containment tank)
- communications network infrastructure including:
  - optical ground wire (OPGW) to be established within the substation
  - provision of a microwave link
  - two optical multiplexer network systems (powered by two independent battery systems).

The maximum height of the new equipment would be around 45 metres.

All key substation equipment (such as the transmission gantries, transformers, etc.) within the substation site would be fixed to either a driven steel pile or reinforced concrete footing. The transformers within the substation site would be bunded and incorporate a flame trap and drainage point in the event of an emergency. The hardstand areas of the substation site would be designed to drain to a reinforced concrete spill oil containment tank.

Figure 5-5 and Figure 5-6 show the layout of the proposed Dinawan 330kV substation, which are indicative only and would be subject to finalisation of the infrastructure design.

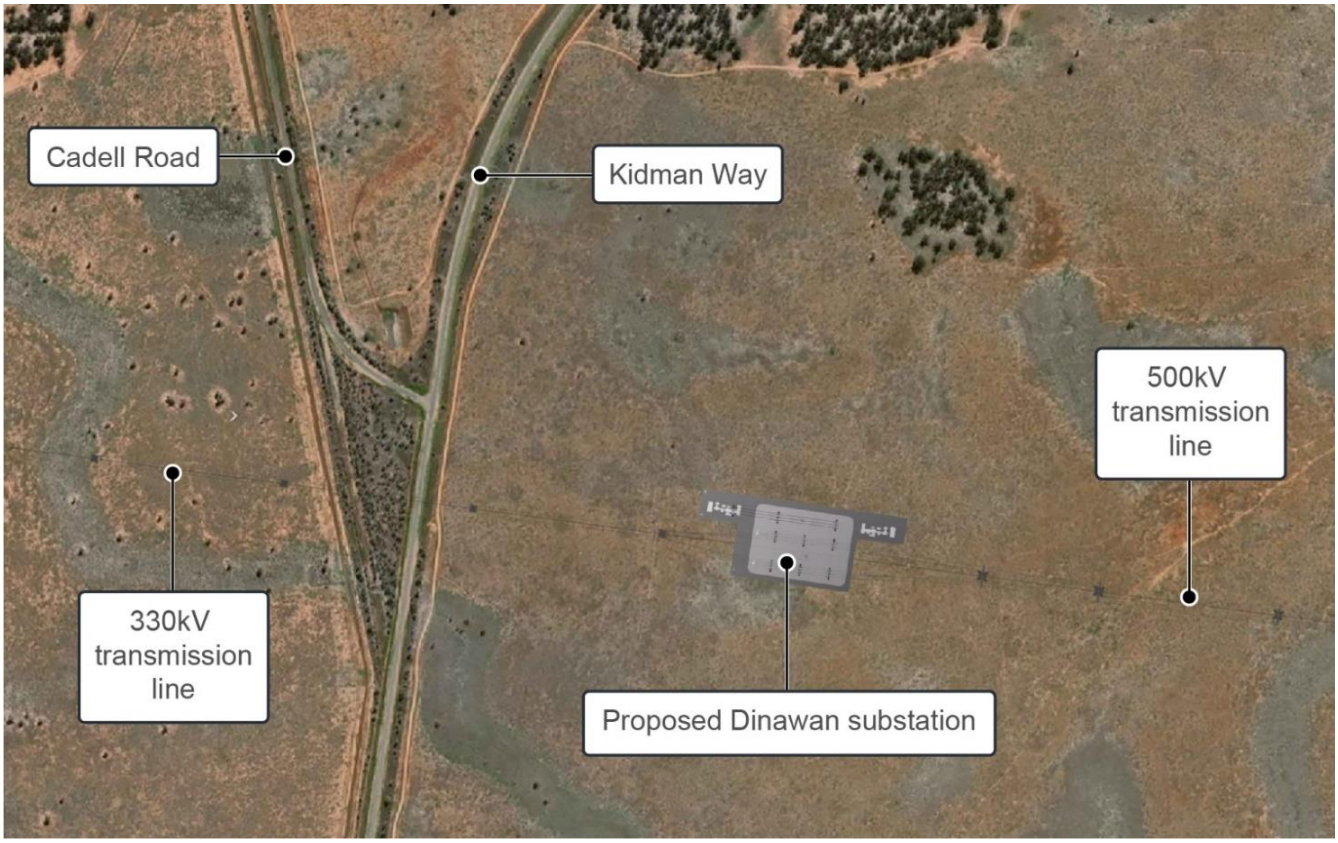


Figure 5-5 Plan of the proposed Dinawan 330kV substation layout (indicative)

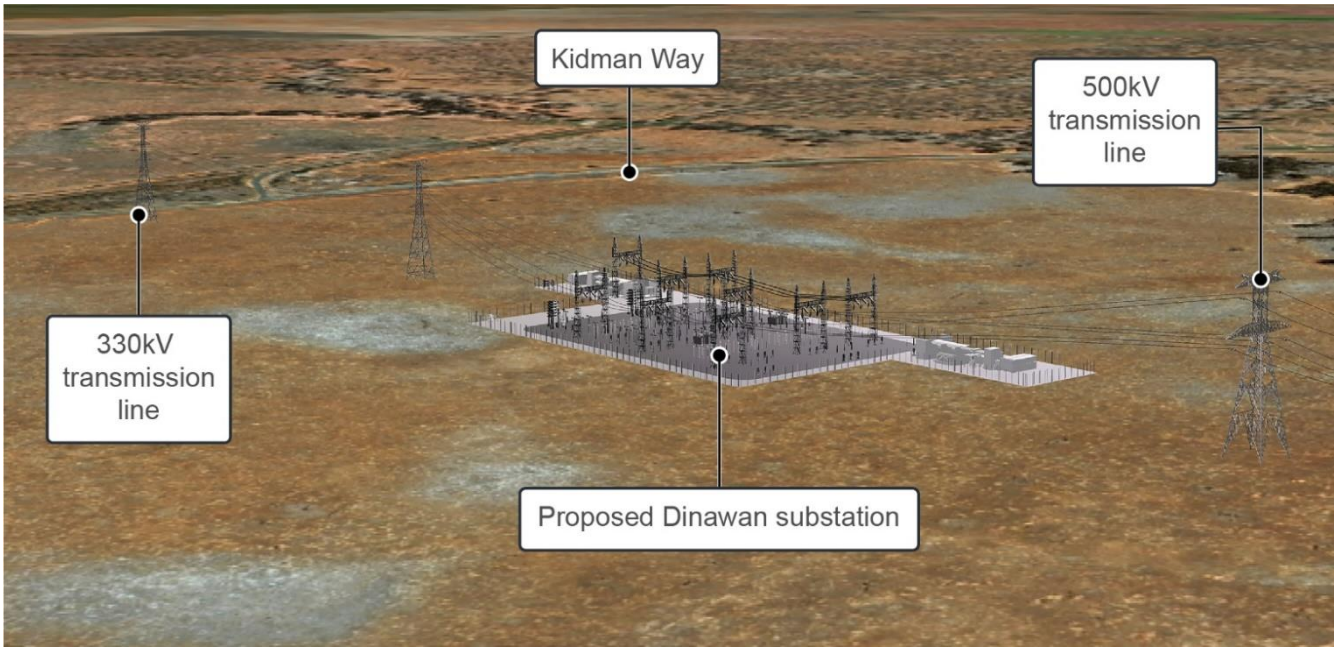


Figure 5-6 Arrangement of the proposed Dinawan 330kV substation layout (indicative)

5.3.4.2. Safety and security

Security fencing would be installed on all sides of the substation and would be compliant with current Transgrid standards for substation fencing. The security fence would be comprised of a galvanised steel (or similar) material. Two motorised sliding gates would also be installed to provide an overall opening of around seven metres at the main entrance point to the site and be operated by a security access card, with an adjacent pedestrian portal gate operated by key access (to allow emergency access).

To comply with Transgrid's safety requirements, additional security measures would be incorporated across and around the substation site. These would include:

- security cameras within the substation site
- safety and public information signage on both the substation and incoming and outgoing transmission line towers connections to ensure public safety
- an asset protection zone (APZ) – consisting of an area maintained to be cleared of all trees and vegetation which may affect the substation during a bushfire in accordance with Transgrid design and safety standards.

5.3.4.3. Lighting

Operational lighting would be required for the operation of the substation for site security and for the safety of operational personnel operating and maintaining the substation equipment. Operation of the substation lighting would be from dusk until dawn, seven days a week. The external lighting would be installed to maintain an even distribution across the site, typically located on poles around four metres in height. The substation lighting would minimise light spill to areas beyond the substation boundary including potential impacts on passing traffic along Kidman Way and local fauna.

5.3.4.4. Access and parking

A new access road around 600 metres long would be constructed from Kidman Way to the new substation as shown in Figure 5-5. The access road would allow access for employees undertaking maintenance operations and would also be suitable to allow longer vehicles as required (such as equipment replacement). The new access points would meet relevant Transport for NSW road design and council guidelines, including required sight-lines along Kidman Way.

Additional parking for around one truck and three general vehicles would be provided within the site boundary near the new control room buildings. Additional parking bays would be used by occasional maintenance and operational crew visiting the site. An unsealed, internal perimeter road would be constructed as shown in Figure 5-5.

5.3.4.5. Water supply

Water would be required for maintenance activities and the operation of the proposed Dinawan 330kV substation. This would require up to around 12,000 litres of water per year which would be sourced from the local council or water supplier and rainwater tanks at the substation.

5.3.4.6. Stormwater and drainage

An on-site stormwater drainage system to capture and discharge stormwater collected from within the expanded substation site during operation.

Runoff from outside the proposed Dinawan 330kV substation site would be intercepted and diverted around the site by new drainage infrastructure. The drains would be designed for rainfall corresponding to an annual exceedance probability (AEP) of two per cent (equivalent to around a one in 50-year probability that a given rainfall event would occur or exceed in any one year). The runoff would be diverted to natural watercourses using appropriate dispersion/dissipation structures or drainage systems.

Within the substation site, the stormwater drainage system would be designed for a rainfall corresponding to an AEP of 10 per cent per year (equivalent to around a one in 10-year probability). This system would include a series of surface drains which would interconnect with a grid of stormwater pits within the substation site.

The new substation would also be designed to have an impervious surface and an oil containment system would be installed (separate to the stormwater drainage collection system to prevent cross-contamination). The oil containment system would be designed in accordance with Transgrid's substation oil containment design procedure which defines Transgrid's approach to meeting the requirements of the *Protection of the Environment Operations Act 1997* (POEO Act).

5.3.4.7. Landscaping

Landscaping or visual screening of the substation site is not proposed.

5.3.5. Upgrade and expansion of the existing Wagga Wagga substation

To accommodate the new transmission lines, expansion and upgrade of the existing Wagga Wagga substation would be required to install new line bays, transformer bays and relocating existing bays including associated electrical and civil works. All works work associated with the upgrade and expansion of Wagga Wagga substation would occur within the existing substation site at the corner of Ashfords Road and Boiling Down Road, Gregadoo (to the south of the main town centre of Wagga Wagga).

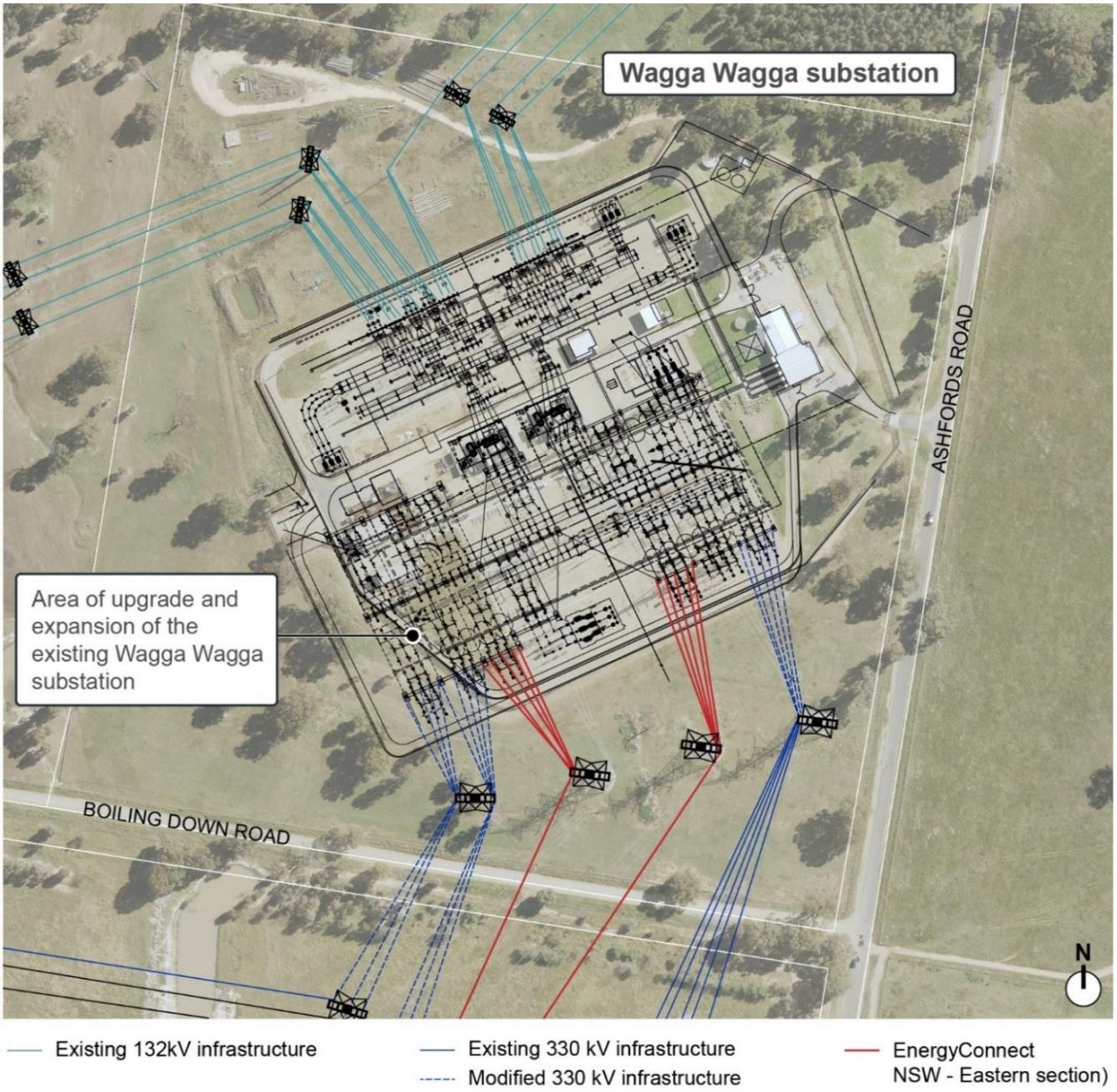
A summary of the proposed upgrade and expansion works within the Wagga Wagga substation site are described in the following sections.

5.3.5.1. Built form and layout

The general layout and built form of the Wagga Wagga substation would not be highly altered by the proposal and expansion of the substation to the west of the existing infrastructure. The typical infrastructure and equipment that would be installed and works associated within the upgrade and expansion substation site for the Wagga Wagga substation would include:

- new bays constructed to the west of the existing infrastructure and associated civil works (new foundations and cable trench extension)
- relocation and connection of existing and proposed new circuit for incoming transmission lines including:
  - Darlington Point transmission line (existing)
  - Jindera transmission line (existing)
  - Lower Tumut transmission line (existing)
  - the proposed 330kV Dinawan transmission line (the proposal)
- relocation, modification and replacement of other existing electrical infrastructure within the Wagga Wagga substation site including existing capacitor banks and associated equipment, line disconnector/ earthing switches, surge arresters and capacitor voltage transformers
- demolition of the existing transformer storage, oil storage and equipment sheds to accommodate the double circuit configuration. Works would be required to clear the concrete base, bunds and other utilities (oil and water pipes which would require relocation)
- extension of the existing switchyard and fencing within the existing substation site
- localised earthworks and associated civil works required to accommodate the new infrastructure within the existing substation site
- potential extension or adjustment to the external catch drains diverting the external catchment (subject to finalisation of the proposal design).

Figure 5-7 shows the layout of the proposed upgrade and expansion of the Wagga Wagga substation infrastructure, which are indicative only and would be subject to finalisation of the infrastructure design.



Note: Design shown is indicative. Subject to finalisation.

Figure 5-7 Arrangement of the proposed upgrade and expansion of Wagga Wagga substation

5.3.5.2. Access and parking

No additional parking or access arrangements would be required for the operation of the additional infrastructure to be constructed within the existing Wagga Wagga substation site. However, the proposed upgrade and expansion of the Wagga Wagga substation would require adjustment/extension to the internal perimeter road to accommodate access to the additional infrastructure.

5.3.5.3. Stormwater and drainage

An on-site stormwater drainage system currently exists within the Wagga Wagga substation to capture and discharge stormwater collected from within the site. Some additional stormwater drainage would be required to be installed to extend any existing infrastructure within the vicinity of the proposed works (within the boundary of the existing substation site).

5.3.5.4. Utility relocations

Minor works to existing electrical infrastructure may be required in order to complete the proposed civil and electrical works, including relocation of some existing utilities.

The proposed upgrade and expansion of the Wagga Wagga substation to accommodate the additional transmission lines associated with the proposal would not impact on any of the other operational aspects of the substation. These aspects include existing operation and maintenance requirements, safety and security measures or parking arrangements.

5.3.6. Ancillary infrastructure

5.3.6.1. Optical repeater sites

In addition to the key transmission line and substation infrastructure, three communication repeater sites would be required at various intervals along the alignment. The repeater sites are communication huts which contain signal boosting equipment and back-up power supplies to ensure the stability of the communications system over great distances (greater than around 135 kilometres). The optical repeater sites facilitate communication of protection and control systems between substations. The communication huts would include a security fence erected around the perimeter of the structure.

The proposed communications huts would be located at the following locations:

- within the existing Balranald substation site (Balranald repeater site)
- adjacent to the proposal located along the Boorooban-Tchelery Road, west of the Cobb Highway (Boorooban repeater site)
- along Urana-Lockhart Road, to the south west of Lockhart (Brookong repeater site).

The locations of the proposed communications huts are shown on Figure 5-2b, Figure 5-2c and Figure 5-2e.

Built form and layout

The general layout and built form of each communication hut would include a small shelter around 3.2 by 4.6 metres. The hut would contain the relevant electrical and communications equipment required to operate the repeater functions.

An example of a proposed communication hut it shown in Figure 5-8.

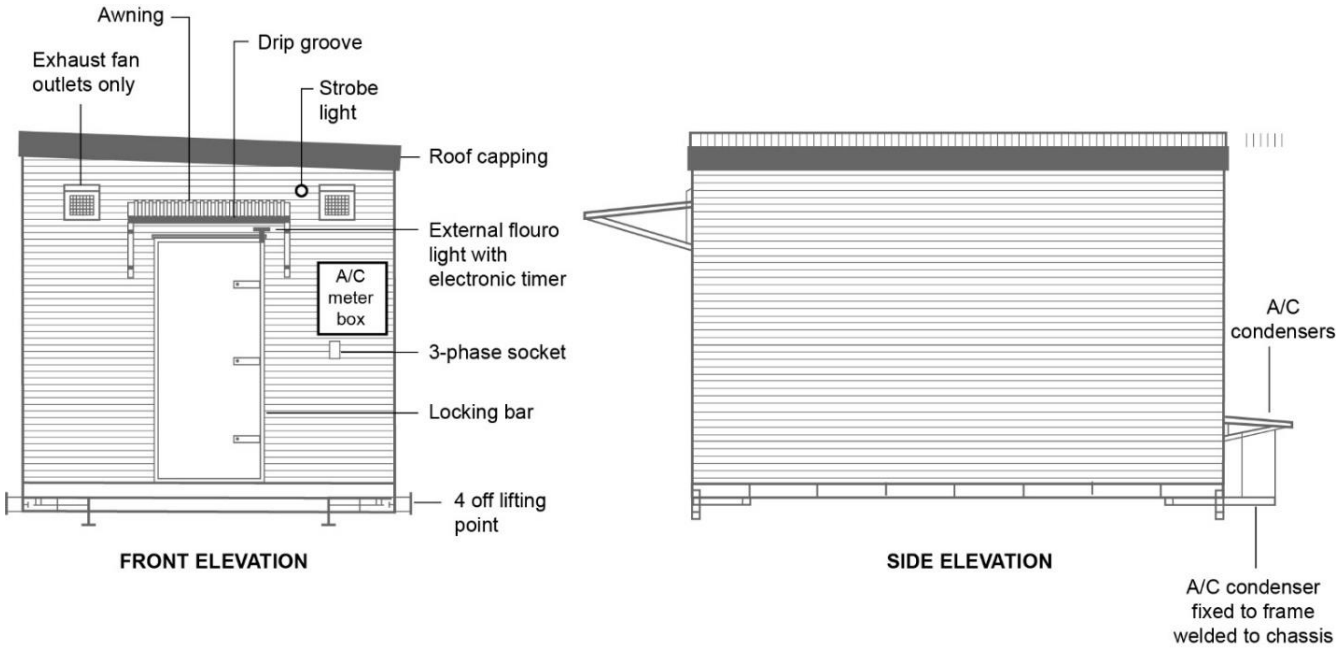


Figure 5-8 Example of a proposed optical repeater station communication hut

Electrical connections

The repeater sites would require two sources of low voltage electrical supply. One source would be via solar panels (to be mounted on the roof of each communications hut), and the other would be from a new connection to the existing the Essential Energy network. The Essential Energy network in this regional area is high voltage. As a result, either a pole-top transformer or a pad-mount transformer would be required to convert the high voltage supply to the necessary low voltage supply. For each of the proposed sites, the following is proposed:

- Balranald repeater site
  - connection of around 75 metres of underground conduit and cabling to connect the new repeater site to the proposal running parallel to the Balranald substation.
- Boorooban repeater site
  - The proposed communication hut would be connected to an existing Essential Energy transmission line to the north of the alignment. The connection would require:
    - > around two kilometres of new overhead electrical infrastructure (overhead wires and around 10 new poles at regular spacings) within a 25-metre easement.
    - > installation of a new pole-mounted transformer adjacent to the communications hut for connection
- Brookong repeater site
  - installation of a new pole-mounted transformer on a new pole close to the proposed communications hut and provision of an overhead electrical connection (around 90 metres) to the nearest Essential Energy infrastructure on the southern side of Urana-Lockhart Road.

An overview of the proposed electrical connection requirement for each communication repeater station is shown on Figure 5-9.

Figure 5-9

Overview of the electrical connection requirements for the proposed optical repeater sites

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Source: NSWSS, ESRI, Transgrid, WSP

5.4. Operation and maintenance

The expanded substation and transmission lines would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required).

Likely maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of electrical equipment
- general building, APZ and general landscaping maintenance
- fire detection system inspection and maintenance
- fence repair
- stormwater and drainage infrastructure maintenance.

5.4.1. Transmission line maintenance

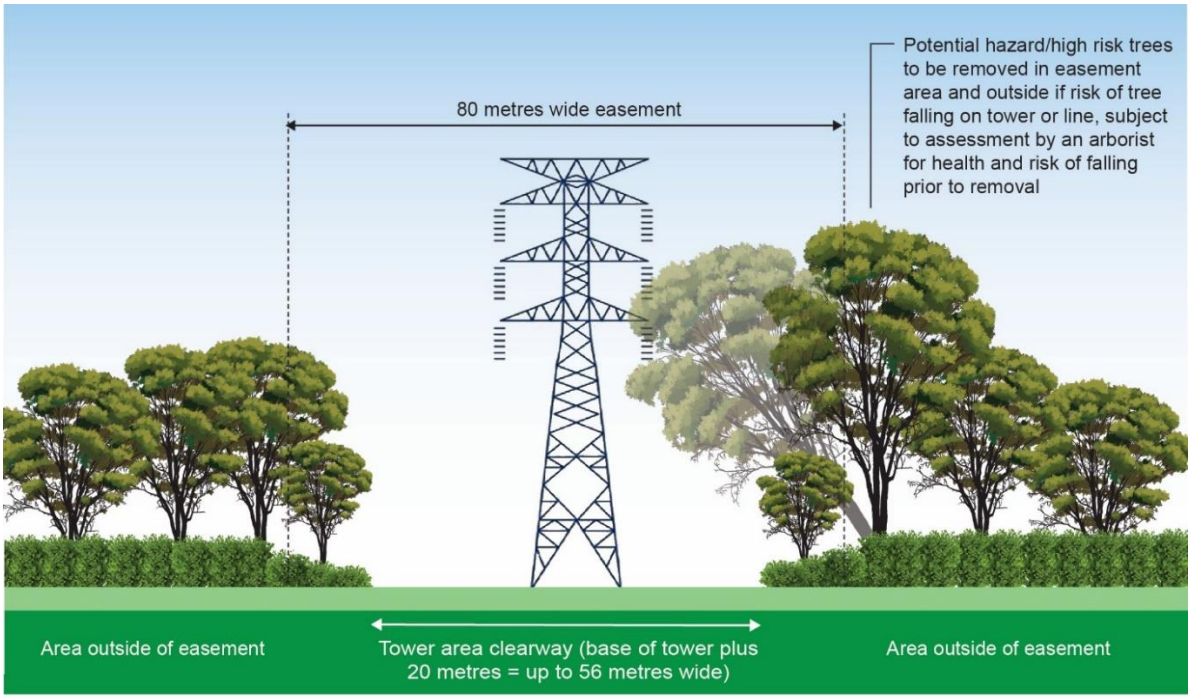
Regular maintenance activities would be required for the transmission lines during its operation. Likely maintenance activities would include:

- regular inspection and maintenance of transmission lines, towers and poles including:
  - an annual fly over as part of seasonal bushfire prevention surveys
  - routine infrastructure inspection on a six-yearly cycle for self-supporting towers and three-yearly cycle for guyed towers. This would typically involve two to three maintenance crews driving a light vehicle from public roads to the easement utilising access tracks, then along the easement inspecting each transmission line tower in turn. Towers would be inspected both from the ground and by personnel climbing the tower
  - routine / planned line maintenance using a light vehicle(s), an elevated work platform and a medium sized truck with up to around five to ten personnel to rectify any defects found from routine inspections. Generally, this would occur within the same three to six-year maintenance cycles as the routine infrastructure inspection
- ad hoc fault and emergency fly over(s) to assess infrastructure condition should an unplanned outage occur (for example through a weather event or other failure of infrastructure). This maintenance would occur as required. The amount of maintenance and/or crew required for repair of any damaged infrastructure would depend on the extent of repairs required
- vegetation removal required to maintain appropriate clearances between ground vegetation and transmission lines. Vegetation below the transmission lines would require ongoing maintenance throughout the operation to ensure electrical safety clearances and protection zones are maintained. The required clearance of vegetation within the corridor would be undertaken in accordance with Transgrid maintenance guides (refer to section below).

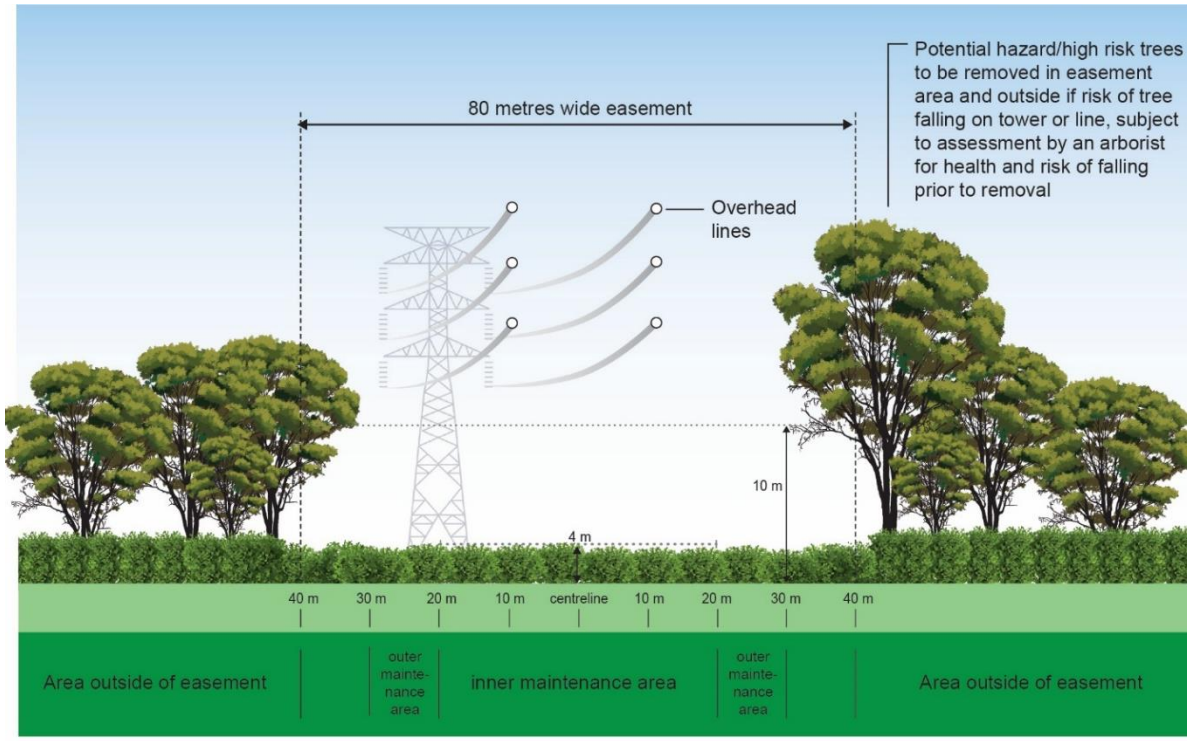
5.4.1.1. Vegetation clearance

The following approach is proposed noting that final refinement of the proposal may allow for some increase in vegetation height to occur if vegetation clearances are able to be achieved for each of the transmission line arrangements:

- For the 80 metre wide 330kV easement, vegetation clearing would generally only be required for the centre 60 metre wide section (which includes the inner and outer maintenance zones combined). To achieve this, the following clearances would be implemented (refer to Figure 5-10):
  - inner maintenance zone – vegetation with growth heights of up to four metres can be retained from the centreline out to 20 metres distance from the centreline (i.e. a 40 metre wide inner section of the easement)
  - outer maintenance zone – vegetation with growth heights of up to 10 metres would be able to be retained in the easement section which is 20 metres to 30 metres from the centreline. This is permitted as the maximum sag point height is increased at this greater distance for the centreline and therefore taller vegetation is permitted without impacting on the vegetation clearance requirements
  - vegetation clearing within the outer 10 metres of each side of the easement would not be required (with exception of hazard / high risk trees – refer below)
  - hazard/high risk trees located along the corridor would be removed, inside and outside the easement area, where they are identified to pose a risk to the transmission line, subject to assessment by an arborist for health and risk of falling prior to removal.
- For the 80 metre wide 500kV easement, vegetation clearing would be required to some extent for the full 80 metre wide section. To achieve this, the following clearances would be implemented (refer to Figure 5-11):
  - inner maintenance zone – vegetation with growth heights of up to four metres can be retained from the centreline out to 30 metres distance from the centreline (i.e. a 60 metre wide inner section of the easement)
  - outer maintenance zone – vegetation with growth heights of up to 10 metres would be able to be retained in the easement section which is 30 metres to 40 metres from the centreline. This is permitted as the maximum sag point height is increased at this greater distance for the centreline and therefore taller vegetation is permitted without impacting on the vegetation clearance requirements
  - hazard/high risk trees located along the corridor would be removed, inside and outside the easement area, where they are identified to pose a risk to the transmission line, subject to assessment by an arborist for health and risk of falling prior to removal.



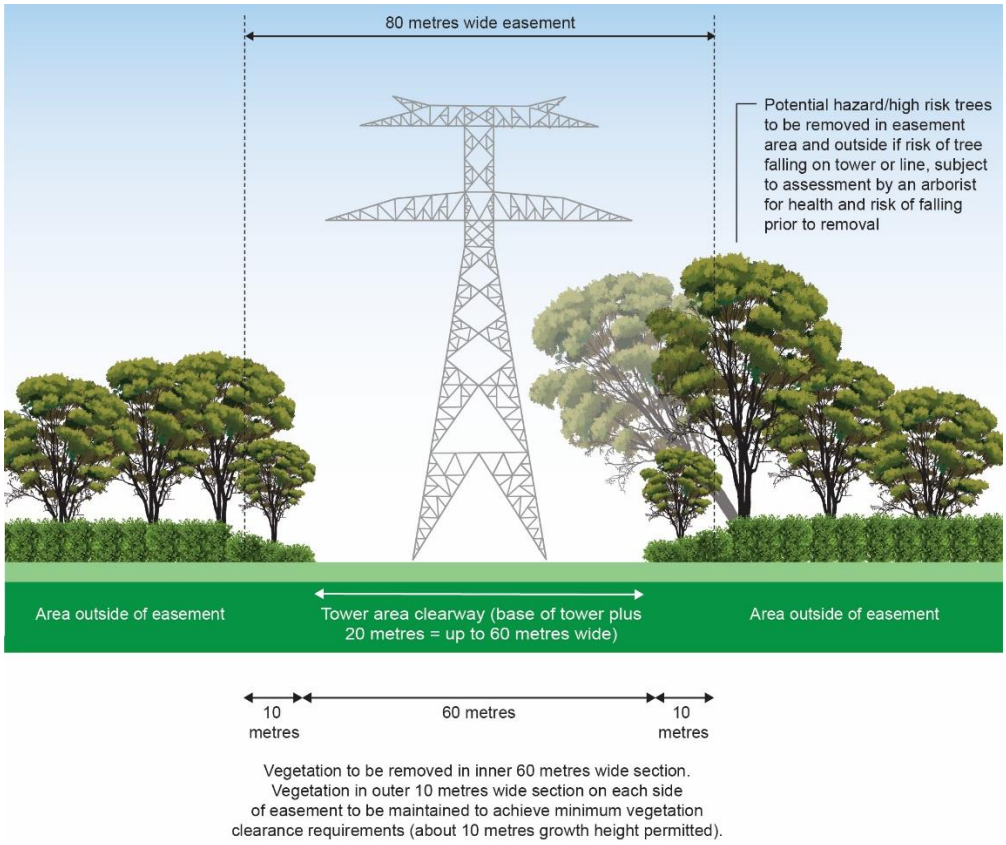
Vegetation in the easement to be maintained to achieved minimum clearance requirements.

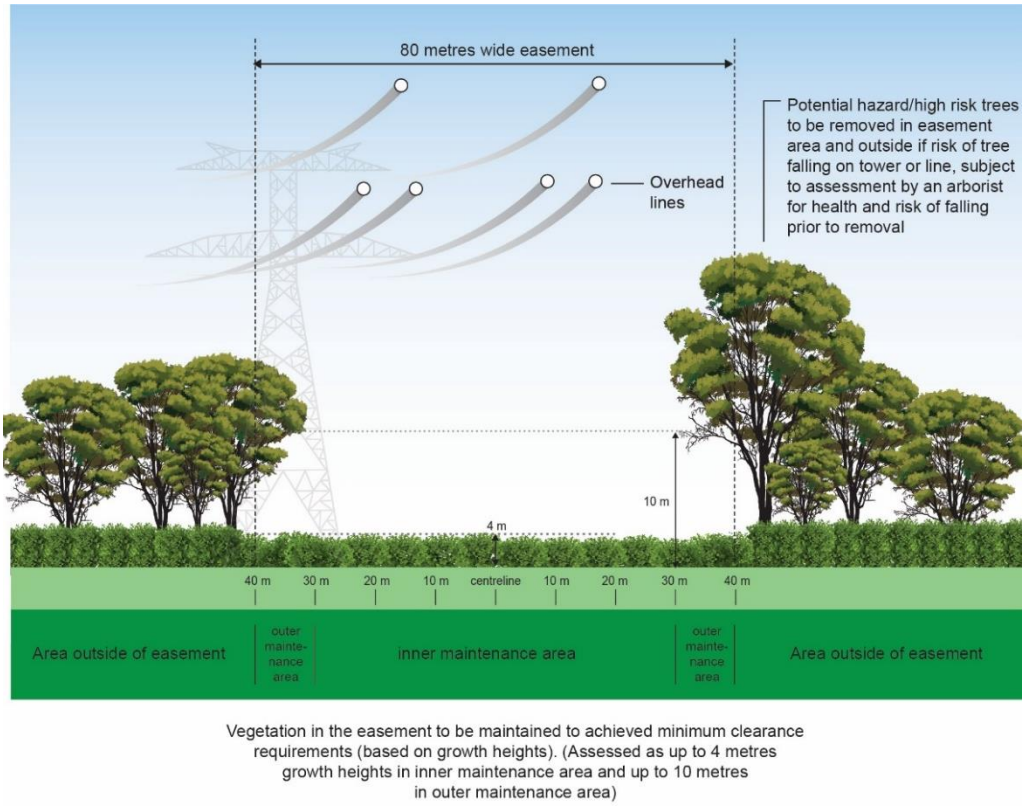


Vegetation in the centre 60 metres wide section of 80 metres wide easement to be maintained to achieved minimum clearance requirements (based on growth heights).(Assessed as up to 4 metres growth heights in inner maintenance area and up to 10 metres in outer maintenance area)

Note: Towers shown are indicative. Subject to finalisation of the proposal design.

Figure 5-10 Elevation of the indicative proposed vegetation clearing requirements within the 330kV transmission line at tower locations (top) and mid easement between towers (bottom)





Note: Towers shown are indicative. Subject to finalisation of the proposal design.

Figure 5-11 Elevation of the indicative proposed vegetation clearing requirements within the 500kV transmission line at tower locations (top) and mid easement between towers (bottom)

5.4.2. Proposed Dinawan 330kV substation operation and maintenance

The proposed Dinawan 330kV substation would not accommodate full-time staff or contractors. Maintenance at the substation site would typically include ad-hoc attendance (up to three times a week) of one or two switching operators to undertake planned and unplanned switching of equipment. It is expected that these activities would only require light vehicles and/or small to medium plant (depending on the works required). Any waste generated during operation would be minimal and disposed of on an 'as need' basis to a licensed waste facility by the attending maintenance personnel.

Additional maintenance activities at the expanded substation site would typically include:

- routine substation infrastructure inspection (such as transformers and other electrical plant and equipment) throughout the year by around two to three personnel
- routine/planned substation maintenance of equipment, property and switchyard areas on a scheduled basis. This would typically be monthly and undertaken by around three to five maintenance personnel
- ad hoc fault and emergency works for repair of any damaged infrastructure (for example through a weather event or other failure of infrastructure). This maintenance would occur as required. The amount of maintenance and/or crew required to access for repair of any damaged infrastructure would depend on the extent of repairs required.

Equipment for the substation is expected to have a service life of around 50 years. Maintenance would be regularly undertaken for the different infrastructure components and plant items such as transformers. These components would be replaced/refurbished towards the end of their serviceable life, allowing the service life of the substation to be extended.

5.4.3. Wagga Wagga substation operation and maintenance

The upgrade and expansion of the Wagga Wagga substation would not change the existing operational or maintenance requirements that currently occur for this infrastructure.

5.5. Land acquisition, easements and operational access

5.5.1. Freehold land acquisition

The land required for the proposed Dinawan 330kV substation (inclusive of APZs) has been acquired and comprise the following parcels:

- Lot 4 DP 593483
- Lot 52 DP 756396
- Lot 53 DP 756396
- Lot 54 DP 756396
- Lot 55 DP 756396.

The need for acquisition of any further land as part of the proposal would be determined during finalisation of the proposal in consultation with relevant landholders (as required).

5.5.2. Easements

Transgrid is continuing to work with relevant landholders to create the new transmission line easements. Typical easement requirements for the proposal are further discussed in the following section.

All acquisitions of privately owned land would be carried out in consultation with the landholders through the private treaty process or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the supporting NSW Government Land Acquisition Reform 2016.

The acquisition of Crown Land would be undertaken in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991, Crown Lands Management Act 2016* and the *Crown Land Legislation Amendment Act 2017*.

Additionally, as the proposal would travel through two areas of land reserved under the NP&W Act being the Yanga State Conservation Area, Cullivel State Forest and the Brookong State Forest, Transgrid would also need to secure easements for these relevant sections under Section 47I of the NP&W Act.

5.5.2.1. Transmission line easement

The transmission line between the Buronga substation and Wagga Wagga substation would be located within an easement up to 80 metres wide. This easement would provide a right of access to construct, maintain and operate the transmission line and other operational assets associated with the line (such as the transmission line towers and conductors). The easement would also ensure safe electrical clearances during the operation of the lines.

The transmission line easement would also be required to accommodate other permanent infrastructure including the optical repeater station communication huts at Booroorban and Brookong (noting the Balranald site within be located within the existing Balranald substation yard). Additional minor easements would also likely be required for the associated power connection infrastructure to these communication huts where this falls outside the proposed easement for the new transmission line.

5.5.3. Operational access requirements

Access to the proposed easement for operational purposes would preferentially use existing public and private roads and tracks, although access tracks created for construction may be retained during operation of the proposal to provide safe access (refer to Section 6.6.1.2). Access easements may be required to provide Transgrid with access from the nearest public road to the easement. These access easements would be negotiated with landholders as necessary. Transgrid may install locked and signed access gates to enable access to the easement should a landholder not have a suitable existing gate nearby.

6. Proposal construction

This chapter describes the likely key construction works for the proposal and describes the indicative construction staging, strategy and program.

The construction approach and methodology presented in this chapter has been developed with input from the nominated construction contractor and would continue to be refined as the design and construction planning progresses. The final construction methodology and program would continue to be developed by the nominated construction contractor. This would be reviewed for consistency with the assessment contained in this EIS, including relevant mitigation measures and any future conditions of approval.

Any material changes to the construction methodology which could result in additional environmental impacts to those assessed in this EIS would be the subject of additional environmental assessment or consistency review, as relevant.

6.1. Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to the description of the proposal and where these requirements are addressed in this EIS are outlined in Table 6-1.

Table 6-1 Secretary's environmental assessment requirements – Proposal construction

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
General requirements	The EIS must include:	
	• a full description of the project, accompanied by suitable maps and plans, including the:	This chapter provides a description of the construction activities and sites associated with the proposal and is supported by figures. A description of operational component of the proposal is provided in Chapter 5 (Proposal infrastructure and operation).
	- disturbance area;	The construction impact area for the proposal is described in Section 6.4. A more defined disturbance area for the biodiversity and heritage assessments is described in Section 8.1.1).
	- physical layout of the project over time, including sections of key components;	Description of the physical layout of the proposal is provided throughout this chapter, in particular Section 6.5 to Section 6.7. Figure 6-1 and Figure 6-4 provide the location of the proposal and key supporting main construction sites and accommodation camps.
	- key uses and activities to be carried out on site;	This chapter provides a description of the key uses and activities to be carried out during construction. A description of operational activities is provided in Chapter 5 (Proposal infrastructure and operation).

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
	- likely timing of the project including any stages, the key phases within each stage (site preparation, construction, commissioning, operation, decommissioning and rehabilitation) and the sequencing of these stages and phases.	This chapter provides the program for the proposed construction of the project and describes the proposed phases of construction (refer to Section 6.3, Section 6.5, Section 6.6 and Figure 6-2).

6.2. Construction overview

Key works for the proposal would typically include (but not be limited to):

- enabling works phase (refer to Section 6.6.1)
  - site establishment (including early stages of establishment and operation of some camp components)
  - vegetation clearance
  - property adjustment
  - service connections, and utility relocation and protection
  - access tracks
  - material deliveries
- main construction phase (refer to Section 6.6.2)
  - transmission line construction
  - Dinawan 330kV substation construction
  - Wagga Wagga substation upgrade and expansion
  - Buronga substation connection
- commissioning and demobilisation phase (refer to Section 6.6.3)
  - commissioning
  - demobilisation.

An overview of the key construction features of proposal is provided in Table 6-2 and shown in Figure 6-1. Further details of each of the construction phases is provided in Section 6.6.

Table 6-2 Project summary table – construction

Proposal element	Summary of the proposal	Figure/table reference
Construction program	Construction of the proposal would commence in late-2022 (enabling works phase). The main construction works phase for the transmission lines and substation facilities would take around 18 months.	Figure 6-2
Construction workforce	During peak construction activities, around 500 workers.	Table 6-6

Proposal element	Summary of the proposal	Figure/table reference
Construction impact area	The construction impact area (i.e. overall site area required for the proposal) for the proposal would encompass all construction activities and components of the proposal (including the main construction compounds and accommodation camp sites and access tracks). This would comprise an approximate area of around 5,000 hectares. Of this area, the construction footprint would comprise the following: • disturbance area A: around 2,066 hectares • disturbance area B: around 2,935 hectares.	Figure 6-4a to Figure 6-4e and Appendix F
Construction compound and accommodation camps	Several main construction compound and accommodation camps would be required to support the construction of the proposal including sites at: • Buronga (approved for use as part of EnergyConnect (NSW – Western Section) • Balranald (two options being considered) • Cobb Highway • Dinawan • Lockhart (two options being considered) • Wagga Wagga. The final location of the Balranald and Lockhart sites would be selected prior to construction following ongoing landholder agreement. The new construction compound and accommodation camp sites would accommodate a range of facilities including: • staging and laydown facilities • concrete batching plants (Balranald, Cobb Highway, Dinawan and Lockhart sites) • new workforce accommodation camp areas (Cobb Highway, Dinawan and Lockhart sites) • demountable offices • construction support facilities including vehicle and equipment storage, maintenance sheds, chemical/ fuel stores and potential stockpile areas.	Figure 6-4a to Figure 6-4e
Water management	Around 1.1 gigalitres of water would be required for construction, comprising: • 728 megalitres for dust suppression • 203 megalitres for earthworks compaction • 20 megalitres for concrete batching activities (potable water) • 11 megalitres for vehicle washdown facilities • 100 megalitres for camp sites (potable water). Water would be supplied for the proposal from existing regulated sources. No new extraction infrastructure from existing watercourses is proposed as part of the water supply points proposed.	Figure 6-9

Proposal element	Summary of the proposal	Figure/table reference
Construction haulage routes	Construction haulage routes have been divided into the following: • Primary haulage routes – haulage route between ports and the main construction compounds • Secondary haulage routes – haulage routes between the main construction compounds and the transmission line work areas • Water haulage routes – identified routes proposed to be used by water trucks to travel between water source and the nearest primary or secondary routes.	Figure 6-12a and Figure 6-12b

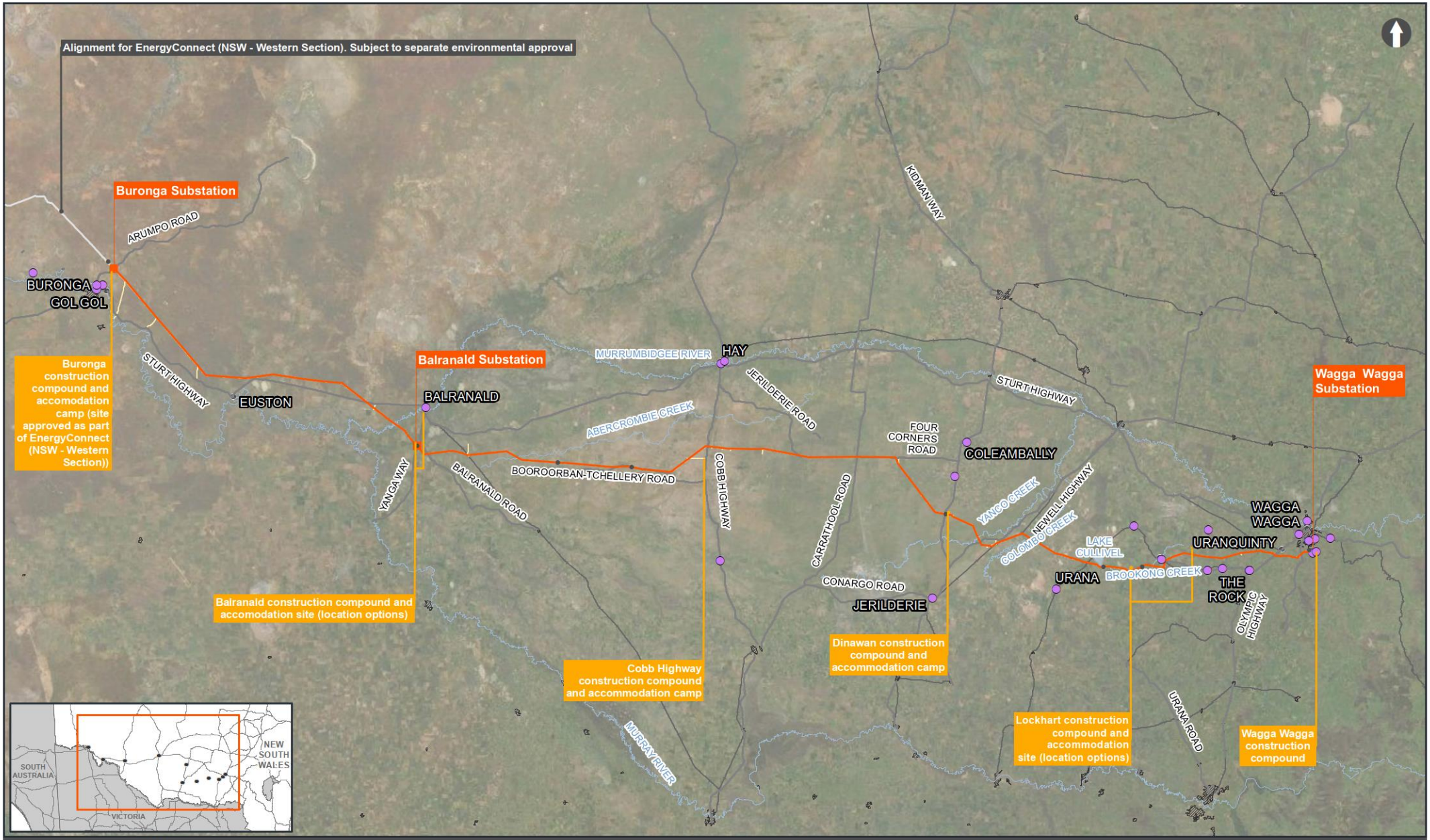


Figure 6-1

Overview of key construction features

6.3. Indicative construction program

Construction of the proposal would commence in late-2022 (enabling works phase), subject to NSW Government and Commonwealth planning approvals. The main construction works phase for the transmission lines and substation facilities would take around 18 months. The upgraded Wagga Wagga substation and proposed Dinawan 330kV substation are expected to be operational by August 2024. Removal and re-instatement of construction compounds and associated works and remediation would extend around six months beyond the commissioning phase, with estimated completion in March 2025.

Figure 6-2 presents an indicative program for the proposal (following planning approval) for all proposed construction phases. The indicative staging strategy for construction is discussed in Section 6.5. Construction at each transmission line tower would be intermittent and construction activities would not occur for the full duration for each phase of construction as expressed in Figure 6-3.

Activity	Duration	Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3		
		Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023	Sep 2023	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024
330kV transmission line - Buronga substation to Dinawan substation																									
Enabling works phase	2																								
Earthworks and civil construction works	15																								
Tower assembly	13																								
Tower erection	16																								
Tower stringing and clipping	14																								
Commissioning/energisation	1																								
Final completion (remediation works)	1																								
330kV/500kV transmission line - Dinawan substation to the existing Wagga Wagga 330kV substation																									
Enabling works phase	4																								
Earthworks and civil construction works	10																								
Tower assembly	8																								
Tower erection	14																								
Tower stringing and clipping	14																								
Commissioning/energisation	1																								
Final completion (remediation works)	1																								
Construction of the Dinawan 330kV substation																									
Enabling works phase	9																								
Earthworks and civil construction works	14																								
Electrical construction works	13																								
Pre-commissioning	12																								
Commissioning/energisation	3																								
Final completion (remediation works)	0																								
Upgrade and expansion of the Wagga Wagga substation																									
Enabling works phase	0																								
Earthworks and civil construction works	17																								
Electrical construction works	15																								
Pre-commissioning	13																								
Commissioning/energisation	1																								
Final completion (remediation works)	0																								

Figure 6-2 Indicative construction program

Figure 6-3 presents an indicative duration of construction activities associated with the transmission line towers. These durations could vary and breaks between activities may be shorter which may lead to longer inactive periods in subsequent stages of construction at an individual transmission line tower. Durations of any particular construction activity, and respite periods, can vary for a number of reasons including (but not limited to), multiple work fronts, resource and engineering constraints, works sequencing and location.

These activities would also have multiple work fronts, therefore (for example) foundation works or tower erection would be occurring in several locations along the easement at the same time.

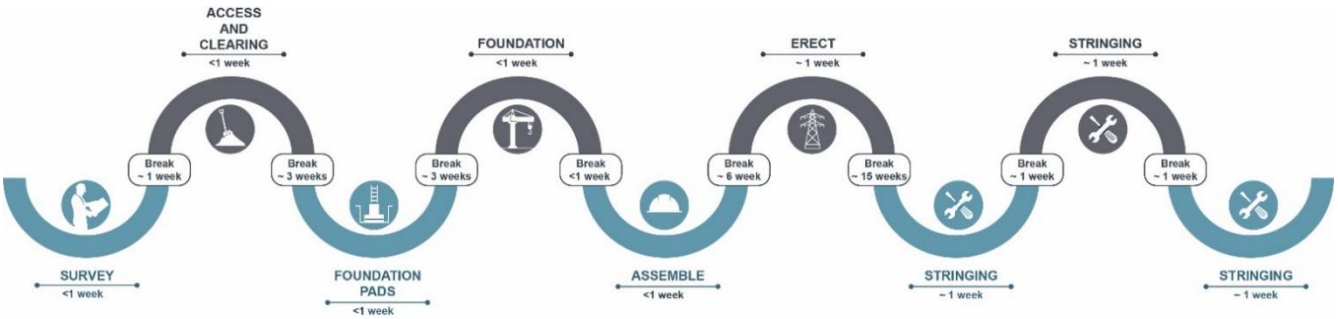


Figure 6-3 Indicative duration of construction activities at each individual transmission line tower site

6.4. Construction impact area

The construction impact area for the proposal would encompass all construction activities and components of the proposal (including access tracks). The operational footprint and associated easements for the final infrastructure would be within the construction impact area.

The construction impact area for the proposal is shown in Figure 6-4a to Figure 6-4e, and includes:

- transmission line and tower locations
- proposed Dinawan 330kV substation
- upgrade and expansion of the Wagga Wagga substation
- main construction compounds and accommodation camps along the alignment (including proposed options for sites at Balranald and Lockhart)
- other ancillary elements for the construction and operation of the proposal such as the optical repeater stations, construction water supply points and earthwork material site.

For the purposes of this EIS and as discussed further in Chapter 8 (Approach to impact assessment):

- the majority of the impact assessments have assumed potential for disturbance across the construction impact area
- for biodiversity and heritage assessments, more defined disturbance areas for the transmission line components (and ancillary construction works) have been assumed within the construction impact area to more appropriately quantify the potential impact extents (refer to Section 8.1.1).

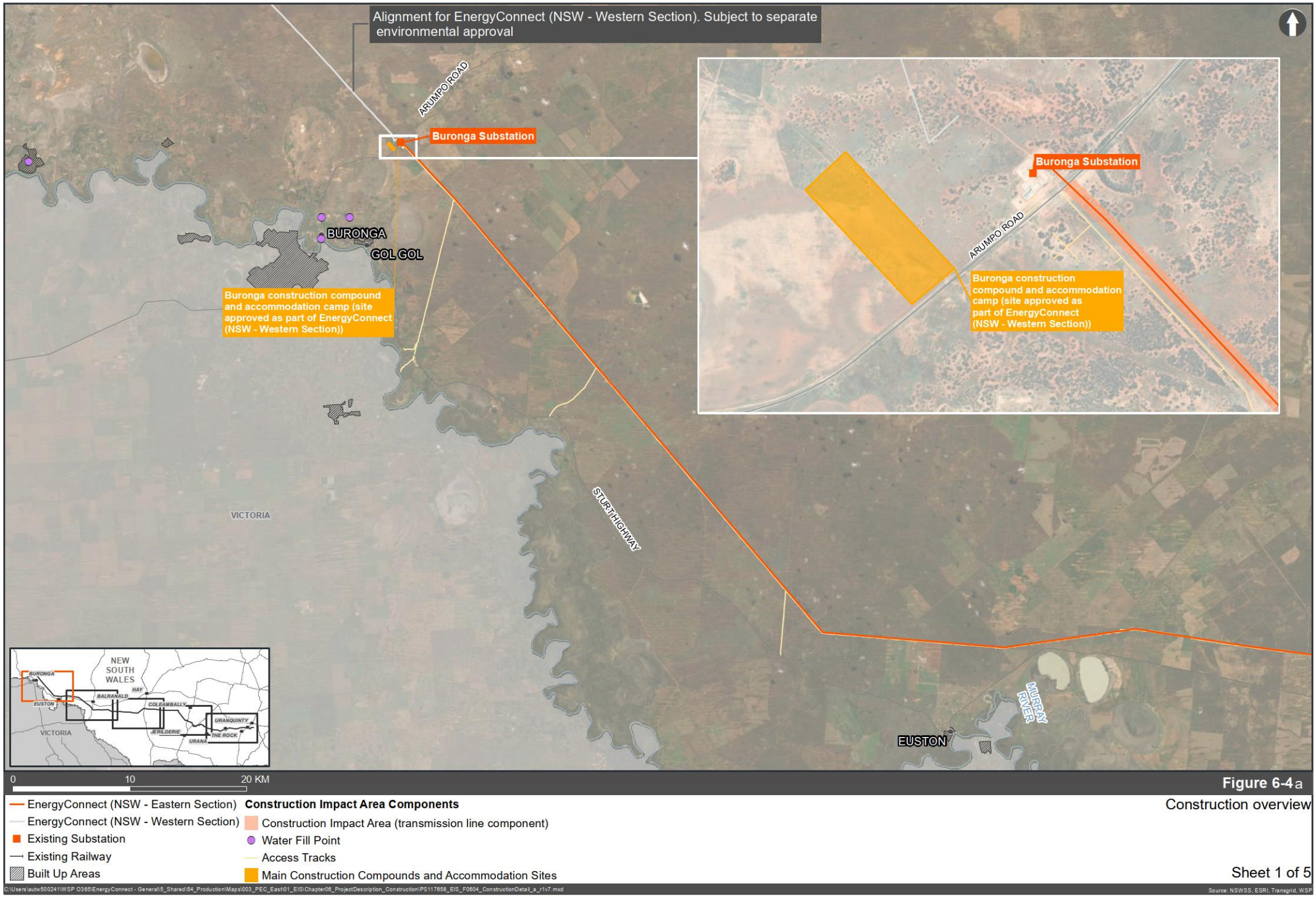


Figure 6-4a

Construction overview

EnergyConnect (NSW - Eastern Section)

EnergyConnect (NSW - Western Section)

Existing Substation

Existing Railway

Built Up Areas

Construction Impact Area Components

Construction Impact Area (transmission line component)

Water Fill Point

Access Tracks

Main Construction Compounds and Accommodation Sites

Sheet 1 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

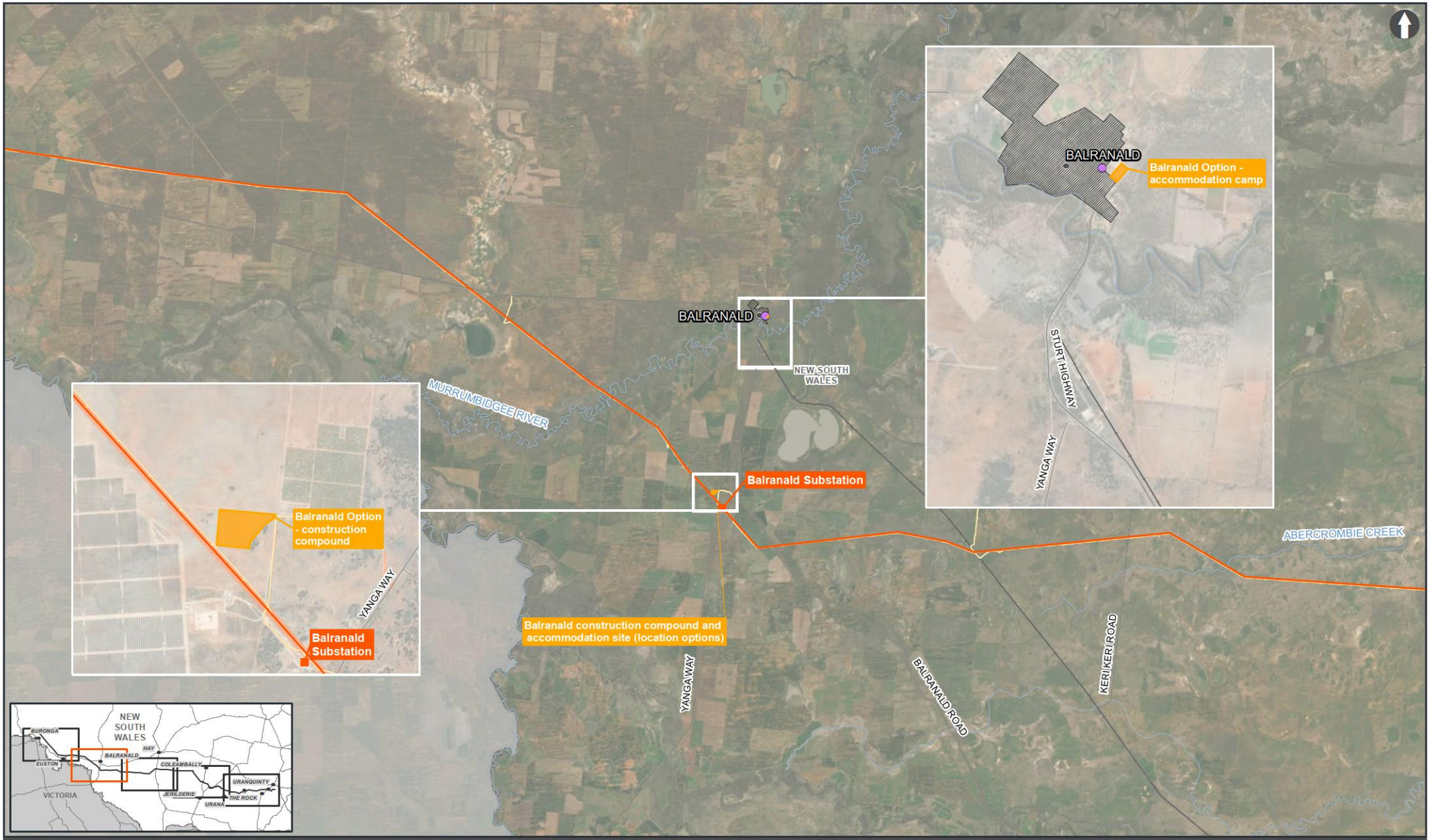

Figure 6-4b

Construction overview

Sheet 2 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

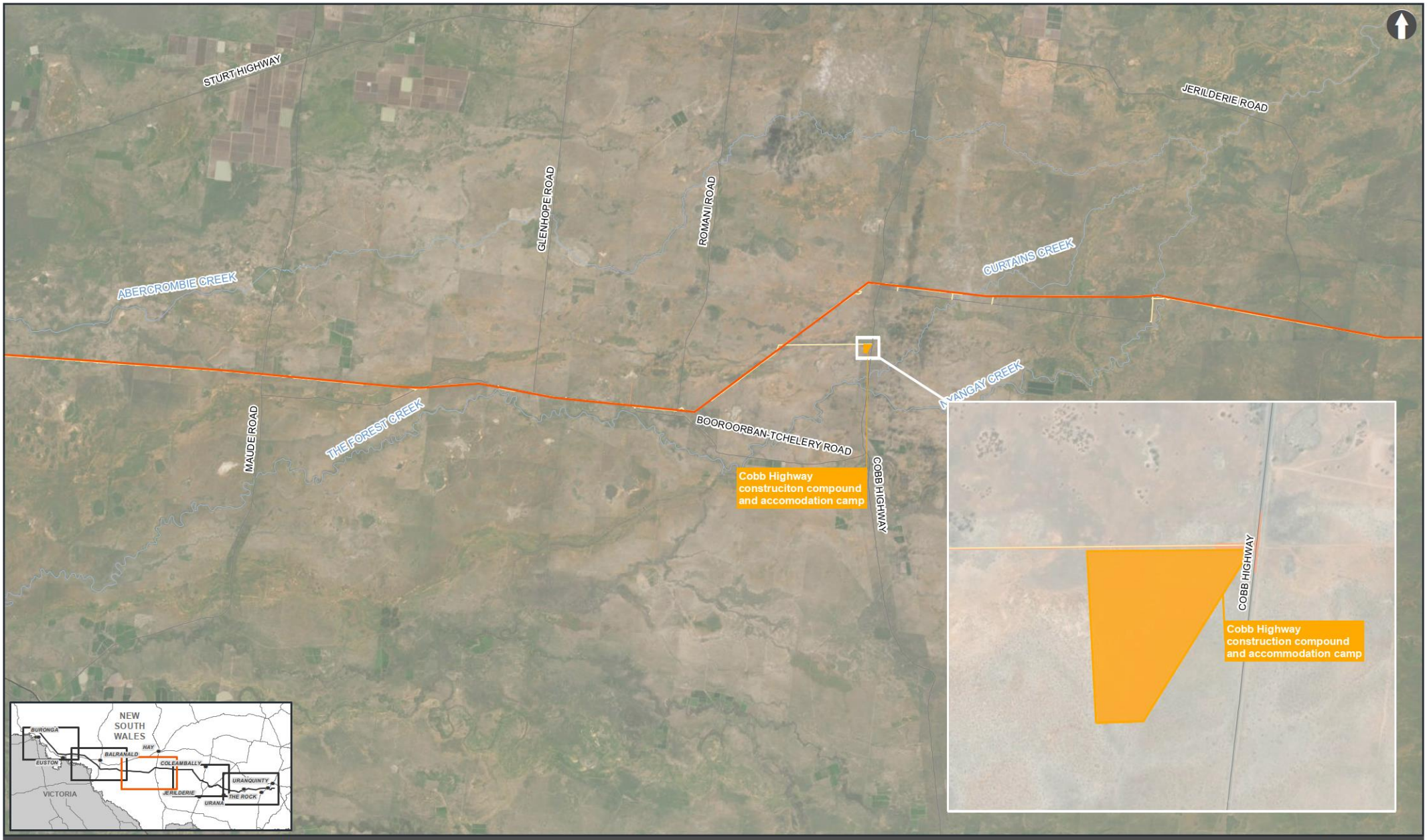

Figure 6-4c

Construction overview

- EnergyConnect (NSW - Eastern Section)
- EnergyConnect (NSW - Western Section)
- Existing Substation
- Existing Railway
- Built Up Areas

Construction Impact Area Components

- Construction Impact Area (transmission line component)
- Water Fill Point
- Access Tracks
- Main Construction Compounds and Accommodation Sites

Sheet 3 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

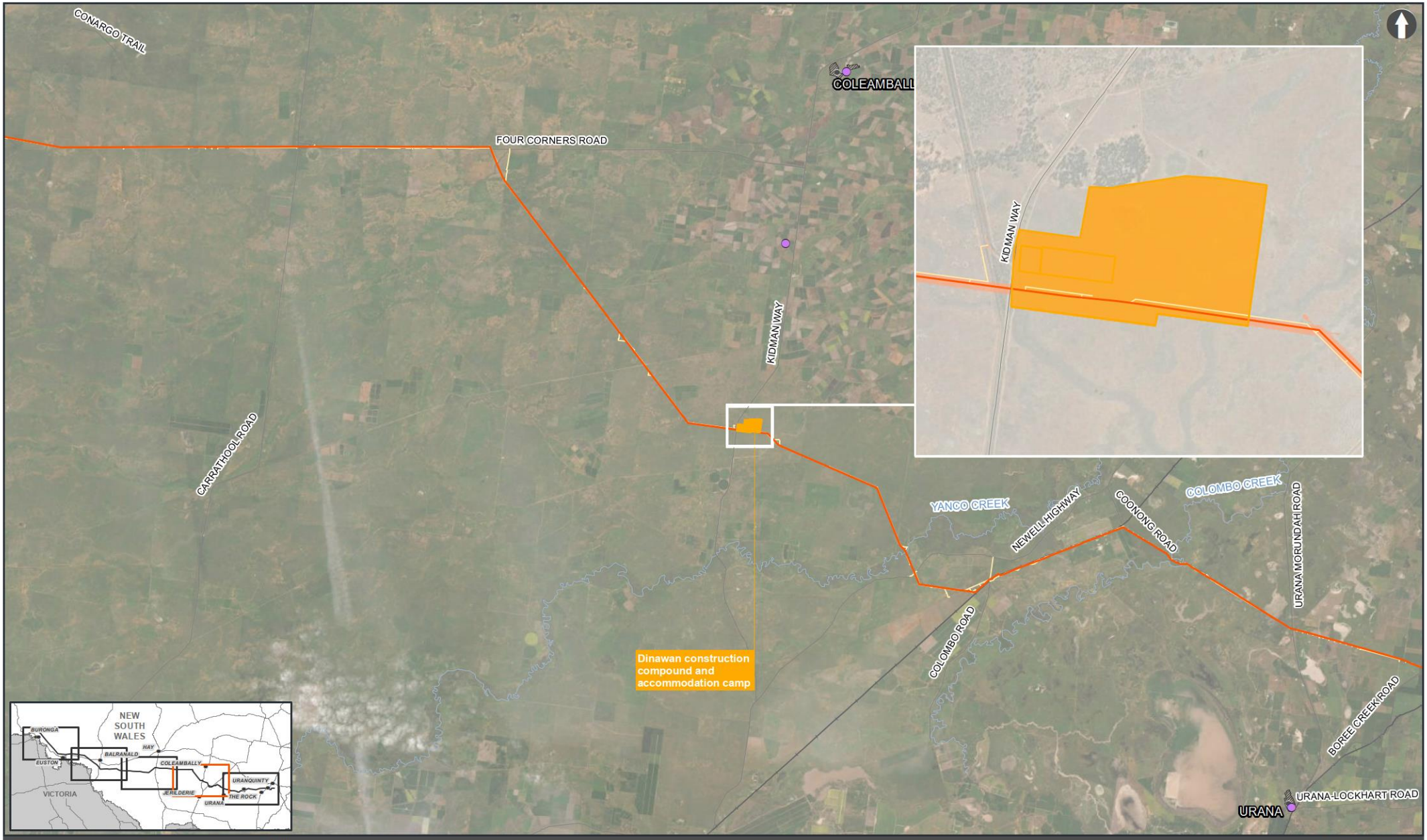

Figure 6-4d

Construction overview

- EnergyConnect (NSW - Eastern Section)
- Existing Substation
- Existing Railway
- Built Up Areas

Construction Impact Area Components

- Construction Impact Area (transmission line component)
- Water Fill Point
- Access Tracks
- Main Construction Compounds and Accommodation Sites

Sheet 4 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

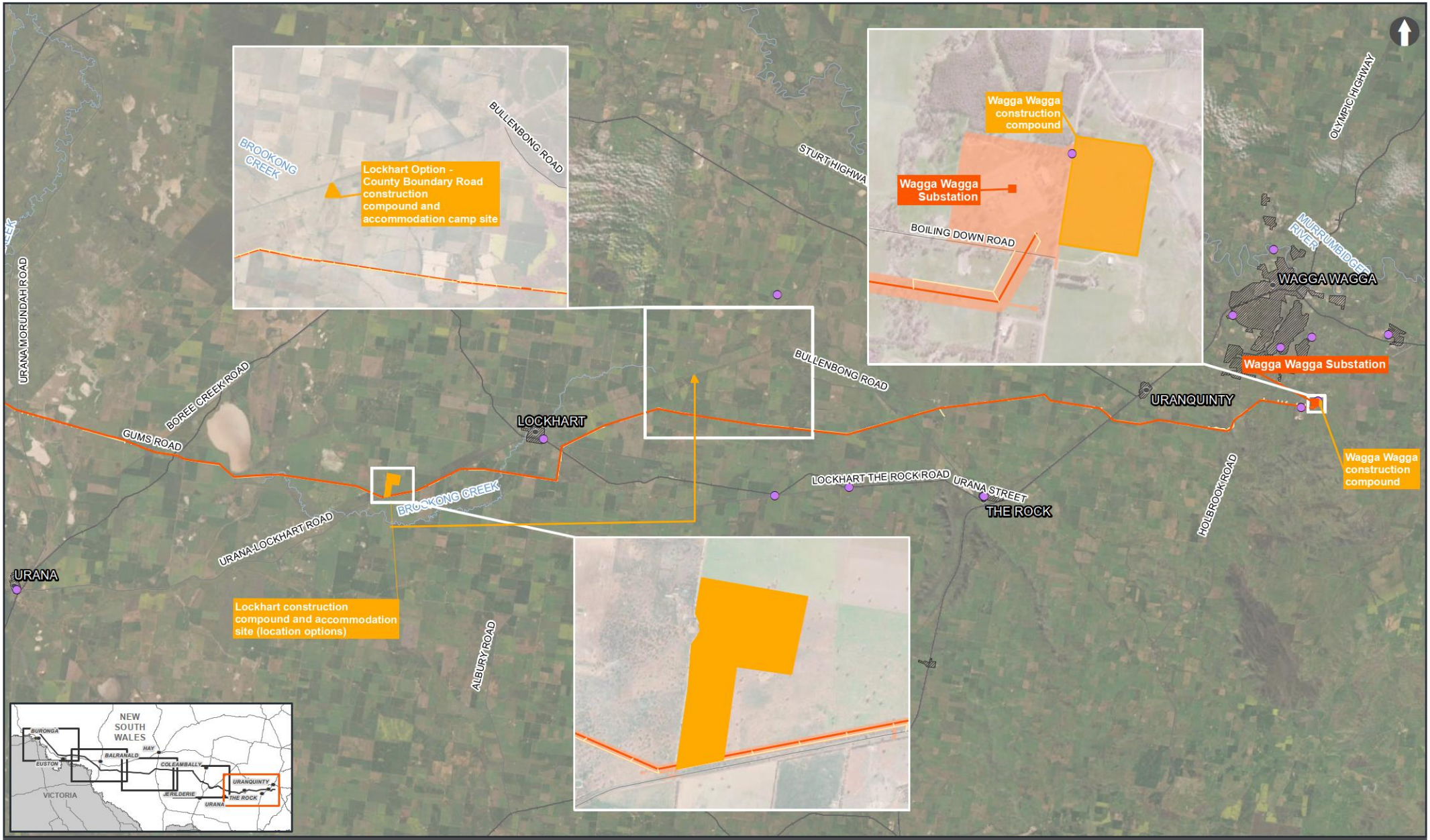

Figure 6-4e

Construction overview

EnergyConnect (NSW - Eastern Section)
Existing Substation
Existing Railway
Built Up Areas

Construction Impact Area Components

Construction Impact Area (transmission line component)
Water Fill Point
Access Tracks
Main Construction Compounds and Accommodation Sites

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Source: NSWSS, ESRI, Transgrid, WSP

6.5. Construction staging and construction phases

6.5.1. Construction staging

The construction of the proposal would involve staging of various elements of the proposals' construction. Staging involves constructing only certain parts of the infrastructure or carrying works in only certain locations at a time. Staging is typically adopted to address program, resource, logistical and construction approval requirements. Where staging of the proposal is proposed, the staging arrangements would be confirmed by the construction contractor during detailed development of the construction methodology.

6.5.2. Construction phases

The delivery of the proposal is expected to occur in the following three general phases:

- enabling works (minor/low impact pre-construction activities)
- main construction
- pre-commissioning, commissioning and demobilisation.

6.5.2.1. Enabling works

Enabling works are low/minor impact pre-construction activities that would be carried out to make key construction sites (including construction compounds and substation locations) ready to facilitate the commencement of main construction activities, establish the accommodation camps, manage features or issues, and collect additional information required to finalise the design and construction methodology of the proposal.

To be considered minor/low impact, the activities typically must involve no impact to:

- features of high environmental or heritage conservation significance
- excessive amenity impacts to nearby receivers.

Enabling works would include activities such as (where they meet the above requirements):

- site establishment and operation of the main construction compound and camp sites
- site establishment and earthworks at the proposed Dinawan 330kV substation
- additional and ongoing biodiversity and heritage investigations.

Details of the proposed enabling work activities are provided in Section 6.6.1. Further details regarding the considerations that would be undertaken when confirming whether an activity is minor/low impact are provided in Section 23.1.2.

6.5.2.2. Main construction works

Where construction activities have the potential to result in environmental, heritage and amenity impacts that are not considered to be minor/low, these activities would be conducted in accordance with a construction environmental management plan (CEMP) (or similar) approved by the Secretary of the NSW Department of Planning, Industry and Environment (DPIE). These activities are referred to as main construction works.

Main construction works for the proposal would include:

- transmission line construction (vegetation clearance, civil construction works, tower erection and assembly and conductor stringing)
- upgrades and expansion of the Wagga Wagga substation
- construction of Dinawan 330kV substation and associated works.

Details of the proposed construction activities to occur during the main construction works are provided in Section 6.6.2. Once the main construction phase commences, all remaining enabling works are typically also carried out in accordance with the approved CEMP.

6.5.2.3. Commissioning and demobilisation

Commissioning is the process by which the constructed infrastructure is energised and integrated into the existing electricity network (i.e. made operational). These activities typically occur entirely within existing project areas and involve no additional environmental or heritage impacts and minimal amenity impacts to nearby sensitive receivers.

Demobilisation is the process by which all remaining construction materials and equipment are removed from site and the project areas are rehabilitated and restored in accordance with project commitments. Depending on the detailed construction methodology and program, the general phases described above may overlap at some points throughout the overall construction program. Details of the proposed commissioning and demobilisation activities are provided in Section 6.6.3.

6.6. Construction methodology

6.6.1. Enabling works

Enabling works are activities that would be carried out before the start of substantial construction in order to make ready the key construction sites (including camps and compounds), facilitate the commencement of substantial construction, manage specific feature or issues and collect additional information required to finalise the final design and construction methodology.

Enabling works are to include:

- site establishment and operation of the main construction compounds and accommodation camp sites
- site establishment and earthworks at the proposed Dinawan 330kV substation site
- site establishment and earthworks at the Wagga Wagga substation upgrade and expansion site
- minor clearance of vegetation (excluding threatened species and ecological communities) to facilitate other enabling works, and relocation of salvaged habitat features
- biodiversity, heritage and other investigations, including test excavation, protection, salvage, environmental monitoring and recordings
- establishing connections at water supply points
- utility works, connections, adjustments, relocation and protection
- property adjustment work, including adjustments to property fencing, barricades
- installation of fencing, gates, barricades, exclusion zones and other access controls
- establishing access tracks and adjustments to regional and state roads
- additional geotechnical and contamination investigations

- realignment of the existing TL62 (Wagga – Jindera 330kV), TL63 (Wagga – Darlington Point 330kV) and TL51 (Wagga – Lower Tumut 330kV) transmission lines outside the Wagga Wagga substation to make way for the proposed transmission line from Dinawan
- other survey work, such as road dilapidation surveys, and surveys of the general alignment and existing utilities, installing survey controls (including installation of global positioning systems (GPS)), installing repeater stations, carrying out surveys of existing and future utilities
- installation of environmental controls, mitigation measures and monitoring equipment
- installation of temporary site sheds, amenities facilities and storage containers
- maintenance of existing buildings and structures required to facilitate the carrying out of the proposal (as required)
- removal of waste from the proposal impact area and remediation of contaminated land (if present and required)
- installation of communication towers (other than those using microwave technology).

These works are described further in the relevant sections of this chapter.

6.6.1.1. Site establishment

Site establishment is the preparation of the site for further activity, for example the construction compounds, accommodation camps or substation locations. Site establishment activities would commence as enabling works.

Site establishment activities would include:

- clearing and removal of vegetation and topsoils (excluding threatened species and ecological communities). Topsoil would be stockpiled on site
- establishing temporary advance accommodation camps to support the construction start up phase of the proposal. These camps would be required to temporarily house the construction workforce (particularly early works contractors) to carry out the establishment of the permanent camps, pre-construction works activities and early earthworks activities. These camps would be located within the same areas identified for the main construction compound and accommodation camps and would occupy a portion of the proposed camp boundary at each location and be supported by temporary infrastructure such as portable generators and water trucks for potable water
- establishing the main construction compounds, batching plants, accommodation camps and ancillary facilities, including offices, amenities, workshops, and creating internal roads
- connections of utilities (water and power) to main construction compounds and accommodation camp sites, where possible
- establishing vehicle access and egress points, including adjustment of public roads, to ensure safe vehicle movements at relevant locations
- establishing wheel washes, rumble grids and vehicle washdown facilities (for weeds etc)
- establishing hardstand areas for storage, laydown and carparking
- establishment of the earthwork material site at the proposed Dinawan 330kV substation site (refer to Section 6.9.1)
- establishing perimeter fencing, where required
- installing temporary fencing and security measures as well as any necessary environmental management measures such as erosion and sediment controls.

Further discussion on some components of site establishment are discussed below.

Vegetation clearance

Vegetation clearing carried out as enabling works to facilitate other enabling works only. Such clearing would only occur in locations that have been subject to full assessment in accordance with the Biodiversity Assessment Method (refer to Chapter 9) and would be limited to vegetation that is not a threatened species or part of a threatened ecological community (TEC).

All other vegetation clearing would be undertaken during the main construction phase in accordance with the approved CEMP and this EIS.

Property adjustments

Property adjustments that would be carried out as enabling works include installation of or alterations to gates, fences, installation of exclusion zones and other access controls. Property adjustments would occur in consultation with the affected landholder. Where the transmission line crosses or runs parallel in close proximity to a metallic fence, an earthing or isolation section would be installed in the fence to reduce the potential for induced currents due to electromagnetic effects.

Service relocations and/or protection works

Utility service connections (including power, water, gas and communications) for accommodation camps, construction compounds and other location would occur as enabling works.

The following utility relocation and protection works are proposed as part of enabling works:

- installation of a new transmission tower outside the Wagga Wagga substation to allow realignment of TL62 (Wagga 330kV – Jindera transmission line) and TL051 (Wagga 330kV – Lower Tumut transmission line) and transfer of the existing conductors
- conversion of overhead distribution powerlines up to and including 66kV to underground cables for the entire width of the transmission line easement, at locations where the existing powerlines cross the proposed transmission line easement. Alternately, hurdles may be erected to protect overhead lines that are unable to be undergrounded.

The proposal would cross an existing high-pressure gas main that runs in a generally north-south alignment to the west of the Olympic Highway. The proposal has sought to locate the towers either side of this pipeline to avoid the gas main and avoid the need for any protection works. Transgrid would continue to consult with the asset owner and enter into any agreements as required.

Other potential impacts to, or clashes with, other existing services and utilities would be confirmed prior to construction and any proposed relocation or protection works to be carried out as enabling works would be determined at the time in consultation with the relevant asset owners.

6.6.1.2. Establishment of access tracks

The establishment of access tracks would include:

- installation of access points from public roads
- installation of access tracks to accommodate safe access of construction machinery and materials to each transmission line tower site and the expanded and new substation sites.

Each of these elements are described in greater detail below.

Construction of access points

Access points are locations where access tracks and construction camp/compound access roads meet a public road. Where this occurs, works may be required to ensure safe vehicular access and egress. A series of locations have been identified along the length of the proposal which required construction of access points. These locations may require minor works such as the creation of widened lanes, widened road shoulders as well as sections which have been identified as potentially requiring either pavement alterations, minor earthworks (infill, grading and rolling etc) in adjacent unsealed surfaces, and new/or altered line marking and signage.

The type of access point and activities required would depend on sight distance, the largest design vehicle to utilise the access point, deceleration or acceleration movements, topography and existing road and track condition (dilapidation). All access points will be designed in consultation with the relevant road authority and would occur in accordance with road occupancy licence(s) as required. These features would be designed in accordance with the Austroads and other relevant guidelines. These areas have been included as part of the overall area of impact assessed for the proposal. Drainage works (for example culverts) may also be required.

Construction access tracks

Access to each tower would be required during construction, and tracks may be retained for operational purposes. Access tracks would be required to be traversable by a range of vehicles. Access tracks would fall into the following broad groups:

- un-improved access tracks
- improved access tracks
- constructed access tracks.

The proposed access tracks for the construction of the proposal are shown on Figure 6-4.

Un-improved access tracks

Un-improved access tracks would provide access to work sites by using existing roads or tracks or driving on existing soil or ground surface with minimal or no prior preparation. Existing roads, tracks and other existing disturbed areas would be used wherever possible in order avoid or minimise disturbance.

Where access is across open spaces, particularly in cultivated areas, pasture improved grazing land or native grasslands, care would be exercised to ensure that minimum damage is caused to the surface by confining movement, as far as possible, to one route.

Improved access tracks

Improved access tracks would provide access to work sites by using existing roads or tracks where some additional grading or widening of the existing track is required. This may include widening of existing narrow sections to allow for sufficient width to allow construction vehicles to pass without leaving the roadway.

Constructed access tracks

Constructed access tracks would be required in areas where there are no existing roads or tracks, or where terrain conditions prevent continuous access along the line easement between road crossings. In these situations, 'off easement' access may be required, and suitable access tracks would be constructed. Alignment selection for construction access tracks would consider existing vegetation and minimise the need for clearing as much and practicable. Any vegetation clearing required to create construction access tracks as enabling works would occur as described above.

All construction access tracks would be between four and eight metres wide, with an additional metre either side for material windrows, and would generally follow existing property owner tracks as well as the natural contour of the land as far as practicable to minimise the amount of cut and fill and soil disturbance. Access tracks would also include drainage control features such as table drains or cross banks to minimise erosion.

Where access tracks extend beyond the transmission line easement, the location of the access tracks would be agreed with the landholder and subject to separate agreements. For permanent access tracks beyond the transmission line easement, an access easement may be required and negotiated with the landholder. Where these tracks are currently known, impacts to these areas have been considered as part of this EIS.

In the case of cultivated land, it may be necessary to route access tracks along fence lines or otherwise in accordance with landholder requirements. Final track alignments would be selected and track construction would be carried out so as to cause minimum disturbance to soil and vegetation both on and adjacent to the track, including restricting the use of bulldozers where practical.

Where tracks are, or are required to be, located in areas which are not suitable for use by vehicles and plant following adverse weather conditions, the area would be temporarily by-passed (i.e. alternative access paths would be identified).

6.6.2. Main construction phase

The main construction phase would include the completion of any enabling works that were not completed prior to approval of the CEMP and any similar activities that could not be completed as enabling works. Main construction works would include:

- transmission line construction
- Dinawan 330kV substation construction
- Wagga Wagga substation upgrade and expansion
- connection to the Buronga substation.

Further details are provided in the sections below.

6.6.2.1. Transmission line construction

Main works associated with the construction of the transmission lines would include (but not be limited to):

- remaining vegetation clearing
- remaining access track installation
- earthworks and footing construction including:
  - earthworks and establishment of laydown areas and construction pads for each transmission line tower
  - construction of footings and foundation works for the new transmission line towers including with concrete or steel piles (driven and/or screw), boring and/or excavation, steel fabrication works and concrete pours
- assembly of transmission line towers
- erection of the transmission line towers
- installation of earthing conductors
- stringing of the conductors and overhead earth wires and optical ground wire
- earthing of fences and gates (as required).

Further detail of these key tasks is provided below.

Earthworks and transmission tower footing construction

Excavation works at each tower site would typically be required for the installation of foundations, levelling around the individual tower foundations, drainage and grading or preparation for construction at the tower site.

Bench sites (stepped ground excavation) may be required to provide a level platform for equipment setup, the erection of the tower and other construction activities. Benching would be constructed by use of earth moving equipment such as graders and excavators. Due to the topography of the line corridor the requirement for benching is assumed to be minimal.

Where excavation is required (excluding piling for tower foundations), excavations would typically be up to around five metres. Where groundwater is shallow, alternative construction methodologies and designs may be implemented to limit interaction with groundwater and avoid or minimise the need to dewater.

Typical transmission line tower piling depth would be up to 16 metres below ground level and would depend on ground conditions (e.g. greater piling depths would be required where soft soil types are present).

The foundation type would also vary and (subject to finalisation of the proposal infrastructure) would consist of either:

- bored pile/cast in-situ (reinforced concrete)
- driven or screw pile (concrete or steel).

If groundwater is encountered or the excavations are filled by rainwater, the excavation would be dewatered and managed as appropriate. Dewatering may also be required during the concrete pour process. Concrete would be poured wet into the pile footings with any water removed from the top of the concrete as required.

Excavated material would be stockpiled to be used for backfill around the transmission line tower foundations and embankment filling at the tower site from which it was excavated. Topsoil would be stripped and stored separately from the excavated material to assist in site restoration. Any excess excavated material would be spread evenly around the site after completion of the foundation backfilling (if suitable) or removed from the site and disposed of in accordance with the appropriate waste classification.

Blasting

Blasting may be required, depending on geotechnical conditions along the alignment of the proposal to loosen and break up existing rock to allow for creation of transmission tower pads. This would be confirmed during detailed development of the construction methodology however would be expected to be limited to small areas as required at tower locations where shallow bedrock or hard geological conditions are identified.

The controlled blasting would typically be done by drilling a line of closely spaced holes within the area required (such as a transmission tower pad). Each hole would then be loaded with a small amount of explosives and a delayed detonation of the explosive would be carried out to limit the amount of energy being released at any particular moment. The energy generated as a result of detonating the explosive would break the harder rock formation(s) into smaller pieces to allow subsequent removal. Following the controlled blasting activities, two options would be available for the removal of the rock material. These would include traditional excavation with excavation equipment or additional blasting. The technique to be used would be determined based on the success of the initial blasting activities.

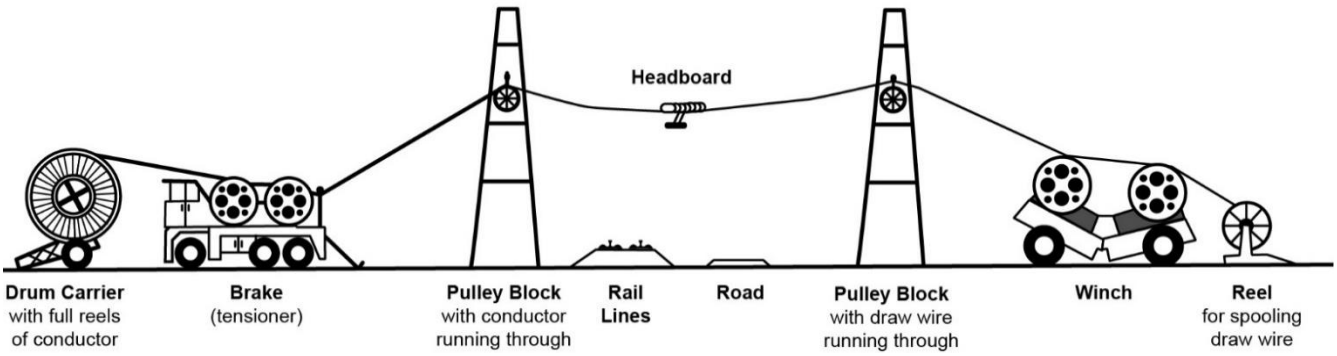
Construction of transmission line towers

Transmission line towers are typically erected by assembling in sections on the ground and hoisting or lifting successive sections into place using cranes. Alternatively, towers may be erected in place on the footings by installing individual members. These towers would include infrastructure such as step bolts, climbing attachment plates, ladders, platforms, climbing barriers, identification plates, warning plates, other fixtures and fittings for the attachment of earthwires and insulators.

Construction of each tower would require access for tower assembly and stringing works. Where a transmission tower is proposed to allow for a direction change of the transmission line, a larger area would be required (to allow for brake and winching sites). At a typical site, this would include a temporary area of up around 60 metres by 80 metres at each transmission line tower location.

Stringing of the transmission lines

Following erection and securing of the tower, the transmission line would be strung by either a ground pulled draw wire (with brake and winch sites – refer to indicative schematic shown in Figure 6-5 which shows how each component of the brake and winch site would interact) or a line stringing drone. A brake and winch site is a temporarily cleared area where plant and equipment is located for the purposes of spooling and winching a conductor into place on erected transmission line towers along a transmission line easement.



Note: Schematic illustration only. The location of brake and winch components could be up to around 10 kilometres apart (up to around 20 towers, not consecutive towers)

Figure 6-5 Diagram of how conductor stringing operations could occur over road and rail corridors

To assist with the stringing of conductors, a centreline area cleared of vegetation between towers would be required. For the 330kV line, this area would be up to 10 metres wide and for the 500kV section this would area be up to 20 metres wide. In certain highly significant areas (such as identified Plains Wanderer primary habitat – refer to Chapter 9), alternative construction methods that would not require vegetation clearing between towers would be adopted.

Transmission line crossing points

Spanning watercourses

The proposed transmission line would require spanning of a series of major watercourses including the Murrumbidgee River at Balranald; Abercrombie Creek; Yanco Creek; the Coleambally Outfall Drain, Colombo Creek; Halliday's Cut (at Lake Cullivel); Burkes Creek (The Rock) and several other smaller creek spans.

Generally, the design of the transmission line would include a transmission line tower on either side of each watercourse. A drone would then be used to take a lead wire over the river to allow cables to then be pulled and strung tower to tower. In some circumstances it may be impractical to use a drone, and in such cases alternative methods, such as the use of watercraft, might be required.

It is not envisaged that any access tracks or bridges would be required for these particular crossings due to the design and proposed construction method of the transmission line at these locations. There would likely be some temporary works at the transmission line tower on each side of the span to allow for the construction of the transmission line tower, however it is likely that these would be at least 50 metres from the river bank and with appropriate environmental controls (such as erosion and sediment controls).

Where alternative access routes are impractical, a number of local waterway spans and causeways would be required at other smaller waterway locations along the length of the proposal. Where required, bed-level fords (i.e. construction of a good footing where a river or stream may be spanned) or causeways may be required to be constructed to provide temporary access. Where these crossings are required, they would typically be constructed using the following typical methodology:

- removing all loose material from the watercourse at the point to be spanned, forming a depression with firm base and sides
- the depression would then be filled with graded layers of rock. The rock layers would be placed so as to produce an interlocked bed of rock, sloped and dished, to allow water to drain freely through and flow over the causeway (minimum thickness of around 450 millimetres but not higher than the bed of the watercourse).

The spanning of all watercourses would be designed and installed in accordance with relevant Department of Primary Industries (DPI) guidelines for waterway crossings including:

- *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI, 2004a)
- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (DPI, 2004b)
- *Guidelines for Controlled Activities on Waterfront Land* (DPI, 2012a).

If required as part of a water crossing, culverts may also be installed in accordance with required standards (such as *Precast concrete pipes (pressure and non-pressure) - AS/NZS 4058:2007* (Standards Australia and Standards New Zealand, 2007)).

Road and rail crossings

The proposal would cross a number of major and minor road crossings between Buronga and Wagga Wagga. Key roadway crossings would include (but not be limited to):

- Arumpo Road
- Sturt Highway
- Yanga Way
- Maude Road
- Booroorban-Tchelery Road
- Cobb Highway
- Jerilderie Road
- Four Corners Road
- Kidman Way
- Newell Highway
- Urana-Morundah Road
- Boree Creek Road
- Urana-Lockhart Road
- Lockhart-The Rock Road
- Bullenbong Road
- The Rock-Collingullie Road
- Olympic Highway
- Holbrook Road.

Key railway line crossings would consist of:

- Moama Balranald Railway, around 25 kilometres southeast of Balranald (non-operational)
- Narrandera Tocumwal Railway, near intersection of Colombo Road and Crutchs Road, Bundure (non-operational)
- The Rock Oaklands Railway, around nine kilometres northeast of Urana (non-operational)
- The Rock Oakland Railway, around two kilometres southeast of Lockhart (operational)
- Main Southern Railway, around three kilometres southwest of Uranquinty (operational).

Similar to the proposed method for crossing waterways as outlined above, the design of the transmission line would include a transmission line tower on either side of each road or rail crossing. Typically a brake and winch style operation would then be used to string the transmission lines, with temporary road and/or rail stoppages as required put in place (subject to confirmation of the final construction methodology) (refer to Figure 6-5).

6.6.2.2. Dinawan 330kV substation

As described in Section 5.3.4, a new 330kV substation between Buronga and Wagga Wagga, the proposed Dinawan 330kV substation, would be constructed east of Kidman Way, around 30 kilometres to the south of Coleambally. The construction of the proposed Dinawan 330kV substation would be up to around 36 hectares in area.

The construction methodology for the proposed Dinawan 330kV substation would consist of the following key activities:

- site establishment, including vegetation removal and establishment of temporary construction site office and amenities within the proposed substation site
- earthworks to form the substation pad including placement of up to around 150,000 to 200,000 cubic metres of material to allow for the construction of the substation pad, and the temporary stockpiling of existing soil that does not meet engineering requirements for the substation pad. The earthwork material would be primarily obtained from a proposed earthwork material site to the north of the proposed Dinawan 330kV substation where possible (refer to the following section). Where materials cannot be obtained from within the earthwork material site, additional earthwork material would be imported to the site
- excavation and preparation of the site for concrete foundations
- installation of reinforced concrete and piled foundations for the electrical equipment
- excavation and installation of electrical equipment conduits, including earth grid, trenches and general site drainage works, including construction of oil containment facilities
- construction of two to three new ancillary and equipment control buildings
- erection of galvanised steel supports for electrical equipment and gantries on foundations, using cranes
- installation of high voltage electrical cables and terminations, including earthing wire
- installation of site wiring and electrical control equipment within the control buildings
- erection of the substation site boundary security fence, including site access gates
- surfacing and stabilising works for access, dust and vegetation suppression.

Site establishment and earthworks would commence as enabling works.

Dinawan earthwork material site

The construction methodology for the earthwork material site would generally consist of the following key activities:

- existing topsoil would be stripped from the earthwork material site (refer to Figure 6-8 and Section 6.9.1 for detail of the proposed location). These would be stockpiled within the construction impact area and proposed APZ
- excavation of the earthwork material sites. Following excavation, the material may be passed through a mobile screening plant (refer to section below)
- following the screening process, the refined material would be transferred to the pad site for the substation upgrade and expansion
- contouring to the site to re-establish surface flow regimes, noting the final site would consist of a depression within the existing landscape up to around two metres deep at the lowest point.

Screening plant

The main purpose of the mobile screening plant would be to reduce the size of large rocks and meet the engineering requirements for use as the substation base.

Up to around 150,000 to 200,000 cubic metres (total volume) of material may need to be screened at a rate of around 600 to 700 cubic metres per day (with the final quantity material requiring screening to be confirmed after geotechnical investigations are complete). Screening activities are proposed to be undertaken between the period of 7:00am to 7:00pm seven days per week for the duration of the earthworks at this site.

Typical screening operation would include:

- unloading the accepted material via dump trucks/scrapers to a designated area within the earthwork material sites ready for the screening process
- loading the material into a hopper that feeds the screening plant which would consist of a deck which holds a screening media, that, when vibrated, causes particle separation
- once processed, a conveyer belt would transport the material out of the plant. Material for use would be stockpiled in a designated area adjacent to the earthwork material site.

The proposed screening plant would be relatively small and typically consist of two mobile units requiring a footprint of around 40 square metres to 60 square metres each. The specifications of the plant would be confirmed prior to construction (refer to example in Figure 6-6).

The screening plant and material stockpiles would be contained within the earthworks material sites as shown in Figure 6-8. Material that is not suitable for use in the substation pad would be used during the re-instatement of the earthwork material sites.

Details of the Dinawan earthwork material site is provided in Section 6.9.1. Further discussion of the proposed earthwork and material management is discussed in Chapter 21 (Soils, contamination and groundwater) and Chapter 22 (Waste management and resource use).

Figure 6-6 Example of a mobile screening plant process as proposed for use within the Dinawan earthwork material site

6.6.2.3. Wagga Wagga substation upgrade and expansion

As described in Section 5.3.5 the existing Wagga Wagga substation would be upgraded and expanded to add new line entry bays, transformer bays and to other associated works. The construction methodology for the proposed expansion of the Wagga Wagga substation would consist of the following key activities:

- site establishment, including vegetation removal and establishment of temporary construction site office and amenities within the expanded substation site
- earthworks and preparation of the site for concrete foundations
- installation of reinforced concrete and piled foundations for the electrical equipment
- excavation and installation of electrical equipment conduits, including earth grid, trenches and general site drainage works
- erection of galvanised steel supports for electrical equipment and gantries on foundations, using cranes installation of electrical equipment on steel supports installation of site wiring and electrical control equipment within the control buildings
- removal of existing electrical equipment (as required based on detailed connection requirements)
- demolition of existing foundations (where required)
- erection of the expanded substation site boundary security fence, including site access gates (where required) surfacing and stabilising works for access, dust and vegetation suppression and drainage.

Site establishment and earthworks would commence as enabling works.

6.6.2.4. Optical repeater sites

As described in Section 5.3.6, three optical repeater site communication huts would need to be constructed at Balranald, Boorooban and Lockhart. The construction methodology for the proposed optical repeater sites would consist of the following key activities:

- site establishment, including any vegetation removal and establishment of temporary construction site office (if required)
- earthworks and preparation of the site for concrete foundations
- construction of a new communication hut building at each site
- provision of power connections between the transmission line and associated optical repeater site consisting of:
  - trenching for underground conduit between the Balranald optical repeater hut and transmission line
  - installation of new above ground poles between the transmission line and the respective Booroorban and Lockhart optical repeater sites
  - installation of new pole-mounted transformers
  - installation of electrical cables and terminations (either through the installed conduits or stringing of the aboveground poles)
- installation of site wiring and electrical control equipment within each building
- removal of waste and remediation of site areas).

6.6.2.5. Buronga substation

EnergyConnect (NSW – Western Section) includes new and upgraded infrastructure associated with the existing Buronga substation. Parts of those works include changes to accommodate a connection with the new infrastructure proposed as part of this proposal. Connection to new and upgraded infrastructure at the Buronga substation would occur as part of main construction for this proposal.

6.6.3. Commissioning and demobilisation phase

6.6.3.1. Pre-commissioning and commissioning

The pre-commissioning process would commence in the final phase of construction. This process would be to ensure that the proposal has been constructed in accordance with the design and statutory standards and is safe to proceed to main commissioning.

The key activities involved in the pre-commissioning process would include:

- testing and commissioning of the new substation equipment
- point to point testing of the new transmission lines and substation connections
- earthing testing
- high voltage testing
- high voltage equipment operational checks
- testing of the installed protection, metering, control, and communication systems
- testing oil containment systems at the proposed Dinawan 330kV substation
- cut over (energisation) of electricity between the existing and new transmission lines (where required, such as the section south of the Buronga substation).

Once all high voltage and low voltage testing is completed, the electrical protection systems have been set and all quality assurance documentation has been completed, main commissioning would proceed.

The key activities involved in the main commissioning process would include:

- transmission line cut in and connection to the electrical network
- protection, control, and metering checks
- high voltage equipment operation and energisation
- audible noise, thermographic imaging and electric and magnetic field (EMF) testing.

The new substation components would be commissioned and integrated with any necessary Transgrid external facilities.

6.6.3.2. Demobilisation and site rehabilitation

Site rehabilitation would be carried out progressively along sections of the transmission line and at tower installation sites as well as the substation sites. This phase would occur following the completion of construction and would involve the removal of all construction plant and equipment, and all materials not required during the operation of the proposal. This phase would include the removal and restoration of the construction compounds and camp sites (where these have been established as part of the proposal), removal of any temporary site buildings and temporary environmental controls. Rehabilitation of access roads or tracks would also be undertaken where they are not required for further construction or maintenance activities, or where a landholder has requested the access track to remain.

Within the transmission line easement, restoration works would consider and facilitate proposal commitments in relation to future vegetation maintenance and management. In other non-operational locations, site restoration would occur to make good any disturbances caused during proposal activities. Works may also be undertaken to restore the following (where impacted by the construction of the proposal):

- irrigation and water infrastructure facilities to pre-existing conditions before arrival on site
- natural drainage in areas where temporary facilities were provided
- fences, gates, etc. which may have been damaged during construction.

Installation of the permanent Transgrid property boundary fence surrounding the proposed Dinawan 330kV substation site and the expanded Wagga Wagga substation site (as required) would also likely occur during this phase.

Dinawan earthwork material site

Rehabilitation and remediation of the areas surrounding the Dinawan earthwork material site would generally include:

- removing temporary access tracks to/from the material site
- removing all hardstand material and surplus extracted material. These would be placed and spread back into the material site area
- contouring to the site to re-establish surface flow regimes, noting the final site would consist of a depression within the existing landscape up to 2.5 metres deep at the lowest point
- ensuring the material site is made stable and safe (i.e. reshaping any steep sides to the final depression form to ensure safe grades are provided.
- ripping disturbed areas to a depth of around 300 millimetres
- re-using stripped topsoil over disturbed areas
- seeding with a suitable cover crop and in accordance with any revegetation / landscaping requirements.

It is currently estimated that the final depression would be up to 2.5 metres in depth (from the existing surface level) and cover an area around 250 metres by 250 metres. Subject to final agreement with the landholder, this area would be returned to the landholder for use as a future dam. Further discussion of the proposed earthwork and material management is discussed in Chapter 16 (Flooding, hydrology and water quality).

6.7. Construction facilities

6.7.1. Main construction compound and accommodation camp sites

Several main construction compound and accommodation camps would be required to support the construction of the proposal. Lease agreements to utilise the identified properties for the main construction compound and accommodation camps would be established prior to commencement of works within these sites.

The proposal would use the Buronga construction and accommodation camp site which has been approved as part EnergyConnect (NSW – Western Section). The approved EnergyConnect (NSW – Western Section) approval identified and assessed impacts of the operation of the Buronga construction camp and compound facility for the duration of the project up to around mid-2024 with the facility potentially still being used during the decommissioning and rehabilitation phases up to this point. The scope of the EnergyConnect (NSW – Eastern Section) is expected to require the usage and operation of this facility for a similar timeframe, to around mid-2024 (August 2024). It is confirmed that the decommissioning of this facility and rehabilitation of the site would now occur post this time period and be completed by about March 2025. The decommissioning and rehabilitation of this construction compound and accommodation camp site would occur as part of the EnergyConnect (NSW – Eastern Section) approval. The concurrent use of the Buronga main construction compound and accommodation camp would not increase the type or intensity of activities within the main construction compound or increase the capacity of the accommodation camp as approved for EnergyConnect (NSW – Western Section).

The other main construction compound and accommodation camps that are proposed are summarised in Table 6-3. Construction compound and accommodation camps have been selected to be located near a sealed main road to facilitate journeys to worksites and airports and local services and amenities. The construction compound and accommodation camps would typically be located adjacent to each other with the exception of the Balranald site (see Table 6-3). For the Balranald and Lockhart main construction compounds and accommodation camp sites, options for the final site have been considered as part of this EIS.

Table 6-3 Summary of proposed construction compound and accommodation camps

Site name	Indicative camp area (m^2)	Indicative laydown area (m^2)	Approximate number camp beds	Office size (no. of people)
Balranald (option – split arrangement)	n/a – propose to use existing accommodation opportunities	87,000	n/a	50-100
Balranald (option – combined arrangement)	36,000	87,000	n/a	50-100
Cobb Highway	36,000	87,000	250	50-100
Dinawan 330kV substation	33,000	122,000	400	50-100
Lockhart (approx. for each option)	32,000	73,000	250	50-100
Wagga Wagga	n/a – propose to use existing accommodation opportunities	115,000	n/a	50-100

The main construction compound and accommodation camp sites would be established as enabling work and demobilised at the completion of the proposal. The new construction compound and accommodation camp sites would accommodate a range of facilities including:

- staging and laydown facilities
- concrete batching plants (at the Balranald, Cobb Highway, Dinawan 330kV substation and Lockhart sites construction compounds)
- new workforce accommodation camp areas proposed at the Cobb Highway, Dinawan and Lockhart sites. These locations would also include food and catering facilities, fitness and recreational facilities (such as indoor and outdoor recreational spaces, gymnasium areas) and telecommunication services for personal use. An option for an accommodation camp is also being considered at the Balranald main construction compound and would be accommodated within the existing area identified for the main construction compound
- demountable offices
- construction support facilities including vehicle and equipment storage, maintenance sheds, chemical/ fuel stores (such as petroleum, diesel, liquefied natural gas, herbicide, pesticide and mineral oils) and potential stockpile areas. Hazardous and dangerous good storage would be secured in purpose-built bunded and secure areas.

Upon completion of works, the construction compound and accommodation camp sites would be cleared of any temporary infrastructure and equipment, and rehabilitated in line with Section 6.6.3.

6.7.1.1. Balranald

Two options for the Balranald construction compound and accommodation camp are currently being considered. These options include a split arrangement and a combined arrangement for the accommodation camp. These options are described below. The final arrangement of the Balranald site would be determined following prior to commencement of construction.

Balranald – option – split arrangement

For this option, the Balranald main construction compound (laydown and compound area only) would be located within a cleared area adjacent to the proposal, around 1.1 kilometres to the north west of the existing Balranald substation (located along Yanga Way). The Balranald main construction compound would provide primary support for the construction of the western and central west sections (generally west of Maude Road) of the transmission line. An indicative location for the main construction compound is shown on Figure 6-4b.

Worker housing for the Balranald section of the proposal would be accommodated within an established accommodation camp within the town of Balranald (around 16 kilometres to the north of the proposal). The location for the proposed worker accommodation in Balranald is shown on Figure 6-4b.

A photo of an existing accommodation camp (existing Balranald camp) is also shown in Figure 6-7.

Balranald – option – combined arrangement

An option for an accommodation camp is also being considered at the Balranald main construction compound should the existing camp within the Balranald township not be available. The accommodation camp would be accommodated within the existing area identified for the Balranald construction compound (as described in the previous option above).

Figure 6-7 Example of an existing accommodation camp site (existing accommodation camp located in Balranald)

6.7.1.2. Cobb Highway

The Cobb Highway main construction compound and accommodation camp site would be located along the western side of the Cobb Highway around five kilometres to the south of the alignment of the proposal. The Cobb Highway site would provide primary support for the construction of the central section of the transmission line (generally west of Maude Road to For Corners Road) as well as worker accommodation. An indicative location for the main construction compound and accommodation camp site is shown on Figure 6-4c.

6.7.1.3. Dinawan 330kV substation

The proposed Dinawan 330kV substation construction compound and accommodation camp site would be located along the eastern side of Kidman Way adjacent to the proposed Dinawan 330kV substation site, around 30 kilometres to the south of the township of Coleambally. The Dinawan camp would provide primary support for the construction of the proposed Dinawan 330kV substation and central east section of the transmission line (generally along For Corners Road to Coonong Road between the Newell Highway and Urana-Morundah Road) as well as worker accommodation. An indicative location for the main construction compound and accommodation camp site is shown on Figure 6-4d.

6.7.1.4. Lockhart

Two alternatives for the Lockhart main construction compound and accommodation camp site have been identified. These sites have been identified to the north east of (County-Boundary Road site) and west (Urana-Lockhart Road site) of the township of Lockhart.

The Lockhart site would provide primary support for the construction of the central east and eastern sections of the transmission line (generally west of Coonong Road to the Bullenbong Road, north of the township of The Rock) as well as worker accommodation.

An indicative location for the main construction compound and accommodation camp site is shown on Figure 6-4e. The final location of the Lockhart site would be selected subject to ongoing landholder agreement.

6.7.1.5. Wagga Wagga

The Wagga Wagga main construction compound (laydown and compound area only) would be located within a cleared area adjacent to the existing Wagga Wagga substation (to the east of Ashfords Road). The Wagga Wagga main construction compound would provide primary support for the construction of the eastern section of the transmission line and proposed expansion and upgrade works to the Wagga Wagga substation. An indicative location for the main construction compound is shown on Figure 6-4e.

6.7.1.6. Additional worker accommodation

Worker accommodation at the eastern end of the proposal is proposed to be provided within the township of Wagga Wagga utilising local hotel, motel and rental accommodation opportunities. Local hotel, motel and rental accommodation are also proposed to supplement the accommodation camps where necessary during portions of the construction period at:

- Mildura
- Hay
- Narrandera.

6.7.2. Other ancillary facilities and the transmission line construction corridor

A number of minor staging, storage and laydown ancillary areas would be required within the construction impact area for the temporary storage of materials, plant and equipment required to construct the various elements of the proposal (in particular transmission line towers). Upon completion of works, these ancillary sites would be cleared of any temporary infrastructure and equipment, and rehabilitated in line with Section 6.6.3. These sites would be in place for shorter periods at locations suitable to support the construction works as they move along the alignment.

6.8. Plant and equipment

An indicative list of construction plant and equipment likely to be required for the key construction elements is provided below. Not all the equipment identified below would be required for all phases of construction.

- asphalt plant
- air compressor
- backhoe
- bob cat
- cable truck
- chainsaws
- cranes (ranging from 50 to 300 tonnes)/crane trucks
- compactor
- concrete agitator
- concrete pump
- crawler crane with grab attachments
- dozers (D6 to D10)
- drones
- dumper trucks
- elevated working platforms
- excavators (ranging from five to 45 tonnes)
- excavator(s) with hammer or harvester
- forklift
- franna cranes (ranging from 12 to 25 tonnes)
- flatbed Hi-Ab trucks
- generators
- geotechnical boring rigs
- graders (CAT 14M and 140M)
- haulage trucks
- lift trucks
- mulchers
- piling rig(s)
- pneumatic jackhammers
- prime mover and semi-
- telehandlers
- trailers
- rigid tippers with trailers

- rollers (ranging from 10 to 15 tonnes)
- scrapers
- semi-trailers
- stringing winches
- specialised heavy haul, lift and shift plant
- specialised plant for large specialist equipment assembly and commissioning
- stump grinder and mulcher/chipper
- tilt tray trucks
- tractor and slasher
- transport trucks
- trenchers
- watercarts.

6.9. Resources and materials

6.9.1. Excavation volumes

As described in Section 6.5, excavation works would be required within the construction impact area for activities such as transmission line construction, preparation of the Dinawan 330kV substation site to provide level surfaces, to create the required trenches for drainage, earthing, and electrical conduits and to construct access tracks.

Spoil from the excavations associated with the transmission line may be reused on site wherever possible, however in some instances spoil would be removed from site and disposed of at an appropriately licensed facility. Any such on site re-use would be within the construction impact area, and would not substantially alter landform or drainage in the vicinity of the transmission line towers. Excavation works would be carried out using earth moving equipment such as excavators, dozers, piling rigs and rock breakers.

Based on the current design of the proposal, the anticipated excavation volumes for the proposal are shown in Table 6-4.

Table 6-4 Indicative earthwork volumes

Approximate volume of material to be excavated	Approximate volume of material	Earthwork balance	Typical depth
Dinawan 330kV substation site			
Dinawan earthworks material site	Up to around 150,000 to 200,000 cubic metres of earthworks material may be sourced from the proposed Dinawan earthworks material site (refer below table for details.	–	Up to around 2.5 metres in depth for the earthworks material site.
Excavation for new pad foundations	Around 150,000 cubic metres of material would be required for fill to create the new substation infrastructure pad (primarily sourced from the Dinawan earthworks material site).	Nil	Minimal earthwork excavation. Concrete pad to be formed on new earthwork surface.

Approximate volume of material to be excavated	Approximate volume of material	Earthwork balance	Typical depth
Wagga Wagga substation upgrade and expansion site			
Excavation for new pad foundations within the expanded substation site	Around 7,500 cubic metres of cut would be required to accommodate the expanded substation area. Around 500 cubic metres of this (subject to suitability) is expected to be able to be used for fill. Around 625 cubic metres of reinforced concrete would be used to create the new substation infrastructure pad.	Excess of around 7,000 cubic metres for reuse or removal	Depth typically around 500 millimetres. Concrete pad to be formed on existing surface.
Transmission line			
Excavation for tower foundations Around 260,000 cubic metres of material to be excavated across all tower locations and access tracks	Around 225,000 cubic metres of material required for fill across all tower locations and access tracks. Reinforced concrete would be used to fill the remaining excavation areas at tower footings etc.	Around 35,000 cubic metres (excess/spoil)	8 to 26 metres.

Where required along the overall length of the proposal, imported quarry products would likely be sourced locally and be transported by road to transmission line sites. In order to reduce potential earthwork requirements, top soil would be stockpiled within the construction impact area and reused for re-establishing grasses and other vegetation in areas proposed to be rehabilitated. Where excavated spoil is determined not to be appropriate for reuse on site, it may be necessary to import additional material to site to make up any identified deficit. Where this is required, this would be sourced locally.

There would also be a requirement to maintain safe working clearances under the existing transmission lines where the proposal would be located in or adjacent to existing lines or the Wagga Wagga substation. Accordingly, excavation works would generally commence where clearances from natural ground level to the above transmission lines exceed the safe working requirements. Benching and spoil removal would progress using rock breakers, excavators and trucks. This methodology would ensure that safe clearances are maintained and excavation works can proceed without the requirement to disconnect electrical transmission along these lines during construction.

6.9.1.1. Dinawan 330kV substation earthwork

In order to reduce the potential impacts of the traffic movements to local quarry sources, a substantial portion of the required fill material may be sourced from an area adjacent to the proposed Dinawan 330kV substation site (subject to the suitability of the available fill material). Additional materials (such as gravel or other materials that would not be won from these site) would still be required to be imported to the site from external location(s).

The proposed Dinawan earthwork material site (including an area for suitable laydown of processing equipment and stockpiling) would have an area of around 20 to 25 hectares and be located on the slightly mounded area generally to the north and east of the proposed Dinawan 330kV substation site (refer to Figure 6-8).

The area shown in Figure 6-8 represents a maximum possible extent and would likely require a somewhat reduced area. The final location of the Dinawan earthwork material site would seek to avoid areas of potential environmental impacts as far as practical, while minimising impacts to the overall landform. The suitability of fill material for the raised substation pad and the final extent of the Dinawan earthwork material site would be confirmed by further geotechnical investigations during finalisation of the proposal design.

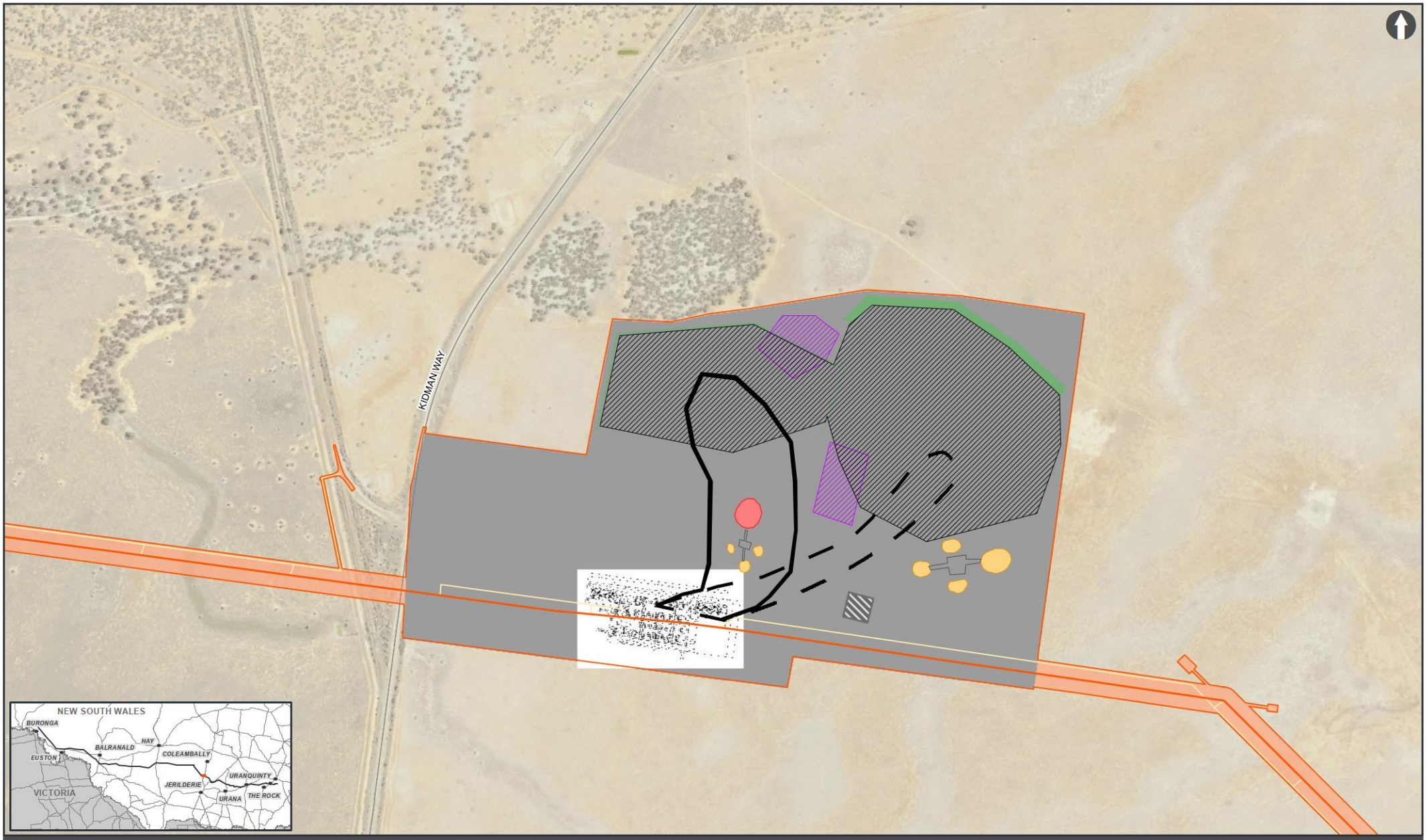


Figure 6-8

Proposed Dinawan earthwork material site

By sourcing some of the material from an area adjacent to the new substation site where a majority of the earthworks would be required to be imported to, the key benefits of the proposed Dinawan earthwork material site would include:

- reduced overall truck movements during construction that are associated with the movement of materials for the proposed Dinawan 330kV substation site
- reduced safety risk associated with trucks and driver fatigue
- reduced overall program timeframe associated with the movement of materials for the proposed Dinawan 330kV substation site
- reduced impacts on local roads and proposed haulage routes.

6.9.2. Water supply

Water would be required during construction for activities such as:

- dust suppression on substation construction sites and line tower construction sites, and on access tracks through the use of a water spray attached to a tanker vehicle (including the possible use of water reduction polymers)
- concrete batching activities
- wetting backfill material (if it is too dry for effective compaction)
- general worker facilities at the main construction compound and camp sites (drinking water, toilets/showers etc).

It is estimated that about 1.1 gigalitres of water would be required for construction, comprising:

- 728 megalitres for dust suppression
- 203 megalitres for earthworks compaction
- 20 megalitres for concrete batching activities (potable water)
- 11 megalitres for vehicle washdown facilities
- 100 megalitres for camp sites (potable water).

Water would be supplied for the proposal from existing regulated sources. Water would be purchased from the existing water market within the region or from local council facilities. Access to these sources would occur through the use of existing, licensed water extraction infrastructure only. No new extraction infrastructure from existing watercourses is proposed as part of the water supply points proposed.

Water storage tanks would be provided, where required, along the transmission line easement to manage demand requirements.

Transgrid has commenced discussions with a number of water suppliers within the broad region through which the proposal would be located to identify the required volume water (potable and non-potable) for the proposal from existing facilities. This has included initial consultation with local councils, Riverina Water and other water suppliers such as the Coleambally Irrigation and private water licence holders.

Based on initial consultation, 26 potential sources of water have been identified along the length of the proposal which have the potential to support the construction water needs for the proposal. The currently identified water supply points are listed in Table 6-5 and shown in Figure 6-9.

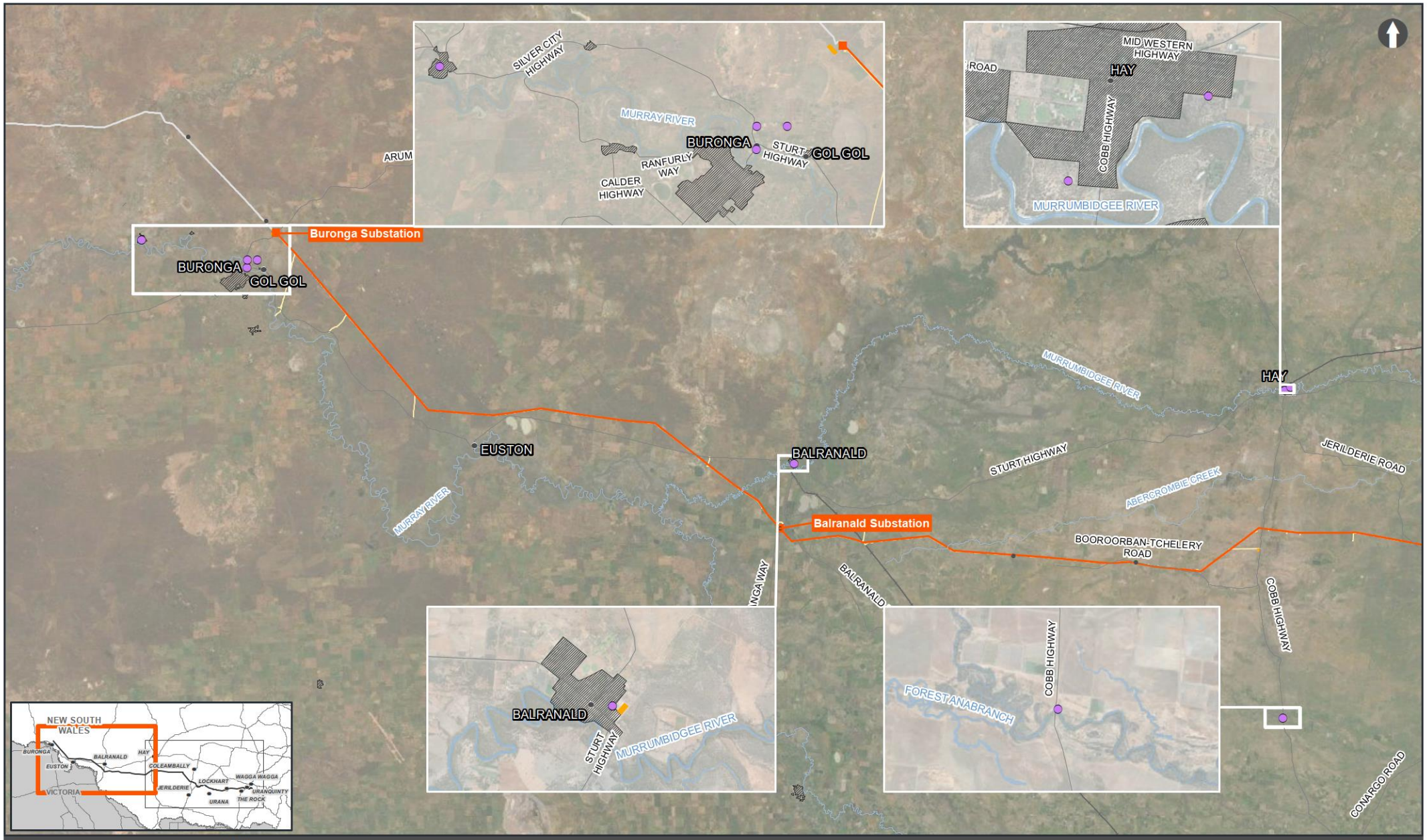


Figure 6-9a

Indicative water supply points

- EnergyConnect (NSW - Eastern Section)
- EnergyConnect (NSW - Western Section)
- Main Construction Compounds and Accomodation Sites
- Access Tracks
- Water Fill Point
- Existing Substation
- Existing Railway
- Built Up Areas
- Waterbody

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Source: NSWSS, ESRI, Transgrid, WSP

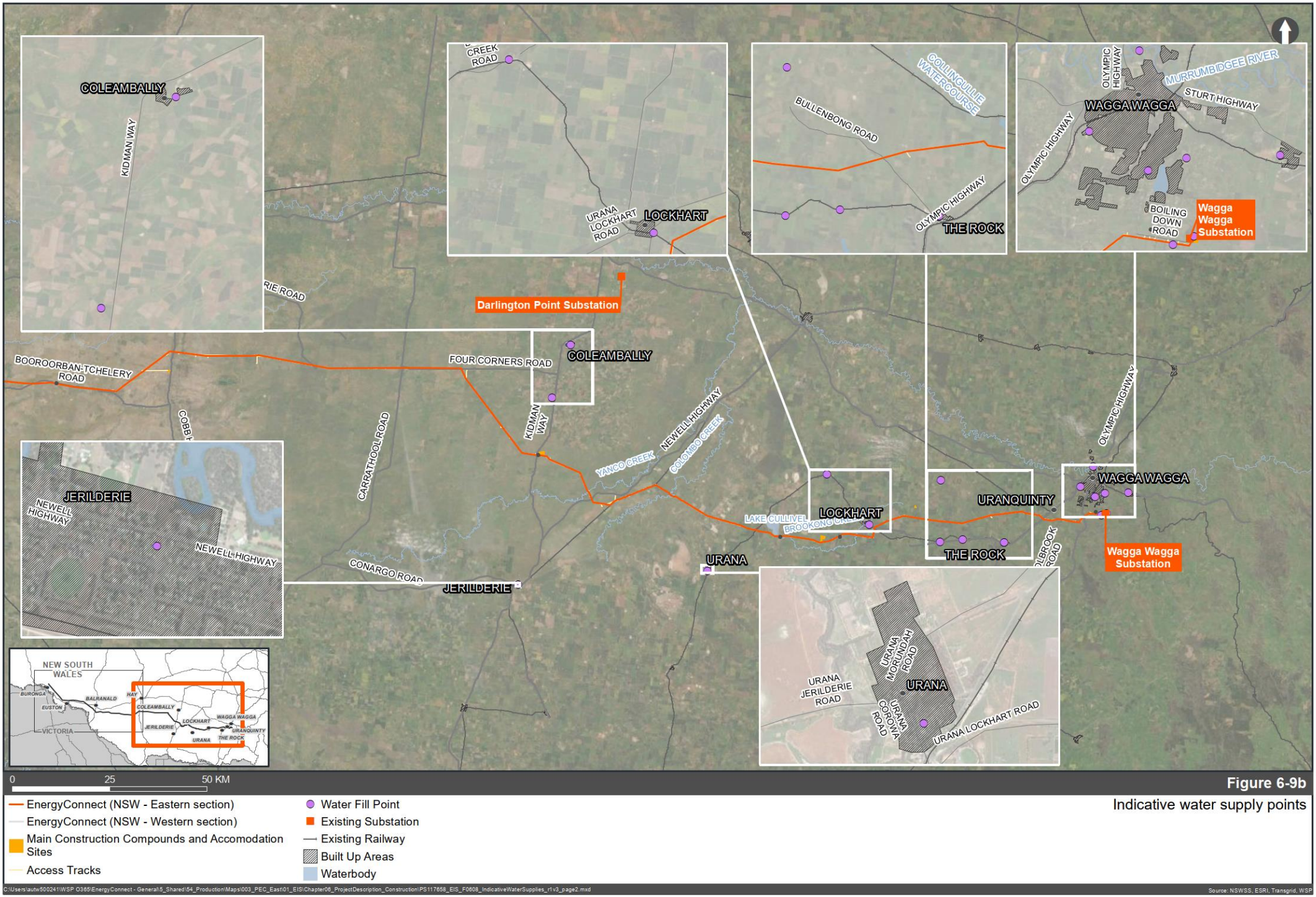

Figure 6-9b

Indicative water supply points

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Source: NSWSS, ESRI, Transgrid, WSP

Table 6-5 Indicative water supply points

Location	Owner	Type of water supply	Typical use	Connection type	Usage (indicative no. of trips per day) [vehicle movements]
Modica Crescent, Wentworth	Wentworth Council	Potable	All proposed uses	Standpipe	5 [10]
Beverley Street, Wentworth	Wentworth Council	Potable	All proposed uses (with exception of concrete)	Overhead	3 [6]
River Drive, Buronga	Wentworth Council	Non-potable	Dust suppression, earthworks, washdown	Overhead	3 [6]
Alcheringa Road	Western Murray Irrigation	Non-potable	Dust suppression, earthworks, washdown	Existing	5 [10]
Church Street, Balranald	Balranald Shire Council	Potable	All proposed uses	Standpipe	10 [20]
Wanganella	Edward River Council	Potable (TBC)	All proposed uses	Existing	5 [10]
Cadell Street	Hay Shire Council	Potable	All proposed uses	Existing	3 [6]
Pine Street	Hay Shire Council	Potable	All proposed uses	Existing	3 [6]
111 Jerilderie St, Jerilderie	Murrumbidgee Council	Potable	All proposed uses	Existing	5 [10]
3 Bencubbin Av, Coleambally	Murrumbidgee Council	Potable	All proposed uses	Existing	4 [8]
Coleambally to Dinawan	Murrumbidgee Council	Potable	All proposed uses	Existing	10 [20]
Bulgary	Riverina Water	Potable	All proposed uses	Overhead	10 [20]
Boree Creek	Riverina Water	Potable	All proposed uses	Overhead	3 [6]
Urana	Riverina Water	Potable	All proposed uses	Overhead	5 [10]
French Park	Riverina Water	Potable	All proposed uses	Overhead	10 [20]
Tootool	Riverina Water	Potable	All proposed uses	Overhead	10 [20]

Location	Owner	Type of water supply	Typical use	Connection type	Usage (indicative no. of trips per day) [vehicle movements]
Lockhart	Riverina Water	Potable	All proposed uses	Existing	20 [40]
The Rock O/Head	Riverina Water	Potable	All proposed uses	Overhead	10 [20]
The Rock	Riverina Water	Potable	All proposed uses	Existing	10 [20]
Forest Hill	Riverina Water	Potable	All proposed uses (with exception of concrete)	Existing	5 [10]
Lake Albert	Riverina Water	Potable	All proposed uses (with exception of concrete)	Existing	10 [20]
Glenfield	Riverina Water	Potable	All proposed uses (with exception of concrete)	Existing	10 [20]
Ashfords Road	Riverina Water	Potable	Office/Welfare, Dust suppression, earthworks, washdown	New pipe connecting to existing infrastructure	10 [20]
Kooringal Sewage Treatment Plant	Wagga Wagga City Council	Non-potable	Dust suppression, earthworks, washdown	Existing	5 [10]
Narrung Sewage Treatment Works	Wagga Wagga City Council	Non-potable	Dust suppression, earthworks, washdown	Existing	5 [10]
Gregadoo Waste Management	Wagga Wagga City Council	Non-potable	Dust suppression, earthworks, washdown	TBC	15 [30]

These identified sources and volumes available for supply to the proposal would be confirmed during ongoing negotiations with each water supplier. Ongoing consultation with water suppliers may also identify other water sources that may be used for the construction of the proposal which would be secured under standard supply/purchase agreement from existing facilities (no infrastructure amendments needed for them). This may include additional sources of potable water from areas such as Coleambally Irrigation or private water licence holders.

Effluent from the wastewater treatment facilities at the proposed Cobb Highway, Dinawan and Lockhart accommodation camp sites (see below) would also be collected, treated to appropriate standards, and transported via water carts for reuse in dust suppression, compaction of materials or other construction activities which may require and can utilise grey water.

6.9.2.1. Onsite wastewater treatment

In order to manage effluent and greywater from the main accommodation camp sites, wastewater treatment facilities would be constructed at each of the Cobb Highway, Dinawan and Lockhart accommodation camp sites. The systems would be designed to collect wastewater from showers, kitchens, laundries and toilets, with toilet and kitchen facilities located both at the camp and the office areas.

The wastewater treatment facilities would be designed to accommodate the proposed personnel numbers at each accommodation camp site. The wastewater system would treat the effluent produced from both the camp and office facilities.

Wastewater produced during the initial establishment of the camps would be collected and transported to a council wastewater treatment plant. This process would be in place during the site establishment works for the proposal and would cease once the main wastewater treatment facilities are operational.

The proposed wastewater treatment plants would be a generally contained system and would include biological and chemical treatment, filtration and disinfection. Subject to the final design of the wastewater treatment facilities, it is proposed that a sequencing batch reactor type sewage treatment plant be constructed at each of the primary camp sites. The most suitable treatment processes and plant configuration would however be finalised prior to construction.

At site locations outside the accommodation camp sites, welfare facilities would continue to be installed to provide amenity to workers at these locations. Liquid waste would be removed and transported to a licensed facility.

Treatment process

The volume of water to be treated would be dependent on the camp and office occupancies and associated water use at any one time throughout the construction period. A conservative allowance of up to 240 litres per person, per day has been allowed for (consistent with the allowance made for the EnergyConnect – Western Section project). At peak, each accommodation camp would therefore see a potential daily throughput for treatment of between 84,000 litres for a smaller camp such as Lockhart up to 120,0000 litres for a larger camp such as the Dinawan 330kV substation accommodation camp (when at maximum capacity).

An example of the proposed type of wastewater treatment facility is shown in Figure 6-10.

Figure 6-10 Indicative water supply points

The typical operation of the wastewater treatment facilities would include the following steps.

- *Input of wastewater* – Collection of raw water (from sources such as showers, kitchens, laundries and toilets, with toilet and kitchen facilities) through use of pumps. Wastewater would undergo a mechanical screening process to remove all the inorganic material from the sewage and dispose it to the waste bin.

- *Equalisation process* – Pumps would then transfer the raw wastewater to the wastewater treatment facility (into equalisation tanks). The equalisation tanks would provide sufficient storage capacity to control the peak flow and provide the treatment plant with continuous flow.

- *Treatment tanks* – The treatment tank(s) would function in five different modes being: fill, aerobic, anoxic, settle and decant. The treatment tank would cycle through all modes of operation up to four times per day. The storage tanks would be located above ground next to the wastewater treatment system in a bunded area (up to around 110,000 litre total capacity to allow for potential storage during rain events).

- *Final effluent treatment* – Treated effluent would be withdrawn from the tanks and pumped into the final storage and control tank. Additional tanks would be provided in order to increase the storage capacity of up to three days of operation during wet weather conditions.

Effluent from the wastewater treatment facilities would be discharged to a small basin type structure ('turkey's nests'), following which greywater would be collected and transported via water carts for reuse in dust suppression, compaction of materials or other construction activities which may require and can utilise grey water. The turkey's nests would be lined with high density polyethylene/geosynthetic clay liner to avoid potential interaction with groundwater.

Sludge dewatering

All wastewater treatments plants produce sludge that requires disposal on regular intervals. Liquid waste sludge would be transported to a facility licensed to accept the waste.

Final effluent quality

The wastewater treatment system would be designed, maintained and monitored in accordance with *On-site domestic wastewater management, Designing and Installing On-Site Wastewater Systems* (WaterNSW, 2019), *On-site domestic wastewater management - AS/NZS 1547:2012* (Standards Australia and Standards New Zealand, 2012) and the Aust*ralian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)* (National Resource Management Ministerial Council, Environment Protection and Heritage Council and Australian Health Minister's Conference, 2006).

The wastewater treatment facilities would be designed to produce effluent that meets the requirement for dust suppression and use or dispersion for other construction related activities within the construction impact area.

Based on the proposed capacity of the wastewater treatment facilities at each camp site, it is not expected that an environment protection licence would be required under the POEO Act (clause 36 of Schedule 1).

6.9.3. Hazardous materials and chemicals

During construction, various hazardous materials and chemicals would likely be required to be used and/or stored on site. Hazardous materials and chemicals would typically include (but not limited to):

- acetylene, Oxygen, Liquid Petroleum Gas
- adhesives, glues, epoxies, etc.
- concrete and other mortar products
- contact cleaners
- cold-galvanising spray
- fuels, oils and lubricants (such as diesel, unleaded petrol, thinners, oil for electrical equipment, etc.).
- paints and other paint markers
- SF6 gas for electrical equipment.

6.9.4. Other resources and materials

A range of other materials and resources would also be required during the construction of the proposal. Key additional materials and resources would include around:

- 18,700 tonnes of steel for transmission line towers
- 7,555 kilometres of conductor cables
- up to 3,300 cubic metres of concrete for substation works and up to around 30,000 cubic metres of concrete for transmission tower footings.

6.10. Workforce and working hours

6.10.1. Construction workforce

The construction workforce would vary depending on the stage of construction and associated activities. During peak construction activities, the proposal is expected to employ around 500 full time equivalent construction workers. Table 6-6 provides an overview of the anticipated construction workforce for each stage of construction.

Table 6-6 Anticipated construction workforce

Phase	Anticipated Workforce (approx.)
Dinawan 330kV substation works and Wagga Wagga substation upgrade and expansion works	
Enabling works	20
Substation access road	25
Main civil construction works	170 to 180
Main electrical construction Works	85
Switchyard surfacing	10
Pre-commissioning	10
Commissioning	30 to 40
Demobilisation	20 to 30
Transmission line works	
Enabling works	80
Transmission line easement construction tracks	110 to 120
Tower foundation installation	40 to 50
Erection of towers	160 to 170
Stringing and clipping of conductors	170 to 180
Commissioning	20 to 30

6.10.2. Construction work hours

Construction work would be carried out seven days per week between 7:00 am and 7:00 pm. The main construction compounds would also operate during these hours. Where sensitive receivers are noise affected by construction works (that is, where construction noise is above the noise management level), works would be carried out within standard construction hours (as defined in the ICNG (DECCW, 2009)) or conducted outside of these hours where such works are required/justifiable in accordance with the ICNG (DECCW, 2009). Refer below for potential out of hours work requirements.

The accommodation camp facilities would be operational 24 hours a day, seven days a week.

The extended construction hours are proposed given the distance to sensitive receivers for the majority of the construction impact area, and the shift arrangements of the workforce given the remote nature of the proposal. Extended working hours would also achieve reductions in the overall duration of construction.

Where the extended hours are proposed for activities in proximity to noise affected sensitive receivers (and the works cannot be undertaken during standard work hours), additional measures would be implemented where works would potentially exceed noise management levels (NMLs) through an out of hours work protocol.

6.10.2.1. Out of hours works

A series of works outside the proposed construction hours for the proposal are anticipated including (but not limited to) the following:

- transmission line construction where this would occur as a crossing of a main road or railway. These locations are expected to have restricted construction hours requiring some night works for activities such as conductor stringing over the crossing(s)
- works where Road Occupancy Licenses (or similar) are required
- transmission line cutover and commissioning
- the delivery of equipment or materials outside standard hours requested by police or other authorities for safety reasons (such as the delivery of transformer units)
- substation assembly (oil filling of the transformers)
- emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm
- work timed to correlate with system planning outages (likely 24-hour operations when required to minimise impact to electrical supply services)
- situations where agreement is reached with affected receivers
- potential utilities adjustment works (in consultation with the requirements of asset operators)
- large concrete pours (including concrete batching plant operation which may require commencement before 7.00 am for early pours).

During detailed construction planning, a program would be determined to identify the required night work periods (including dates and durations). Except for emergencies, construction works would be carried out in accordance with the out of hours work protocol and would not take place outside construction hours without prior notification in line with that protocol.

6.11. Construction traffic volumes, parking and haulage routes

6.11.1. Construction traffic volumes

Construction vehicle movements would comprise vehicles transporting compound and camp infrastructure, equipment and plant, materials, spoil and waste, as well as mini-buses and light vehicles associated with construction workers travelling to and from construction areas. These movements would occur daily across the whole of the proposal. Non-standard or oversized loads would also be required for the substation upgrade and expansion works (such as delivery of transformer units) and transportation of transmission line tower materials.

Indicative daily vehicle movements for the proposal are outlined in Table 6-7. These vehicle movements are based on the expected typical and peak construction period for the proposal. The vehicle movements stated in Table 6-7 would be confirmed during finalisation of the proposal design.

Table 6-7 Indicative vehicle movements

Compound site	Light vehicles (typical)	Light vehicles (maximum)	Heavy vehicles (typical)	Heavy vehicles (maximum)
Buronga construction compound and accommodation camps	80	130	80	200
Balranald construction compound	40	70	100	200
Balranald accommodation camp	100	160	20	60
Cobb Highway construction compound and accommodation camp	100	180	100	200
Dinawan construction compound and accommodation camp	160	250	160	320
Lockhart construction compound and accommodation camp	170	280	170	350
Wagga Wagga construction compound	100	130	100	200

Notes:

1. Indicative daily movements based on current program of works. This is an average and there would be days of increased peak activities which may impact these average/indicative numbers and conversely days of decreased activity.
2. Vehicle movements are combined (i.e. a heavy/light vehicle arriving and leaving a site within a day counts as one movement).
3. Indicative movements assume that most of the workers are based in the camp, staff commuting from local townships.

Construction vehicle traffic would be greatest during the main earthworks and civil construction activities. Most of the light vehicle movements associated with the construction works would generally be limited to construction staff travelling to and from individual sites for work from the worker accommodation sites.

Standard traffic management measures would be employed to minimise short-term traffic impacts expected during construction. These measures would be identified in the construction traffic management plan for the site. In general, vehicle movements would be scheduled outside peak periods wherever possible. However, there would be a need for some vehicle movements during these periods. Worker vehicle movements would also be required during both the morning and afternoon peak hour periods.

Further detail and discussion regarding construction traffic volumes is provided in Chapter 19 and Section 5.2.1 of Technical paper 11.

6.11.2. Construction worker parking

Construction worker parking would primarily be provided within the main construction compound and camp sites as described in Section 6.7. For the construction works at the proposed Dinawan 330kV substation, it is expected that relevant workers would be typically based within the accommodation camp at this work site.

For the transmission line alignments, given the transient nature of these construction works, and potentially long distances, it is expected that workers would typically be transported by bus (or other type of crew vehicle) to site from their relevant accommodation camp. Where other vehicles are used to access these sites, parking spaces for construction personnel would generally be within 30 metres on each tower location site within the identified construction impact area.

6.11.3. Construction haulage routes

6.11.3.1. Routes for the movement of construction equipment and materials (local haulage routes)

Construction vehicle movements would be required along the length of the construction impact area. Where feasible, this would be undertaken within the construction impact area, to minimise impacts on the public road network. However, use of public roads would also be required.

Local haulage routes would use all available public roads where available to access relevant sections of the alignment. These routes would be used by both general construction traffic and for heavy vehicle haulage routes.

Given the scale and number of roads that would be required for the proposed construction haulage routes, the haulage routes have been classified as follows:

- Primary haulage routes – haulage route between ports to the main construction compounds which may involve oversized and overmass transport movements. These roads would also include primary haulage routes between proposed the main construction compounds and accommodation camp sites and ancillary sites.
- Secondary haulage routes – haulage routes between the main construction compounds to the transmission line work area. These routes would not involve the movements of oversized and overmass vehicles.
- Water haulage routes – identified routes proposed to be used by water trucks to travel between water source to the nearest primary or secondary routes (where proposed water fill points are not located on otherwise identified primary or secondary routes.

The routes have been developed to minimise impacts on local roads as far as possible, while providing the most direct route to the road network and meeting specific road requirements (such as specified routes for heavy vehicles). These preliminary haulage routes would be reviewed during finalisation of the proposal design and confirmed following appointment of the construction contractor.

The proposed haulage routes along the proposal alignment are shown on Figure 6-12. A summary of the impacted roads associated with these haulage routes is provided in Table 6-8.

Table 6-8 Summary of roads required for proposed construction haulage routes

Primary haulage	Secondary haulage	Water haulage
Roads within Wentworth local government area		
Adelaide Street	Dansons Road	Corbett Avenue
Arumpo Road		Melaleuca Street
Silver City Highway (B79)		Modica Cres
Sturt Highway (A20) (Buronga)		
Roads within Balranald local government area		
Market Street	Abbotts Tank Road	
Mccabe Street	Benanee Road	
Murray Valley Highway	Euston Prungle Road	
Sturt Highway (between Buronga and Robinvale)	Windomal Road	
Sturt Highway (between Robinvale and Balranald)	Church Street	
Yanga Way		
Roads within Murray River local government area		
Baratta Street	Baldon Road	
Carne Street	Balranald Road (south of alignment)	
Cedar Avenue	Balranald Road (north of alignment)	
Kyalite Road	Binbinette Road	
Pretty Pine Road (west)	Brougham Street	
Sturt Highway (between Balranald and Cobb Highway)	Impimi Road	
Balranald Road (near Moulamein)	Keri Keri Road (south)	
	Keri Keri Road (north)	
	Morago Street	
	Moulamein Road	
	Paterson Street	
	Tallow Street	
Roads within Hay local government area		
Cobb Highway	Glenhope Road	
Jerilderie Road	Maude Road	
Moama Street	Romani Road	
Sturt Highway (between Cobb Highway and Newell Highway)	West Burrabogie Road	

Primary haulage	Secondary haulage	Water haulage
Roads within Edward River local government area		
Booroorban-Tchelery Road	Dry Lake Road	
Carrathool Road	East-West Road	
Hay Road	Finley Road	
Moonbria Road	Millears Road	
Pretty Pine Road (east)	Monimail Road	
Riverina Highway (west of Finley)	Nesbits Road	
Wandook Road	Warwillah Road	
Davidson Street	Willurah Road	
Charlotte Street	Wanderer Street	
Ochtertyre Street		
Hardinge Street		
Cobb Highway (south of Deniliquin)		
Roads within Murrumbidgee local government area		
Conargo Road (in Conargo)	Bundure Road	Kidman Way (Near Morundah Road)
Four Corners Road	Cadell Road	
Jerilderie Street (Jerilderie)	Colombo Road	
Jerilderie-Urana Road	Crutchs Road	
Liddles Lane	Fernbank Road	
Morundah Road	Kidman Way (Near Sturt Highway)	
Newell Highway (north of Jerilderie)	Mcdonald Road	
Newell Highway (south of Jerilderie)	Mclennons Bore Road	
North Boundary Road	Six Mile Lane	
Southey Street	Thurowa Road	
Wilson Road	Crosby Road	
Yamma Road	Gilbert Road	
Conargo Road (near Sturt Highway)	Thurowa Road (north)	
Sturt Highway (within Murrumbidgee LGA)		
Roads within Federation local government area		
Back Berrigan Road	Barragunda Road	
Battens Road	Boree Creek Road	
Berrigan Oaklands Road	Coonong Road	
Brookong Creek Road	Cullivel Road	
Browley Street	Drummond Street	

Primary haulage	Secondary haulage	Water haulage
Chapman Street	Eades Street	
Cocketgedong Road	Federation Way (north of Urana)	
William Street	Federation Way (south of Urana)	
Yarrabee Street	Greenvale Road	
	Gums Road	
	Lachlan Street	
	Mahonga Road	
	Mallons Road	
	Meritons Road	
	Spraydon Road	
	Strontian Road	
	West Gums Road	
	Woodhouse Street	
	Riverina Highway (north of Corowa in Federation Council)	
	Honour Ave	
	Boree Creek Road (north of Boree Creek)	
	Richmond Street	
Roads within Lockhart local government area		
Bullenburg The Rock Road	Albury Road	Andriskes Lane
Dunlevys Lane	Ben Hoffmans Lane	French Park-Bullenbung Road
East Street	Bidgeemia Road	Green Street
Lockhart Collingullie Road	Boyds Road/Somervilles Road	Hendersons Road
Olympic Highway (Between Urana St In The Rock And Yarrangundry St In Uranquinty)	County Boundary Road	Lockhart Boree Creek Road
Railway Street	Flood Detour Road	Lockhart-Kywong Road
Urana Street (The Rock)	Ford Street	Old French Park-Bullenbung Road
Urana-Lockhart Road	Frank Westblades Lane	
Olympic Highway (south of The Rock)	Lockhart Road (west of Bullenbong Creek)	
	Lockhart The Rock Road	
	Mangoplah Road	
	Osborne Yerong Creek Road	
	Reid Street	

Primary haulage	Secondary haulage	Water haulage
	Ryans Lane	
	Solider Settlement Road	
	Slys Lane	
	Spanish Avenue	
	Strongs Lane	
	Tenison Lane	
	The Rock Mangoplah Road	
	The Rock-Collingullie Road	
	Tribolets Road	
	Urana Street (Lockhart)	
	Wandella Lane	
	Webbs Lane	
	Yuluma Road	
	Edwards Road	
	Humphries Lane	
	Mortons Lane	
	Napier Road	
Roads within Wagga Wagga local government area		
Ashfords Road	Dunns Road	Billagha Street
Boiling Down Road	Elizabeth Avenue	Elizabeth Avenue
Brunskill Road	Gregadoo Road	Inglewood Road
Colin Knott Drive	Hanging Rock Road	Narrung Street
Edward Street	Holbrook Road	Olympic Highway (north of Wagga Wagga)
Glenfield Road	Old Station Road	Olympic Highway (Between Sturt Highway and Yarrangundry Street in Uranquinty)
Gregadoo East Road	Oxley Bridge Road	Rohans Road
Hammond Avenue	Rowan Road	The Rock-Narranderra Road
Kooringal Road	Somervilles Road	Travers Street
Lake Albert Road	Uranquinty Cross Road	Vincent Road
Lloyd Road	Key Street	
Lockhart Road (east of Bullenbong Creek)	Ryan Street	

Primary haulage	Secondary haulage	Water haulage
Mitchell Road	Bon Accord Road	
Moorong Street	Kendals Lane	
Pearson Street	Old Trunk Road	
Plumpton Road		
Red Hill Road		
Sturt Highway (east of Wagga Wagga)		
Sturt Highway (between Olympic Highway and Wagga Wagga)		
Tumbarumba Road		
Yarragundry Street		
Sturt Highway (between Newell Highway and Olympic Highway)		
Bakers Lane		
Bourke Street		
Docker Street		

Further detail and discussion regarding construction traffic haulage routes is provided in Chapter 19 and section 5.2.2 of Technical paper 11.

6.11.3.2. Oversize and overmass vehicle requirements

Main interstate/long distance haulage routes

Construction materials for the proposal would require transportation from various shipping ports across Australia. While the shipping port locations which would receive each of the anticipated material and proposal equipment deliveries are not confirmed at this stage, locations which have been considered include Newcastle (Port of Newcastle), Wollongong (Port Kembla), Adelaide (Port of Adelaide) and Melbourne (Port of Melbourne). The final haulage routes from each of these locations would be determined by the appointed contractor and they would need to accord with the heavy vehicle haulage guidelines in each of the respective states. Transportation from shipping ports to the construction site would be undertaken on the appropriate restricted freight routes (i.e. restricted access and oversize and overmass vehicle routes).

Haulage routes from port facilities would be expected to include:

- Port of Newcastle – travel from Newcastle to Buronga via Wagga Wagga along the M1 Highway to the Hume Highway (M31) and Sturt Highway (A20) to reach Wagga Wagga prior to accessing other part of the construction impact area as required (such as the proposed Dinawan 330kV substation site via Darlington Point and Kidman Way).
- Port Kembla – travel from Wollongong to Buronga via Wagga Wagga along the Hume Highway (M31) and Sturt Highway (A20) to reach Wagga Wagga prior to accessing other part of the construction impact area as required (such as the proposed Dinawan 330kV substation site via Darlington Point and Kidman Way).

- Port of Adelaide – travel from Adelaide to Buronga via Broken Hill along Silver City Highway (B79), before accessing other part of the construction impact area as required.
- Port of Melbourne – travel from Melbourne to the proposed Dinawan 330kV substation site Bendigo along Calder Highway (A79), Midland Highway (A300) and Goulburn Valley Highway (A39) on the Victorian side, before crossing the Murray River to the Newell Highway (A39) and Kidman Way to access the proposed Dinawan 330kV substation site.

Large scale equipment requirements

Based on the currently available information and design, an indicative overview of the potential extent of large scale equipment (LSE) that would require oversize and overmass vehicles is provided in Table 6-9. This table also provides an anticipated port of delivery for these materials/equipment (subject to further confirmation with the relevant suppliers prior to construction).

Table 6-9 Indicative large scale equipment requirements for oversize and overmass vehicles

Materials	Items	Estimated quantity (i.e. number of trucks)	Length (m)	Width (m)	Height (m)	Weight (t)	Anticipated delivery port
Large scale equipment							
Shunt reactor 50 mega volt ampere	Main body	4	6.5	3.4	4.1	89	Newcastle, Kembla, Geelong/ Melbourne or Adelaide
Shunt reactor 60 mega volt ampere	Main body	4	6.7	3.5	4.1	90	
Synchronous condenser (option 1)	Rotor	4	8.3	5.5	3.6	147	
Synchronous condenser (option 2)	Stator	4	5.3	5.1	4.6	120	
Synchronous condenser (option 3)	Generator	4	10	3.6	3.4	260	
Synchronous condenser (option 4)	Step-up transformer	4	9	3	2.5	160	

6.11.3.3. Containerised material deliveries

In addition to the LSE requirements identified above, the following assumptions have been made in relation to the potential extent of other material and equipment that would be required to be delivered as part of the proposal:

- tower steel (including stubs) would be transported as containerised materials using A-Double transport (refer to Figure 6-11) to the relevant main construction compounds. Redistribution of containers would then occur from these sites as required along the remainder of the construction impact area. It is estimated that a total of around 1,180 containers worth of material would be required (or around 560 A-Double movements)
- conductors would be delivered as rolled, three tonne lots on drums, with six drums per container. It is estimated that a total of around 370 containers would be required (or around 185 A-Double movements)
- OPGW earthwire, insulators, fittings, vibration dampers and other accessories would require around 160 containers (around 80 A-double truck movements)
- reinforcing steel would be bundled as bent or straight bar and delivered as containerised materials. It is estimated that a total of around 150 containers would be required (or around 75 A-Double truck movements
- other non-LSE containers (substation steel etc.) would require around 220 containers for the proposed Dinawan 330kV substation and around 195 containers for the upgraded and expanded Wagga Wagga substation.

Most deliveries would generally be standard, road legal configurations that would travel in accordance with the existing road rules and the appropriate state legislation. It is anticipated most deliveries on site would be received between 7:00 am to 7:00 pm.

Figure 6-11 Indicative example of an A-Double containerised delivery truck

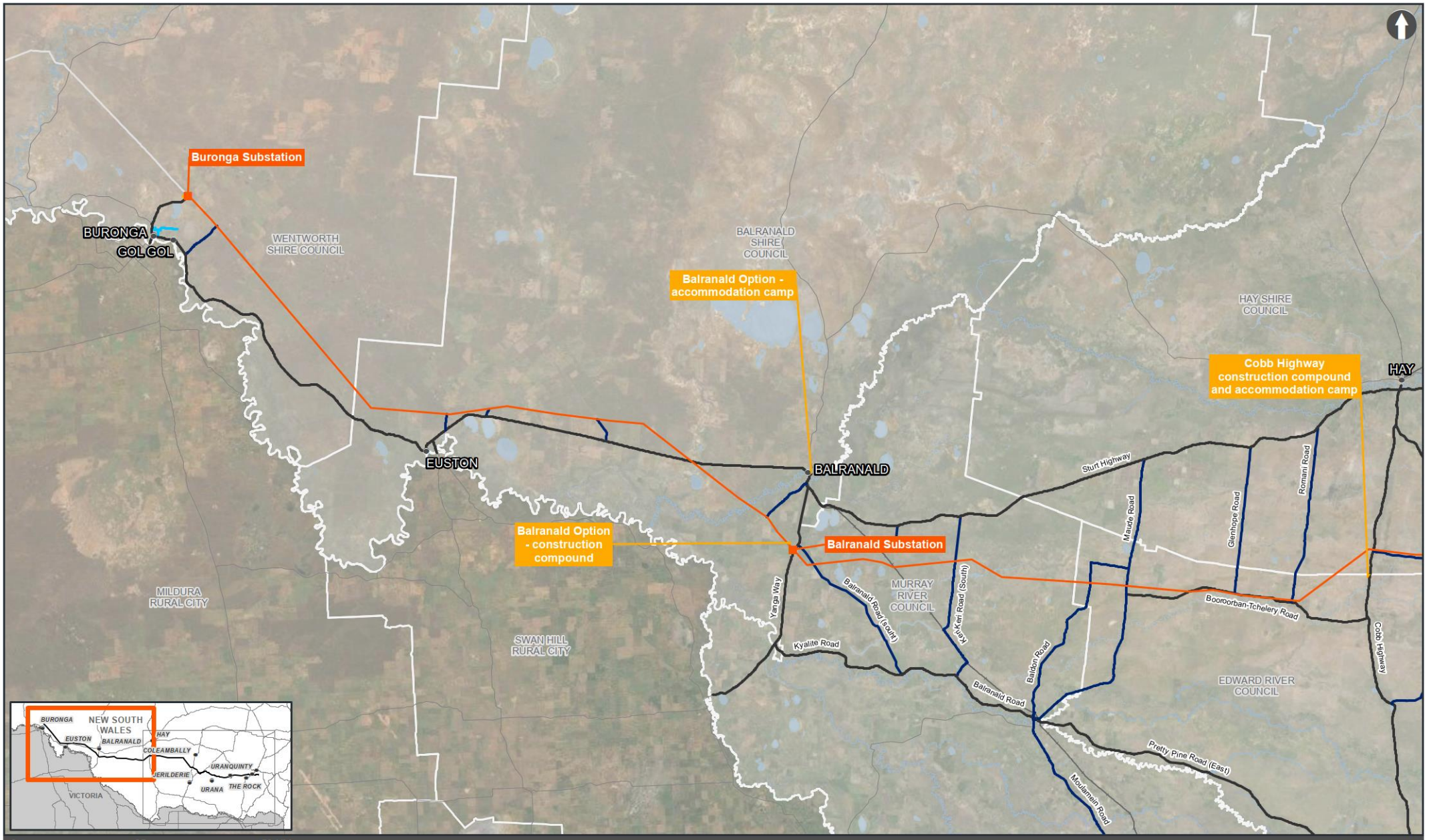

Figure 6-12

Prospective traffic routes within the traffic and transport study area

Sheet 1 of 2

- EnergyConnect (NSW - Eastern Section)
- EnergyConnect (NSW - Western Section)
- Existing Substation
- Main Construction Compounds and Accomodation Sites
- Existing Railway
- Watercourse
- Local Government Areas
- Waterbody

Transport Routes

- Primary Haulage Route
- Secondary Haulage Route
- Water Haulage Route
- Local Haulage Route
- Collector Haulage Route

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Source: NSWSS, ESRI, Transgrid, WSP

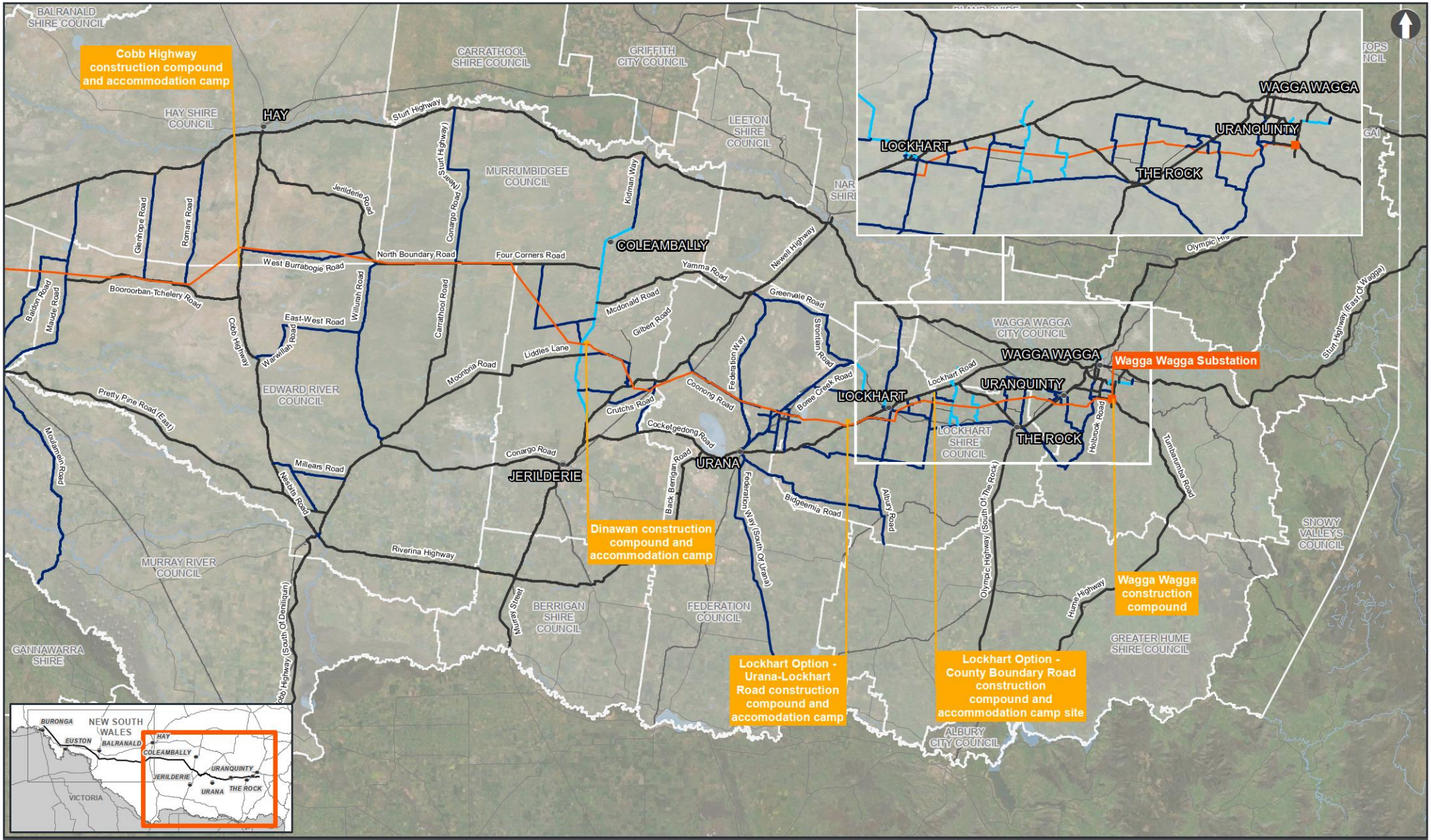

Figure 6-12

Prospective traffic routes within the traffic and transport study area

Sheet 2 of 2

- EnergyConnect (NSW - Eastern Section)
- EnergyConnect (NSW - Western Section)
- Existing Substation
- Main Construction Compounds and Accomodation Sites
- Existing Railway
- Watercourse
- Local Government Areas
- Waterbody

Transport Routes

- Primary Haulage Route
- Secondary Haulage Route
- Water Haulage Route
- Local Haulage Route
- Collector Haulage Route

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Source: NSWSS, ESRI, Transgrid, WSP

7. Stakeholder and community consultation

This chapter summarises the stakeholder and community consultation activities that have been previously undertaken and that are planned for the proposal, and the broader EnergyConnect project. It includes details of consultation methods and a list of the stakeholders and government agencies consulted to date.

The chapter also provides an overview of the key issues raised by stakeholders and the community and where relevant, how these concerns have been addressed through the design of the proposal and/or through the EIS process. Further details of community and stakeholder consultation, issues raised and supporting documents are provided in Appendix D (*Consultation outcomes report*).

7.1. Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to consultation and where these requirements are addressed in this EIS are outlined in Table 7-1.

Table 7-1 Secretary's environmental assessment requirements – consultation

Ref.	Secretary's Environmental Assessment Requirements	Where addressed
General requirements	The EIS must include: • a description of the engagement that was carried out during the preparation of the EIS, the key issues raised during this engagement and the proposed engagement strategy for the project if it is approved.	This chapter provides a description of the engagement that was carried out during the preparation of the EIS, including a summary of the key issues raised.
Consultation	During the preparation of the EIS, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups, affected landowners and lease holders, exploration licence holders and mineral title holders.	This chapter provides a description of the engagement undertaken with relevant stakeholders throughout the development of the proposal and preparation of the EIS.

7.2. Consultation strategy

7.2.1. Consultation approach and objectives

Transgrid is committed to an engagement process that is proactive, transparent and represents a genuine desire to work with stakeholders. Transgrid recognises that a two-way feedback process is the key to understanding the needs and views of stakeholders and communities who are directly and indirectly affected by its operations.

A Community and Stakeholder Engagement Plan (CSEP) for the EnergyConnect project was developed in broad alignment with the *Draft Environmental Impact Assessment Guidance Series*: *Community Guide to EIA* (DPE, 2017a) to establish an appropriate framework for EnergyConnect (including the proposal).

For alignment with leading practice, in addition to the *Undertaking Engagement Guidelines for State Significant Projects* (DPIE, 2021), a range of Transgrid and industry standards and guidelines for community and stakeholder engagement were also considered including:

- *Stakeholder Engagement Charter* (Transgrid, 2015)
- *Landholder Easement and Compensation Guide* (Transgrid, 2019)
- *Quality Assurance Standard* (International Association for Public Participation, 2015)
- *Community Engagement Guidelines* (Clean Energy Council, 2018).

The objectives of the stakeholder and community consultation activities for the proposal are:

- identifying and engaging early with community and stakeholders in a genuine, honest and transparent way
- providing tailored, timely and meaningful information on what the proposal is, relevant/potential impacts and the underlying project need
- encouraging stakeholders to provide informed feedback and actively participate in the route selection process
- consulting on the potential environmental and social impacts of the proposal
- conducting the engagement and communications process in a manner that addresses regulatory requirements but also provides stakeholders with many genuine opportunities to participate
- developing and maintaining respectful working relationships with stakeholders.

7.2.2. Identified stakeholders

A list of key stakeholder groups that have been engaged throughout the development of EnergyConnect and the proposal are detailed in Table 7-2.

Table 7-2 Key stakeholder groups for the proposal

Stakeholder group	Stakeholders
Government – Political representatives	• Commonwealth Minister for Energy and Emissions Reduction, the Hon Angus Taylor MP • NSW Minister for Energy and Environment, the Hon Matthew Kean MP • SA Minister for Energy and Mining, the Hon Dan van Holst Pellekaan MP
Energy Regulator / Operator	• Australian Energy Market Commission • Australian Energy Market Operator (AEMO) • Australian Energy Regulator • Energy Security Board
Federal Members	• Member for Farrer, The Hon Sussan Ley MP • Member for Riverina, The Hon Michael McCormack MP
State Members	• Member for Albury, Justin Clancy MP • Member for Murray, Helen Dalton MP • Member for Wagga Wagga, Dr Joe McGirr MP

Stakeholder group	Stakeholders
Local government – Elected officials/ Executive staff	• Albury City Council • Balranald Shire Council • Edward River Council • Federation Council • Griffith City Council • Hay Shire Council • Lockhart Shire Council • Murray River Council • Murrumbidgee Council • Narrandera Shire Council • Wagga Wagga City Council • Wentworth Shire Council.
Government – Departmental	• Commonwealth Department of Defence • Commonwealth Energy Infrastructure Commissioner • Commonwealth Government Department of Agriculture, Water and the Environment (DAWE) • Commonwealth Government Department of Education, Skills & Employment • Commonwealth Government Department of Industry, Science, Energy and Resources • NSW Department of Communities and Justice, specifically its divisions Fire & Rescue NSW, NSW Police Force, NSW Rural Fire Service, NSW State Emergency Service • NSW Department of Health, specifically its divisions Far West Local Health District, Murrumbidgee Local Health District and NSW Ambulance • NSW Department of Planning, Industry and Environment (DPIE) and its divisions NSW Crown Lands, NSW Environment, Energy and Science (previously referred to as Office of Environment and Heritage (OEH)), NSW National Parks & Wildlife Services and Department of Primary Industries • NSW Department of Premier and Cabinet, specifically its divisions Aboriginal Affairs NSW and Resilience NSW • NSW Department of Regional NSW including its divisions of Forestry Corporation NSW and NSW Local Land Services • NSW Department of Customer Service (DCS), and its division SafeWork NSW • Riverina Emergency Management Committee, which includes local, state and Federal agencies • Transport for NSW, specifically its division Property Acquisition NSW • Victorian Department of Environment, Land, Water and Planning
Directly impacted landholders (in corridor)	Landholders (owners, occupiers, lease and other interest holders in the corridor)

Stakeholder group	Stakeholders
Traditional Owners and other Aboriginal groups	• Balranald Local Aboriginal Land Council • Balranald Mutthi Mutthi Traditional Owners • Bangerang Aboriginal Corporation • Barkandji Traditional Owners (Native Title Group) • Barkindji Maraura Elders Environment Team (BMEET) • Barkindji Maroura Elders Council (BMEC) • Bidya Marra Consultancy • Bundyi Culture • Cummerajunga Local Aboriginal Land Council • Deniliquin Local Aboriginal Land Council • First People of the Millewa Mallee Aboriginal Corporation • Griffith Local Aboriginal Land Council • Hay Aboriginal Corporation • Hay Local Aboriginal Land Council • Kureinji Aboriginal Corporation • Maliyan Horizon • Merrigarn • Miyagan Culture & Heritage • Murra Bidgee Mullangari Aboriginal Corporation • Murugadi • Nari Nari Tribal Council • Narrandera Local Aboriginal Land Council • National Indigenous Australians Agency (NIAA) • NSW Aboriginal Affairs (Broken Hill) • NSW Aboriginal Land Council • NSW Indigenous Chamber of Commerce • NTSCORP • Outback Academy • Wagga Wagga Local Aboriginal Land Council • Wakool Indigenous Corporation • Yalmambirra • Yarkuwa Indigenous Knowledge Centre Aboriginal Corporation • Yorta Nation Aboriginal Corporation • Other individuals, which are Registered Aboriginal Parties for the proposal
Local land users	Local land users e.g. irrigators and agricultural businesses within the project area who are not considered directly impacted or adjacent landholders
Local community	Local communities within Council areas
Local suppliers	Local suppliers within the Murray and Riverina regions
Other suppliers	NSW and Australian suppliers

Stakeholder group	Stakeholders
Industry groups	• AI Group • Business NSW • Committee4WaggaEnergy Consumers Australia • Energy Users Association of Australia • Industry Capability Network (ICN) • NSW Farmers Association • Primary Producers SA • Public Interest Advocacy Centre • Regional Development Australia • Riverina and Murray Joint Organisation (RAMJO) • Wagga Wagga Business Chamber
Service providers / utilities	• Essential Energy • Telstra
Exploration Licence holders	• Viewmont Gold
Interest groups	Local progress associations, issue-specific interest groups including: • Yanco Creek and Tributaries Advisory Committee (YACTAC) • Murrumbidgee Landcare • Riverina Noxious Weeds Advisory Group
Media	Local, State and National print, radio and television
General public	General members of the public who may take an interest in EnergyConnect (including the proposal)

7.3. Engagement activities

A wide-ranging engagement program was developed prior to and during preparation of the EIS to consider the range of stakeholders who may be potentially impacted by or interested in EnergyConnect and the proposal. This included providing opportunities for general stakeholder participation as well as more targeted consultation with government agencies and Aboriginal group representatives.

Direct engagement with the community was made difficult by travel restrictions, social distancing and other health advice requirements associated with COVID-19. Transgrid developed alternative methods for engaging with the community in order to comply with NSW Health advice. A series of facilitated on-line webinars were held in September 2021. These webinars were open to all community members and provided a COVID-safe forum for community members to ask for more information and to share their views on the proposal.

The tables below provide a summary of the three key activities undertaken. This includes:

- Building project awareness with stakeholders and the community (refer to Table 7-3)
- Developing communication channels and materials (refer to Table 7-4)
- Undertaking consultation activities (refer to Table 7-5).

Further detail regarding the specific activities is provided in Appendix D.

Table 7-3 Building proposal awareness

Activity	Description	Key outcome
Print advertisements	Significant local advertising campaigns were planned and implemented. These advertisements promoted upcoming project activities and opportunities for stakeholders to provide feedback. This included in-person and online community information sessions, project contact details, community partnership application periods and other opportunities to provide feedback.	**97** advertisements across **10** media publications, with a total circulation of **~51,000** and an estimated readership of **153,237**
Online advertisements	Digital advertising campaigns were implemented to broaden and supplement the reach of the print advertising campaigns. The advertisement allowed click through to the EnergyConnect webpage, which provided comprehensive information about dates, times and locations of community information sessions, and connected the audience to additional channels for them to continually provide feedback on the project.	**9** online advertising campaigns undertaken with **195,356** views
Social media posts	Social media was used to reach people who do not engage in traditional media, and those in smaller communities who learn about local activities through online groups and pages. Local councils and community Facebook groups have been instrumental in helping raise awareness of engagement opportunities and feedback mechanisms through posting on their Facebook pages.	**73** posts across **25** local community Facebook pages, with more than **63,500** combined followers
Introductory letters	Letters were sent to a variety of stakeholders to provide an overview of the project, initiate the engagement process and outline opportunities to engage further. To stimulate participation, landowners received letters that introduced the initial area of investigation and encouraged feedback, local insights, potential constraints and opportunities to help determine the proposed transmission route. Aboriginal persons and Registered Aboriginal Parties also received introductory letters seeking participation in the Aboriginal Cultural Heritage Assessment process.	**404** letters sent to local stakeholders from Buronga to Wagga Wagga
Flyers, poster displays and other materials	Flyers and poster displays were provided to local businesses at prominent locations introducing the project, information sessions and ways for the community provide ongoing feedback. In addition, letterbox drops were conducted in areas with particularly high landholder and community interest. A Community Card that fits inside a wallet or pocket was also developed as a ready-reference guide to project information channels. The card was distributed and available at all community information sessions, and carried by project staff conducting field works.	**600** flyers circulated to **25** businesses in **9** towns **2,100** flyers delivered to letterboxes

Table 7-4 Communication channels and materials

Activity	Description	Key outcome
Project communication channels	Dedicated lines of communication were established for stakeholders and community members to request additional information, make enquiries or provide feedback. A toll-free number (1800 49 06 66) is answered Monday to Friday from 9 am until 5 pm with a voicemail for afterhours calls. A project email address (pec@transgrid.com.au) was also established. Both channels were promoted in all advertisements and communication materials.	**124** community calls and emails responded to via the project phone line and email address
Project webpage	A project specific webpage was developed providing an accessible central location for information relating to EnergyConnect. The webpage includes the project's purpose, scope, benefits, timeline, milestones, updates, interactive map, resources, approvals process and news. A specific section for landowner and community engagement provides updates on upcoming engagement activities, support services and details of the Office of the Landowner and Community Advocate. Contact details and an option to subscribe to the project newsletter is also available.	**9,500+** visits to the project webpage
Subscription newsletter	The e-newsletter was developed to provide current information on project activities, timeline, milestones, information sessions, and community partnership program funding opportunities. This aligns with stakeholder feedback regarding frequency and preferred content. The newsletter also highlights how people can continue to provide feedback.	**~400** recipients to a monthly e-newsletter, with an average open rate **2.7x** higher than industry average
Guides and factsheets	A series of guides and factsheets have been developed as a resource for stakeholders and local community members. They are available in printed copy and online via the project webpage. These documents have been utilised across engagement activities including stakeholder briefings, landowner meetings and community information sessions to enhance understanding and further build transparency. A separate Community guide to the NSW-Eastern Section EIS will also be developed and made available.	**11** guides and factsheets developed specifically for EnergyConnect

Table 7-5 Consultation activities

Activity	Description	Key outcome
In-person community drop-in information sessions	A series of in-person community information sessions have been held across the NSW-Eastern Section. These sessions provided an opportunity for project stakeholders to 'drop-in' and to talk to project representatives and subject matter experts to learn more about the project, ask questions relevant to them and provide local insights that were taken into account as part of the route refinement process. The sessions were held across various days and times to accommodate a broad spectrum of the community, with a number of sessions held in conjunction with existing community events.	**26** face to face drop-in sessions held across **15** local towns and community centres Average rating when asked "How informative did you find the community information session?"
Online community information sessions (webinars)	Webinars provided a COVID-safe opportunity for community members and stakeholders to engage with project representatives. The webinars were held across different days and times to promote inclusion. The online sessions contained project information such as the scope, timeframe, elements of the environmental impact statement, proposed route alignment, an introduction to SecureEnergy (nominated construction contractor) and Transgrid's community partnership program. Attendees were able to ask questions to a panel of project representatives and subject matter experts. A recording of the presentation was made available online with the Q&A component from all three sessions consolidated, transcribed and made available online.	**3** online community information sessions held, with **171** interested stakeholders and **82** attendees Average rating when asked "I would recommend others to participate in these online community information sessions"
Facilitated landowner Q&A sessions	A series of question and answer style sessions were held in response to landowner requests. Participants were invited to attend one of four sessions, which were conducted at different times to promote inclusion. These sessions gave landowners the opportunity to gain specific and contextual information about the project from a panel of project representatives and independent subject matter experts. Topics that landowners identified and discussed included general project information, route identification and alignment, valuation and compensation process, land use and activities within easements, operations and maintenance of transmission infrastructure, biosecurity and weed management and electrical interference (GPS and radio). Questions, answers and supplementary materials from each session were consolidated and shared to promote transparency.	**34** landowners and community members attended, representing **42** landholdings Average rating when asked "How informative did you find the Q&A session?"

Activity	Description	Key outcome
Interactive map	An online interactive map was available to enable stakeholders to provide local insights to be incorporated as part of the route refinement process. The map includes information about EnergyConnect, the route selection process and the types of local insights considered relevant. Examples included environmental values, social values, land use, opportunities for alignment and visual amenity.	**~9,500** views of the online map, with **319** comments provided
Stakeholder briefings	Two key types of stakeholder briefings were provided in the planning phase of EnergyConnect, including overview/update briefings and specific subject matter briefings. Specific subject matter briefings were held to provide targeted information to key stakeholders. This included matters relating to Aboriginal cultural heritage, biodiversity and conservation. Stakeholder groups briefed included local State and Federal Members of Parliament, State and Federal Government Departments and Agencies, regulatory bodies, elected representatives and key staff at Local Governments, Aboriginal Groups and Peoples, industry groups and local interest groups.	**279** briefings held with key stakeholders
Property-specific meetings	On-site and property-specific meetings were held with landowners and occupiers as part of the NSW-Eastern Section consultation activities to discuss property specific information, insights, opportunities and constraints. As part of this process project representatives and property stakeholders worked together to develop a holding map for the property. This information ultimately supported the route selection process. Other property-specific meetings included land access discussions to enable site investigation and environmental monitoring. These consents also noted any conditions of entry from the landowner, such as advance notification and biosecurity requirements. Additional discussions were undertaken regarding the easement process and proposed infrastructure.	**643** property-specific meetings held

7.4. Stakeholder feedback and topics raised

7.4.1. Government agency feedback

Transgrid has undertaken extensive consultation with a range of government departments and agencies. Transgrid has engaged with government stakeholders to confirm regulatory requirements for the environmental assessments, to gather knowledge on key issues of concern, and to facilitate sharing of information to assist on the preparation of the EIS.

Key agencies consulted during the preparation of the EIS and the general topics discussed or raised during this consultation are detailed in Table 7-6.

Table 7-6 Agency and Government stakeholder feedback

Agency / Government department	Topics raised	Addressed in EIS
NSW Department of Planning, Industry and Environment (Planning and Assessments)	• Regular structured meetings to confirm requirements for EIS preparation, environmental assessment requirements, property acquisition and agency consultation	Throughout the EIS
NSW Department of Planning, Industry and Environment (Biodiversity Conservation Division)	• Local biodiversity values, assessment requirements, biodiversity management strategy and potential offset strategies	EIS Chapter 9 Biodiversity and Technical Paper 1 Biodiversity Development Assessment Report (BDAR)
NSW Department of Planning, Industry and Environment (Primary Industries)	• Potential land use impacts and compatibility issues on agricultural land and farm businesses due to transmission line infrastructure	EIS Chapter 12 Land Use and Property and Technical Paper 4 Agricultural Land Impact Assessment
Commonwealth Department of Agriculture, Water and Environment	• Biodiversity values, assessment requirements, biodiversity management strategy and potential offset strategies	EIS Chapter 9 Biodiversity and Technical Paper 1 Biodiversity Development Assessment Report (BDAR)
Commonwealth Department of Education, Skills and Employment	• Opportunities to develop workforce planning and employment programs	EIS Chapter 14 Social, EIS Chapter 15 Economic, Technical Paper 6 Social Impact Assessment and Technical Paper 7 Economic Impact Assessment
Heritage NSW	• Cultural heritage (Aboriginal and non-Aboriginal) assessment requirements, impacts and management strategies • Ensure appropriate consultation is conducted with Aboriginal stakeholders including Local Aboriginal Land Councils (LALCs) and Registered Aboriginal Parties (RAPs)	EIS Chapter 10 Aboriginal Heritage, EIS Chapter 11 Historic Heritage, Technical Paper 2 Aboriginal Cultural Heritage Assessment and Technical Paper 3 Historic Heritage
Department of Regional NSW (Local Land Services)	• Biosecurity and weed management procedures	EIS Chapter 9 Biodiversity and Technical Paper 1 Biodiversity Development Assessment Report (BDAR)
Forestry Corporation NSW	• Access and management measures during construction	EIS Chapter 12 Land Use and Property and Technical Paper 4 Agricultural Land Impact Assessment

Agency / Government department	Topics raised	Addressed in EIS
National Parks and Wildlife Services	• Requirements to access and conduct activity within Yanga State Conservation Area and proposed route alignment	EIS Chapter 12 Land Use and Property and Technical Paper 4 Agricultural Land Impact Assessment
Transport for NSW	• Transportation of large materials using oversize vehicles, transportation routes, traffic access to sites and traffic management during construction	EIS Chapter 19 Traffic and transport and Technical Paper 11 Traffic and Transport Impact Assessment
NSW Department of Communities and Justice (Fire and Rescue NSW, NSW Police Force, NSW Rural Fire Service & NSW State Emergency Service)	• Operations and emergency response • Risk mitigation and operational infrastructure availability at proposal sites • Work activity during Total Fire Bans	EIS Chapter 20 Hazards and Risk and Technical Paper 12 Bushfire Impact Assessment
NSW Department of Health (Local Health Districts & NSW Ambulance	• Operations and emergency response • Risk mitigation and operational infrastructure availability at proposal sites	EIS Chapter 20 Hazards and Risk and Technical Paper 12 Bushfire Impact Assessment
Commonwealth Department of Defence	• Land use constraints including the Morundah communications facility and test firing ranges	EIS Chapter 3 Proposal Design Development and EIS Chapter 12 Land Use and Property

7.4.2. Local Council feedback

Transgrid routinely engaged representatives of these local governments including elected representatives, senior management and operational staff as part of the development of the proposal. This included route alignment consultation to better understand if and how the proposal may impact local communities from an environmental, social and infrastructure perspective and technical input to inform proposal planning such as land and environment information, traffic and transport data, and socio-economic data.

The key feedback common across the local governments was the proposal benefits, with EnergyConnect being seen as an indicator for further investment and development opportunities in the renewable energy sector. Councils also advocated for local employment and supplier opportunities, while looking ahead to a positive, sustained economic development following the completion of EnergyConnect.

A summary of the general topics discussed or raised during this consultation is provided in Table 7-7. Further detail is included in Appendix D.

Table 7-7 Local Council feedback

Local council	Topics raised	Addressed in EIS
Balranald Shire Council	• Road infrastructure maintenance • Potential visual and spatial impact of transmission towers • Managing local amenity during periods of increased demand from itinerant proposal workforce	• EIS Chapter 18 Traffic and Transport and Technical Paper 11 Traffic and Transport Impact Assessment • EIS Chapter 13 Landscape Character and Visual Amenity and Technical Paper 5 Visual and Landscape Character Impact • EIS Chapter 14 Social, EIS Chapter 15 Economic, Technical Paper 6 Social Impact Assessment and Technical Paper 7 Economic Impact Assessment
Edward River Council	• Plains Wanderer habitat and presence of other bird species (e.g. Mallee Fowl) • Importance of weed mitigation and management • Road infrastructure maintenance	• EIS Chapter 9 Biodiversity and Technical Paper 1 Biodiversity Development Assessment Report (BDAR) • EIS Chapter 12 Land Use and Property • EIS Chapter 18 Traffic and Transport and Technical Paper 11 Traffic and Transport Impact Assessment
Federation Council	• Legacy benefit for local community post EnergyConnect • Workcamp/workforce accommodation	• EIS Chapter 14 Social, EIS Chapter 15 Economic, Technical Paper 6 Social Impact Assessment and Technical Paper 7 Economic Impact Assessment • EIS Chapter 12 Land Use and Property
Hay Shire Council	• Management of water resources (including allocations) • Waste management during construction • Workcamp/workforce accommodation	• EIS Chapter 16 Hydrology, Flooding and Water Quality and Technical Paper 8 Hydrology, Flooding and Water Quality • EIS Chapter 22 Waste Management and Resource Use • Chapter 6 Proposal construction
Lockhart Shire Council	• Route location and impact to future land use planning • Workcamp/workforce accommodation • Legacy benefit for local community post EnergyConnect	• Chapter 6 Proposal construction • EIS Chapter 19 Traffic and Transport and Technical Paper 11 Traffic and Transport Impact Assessment • EIS Chapter 12 Land Use and Property • EIS Chapter 14 Social, EIS Chapter 15 Economic, Technical Paper 6 Social Impact Assessment and Technical Paper 7 Economic Impact Assessment
Murray River Council	• Local business and supplier opportunities	• EIS Chapter 14 Social, EIS Chapter 15 Economic, Technical Paper 6 Social Impact Assessment and Technical Paper 7 Economic Impact Assessment

Local council	Topics raised	Addressed in EIS
Murrumbidgee Council	• Workcamp/workforce accommodation • Waste management • Local business and supplier opportunities • Indigenous participation	• Chapter 6 Proposal construction • EIS Chapter 22 Waste Management and Resource Use • EIS Chapter 14 Social, EIS Chapter 15 Economic, Technical Paper 6 Social Impact Assessment and Technical Paper 7 Economic Impact Assessment
Wagga Wagga City Council	• Land use and potential impacts on productive land and farm businesses • Property and easement access including land at the Gregadoo Waste Management Centre • Road infrastructure maintenance • Electric and magnetic fields • Bushfire management • Visual amenity	• EIS Chapter 12 Land Use and Property and Technical Paper 4 Agricultural Land Impact Assessment • EIS Chapter 19 Traffic and Transport and Technical Paper 11 Traffic and Transport Impact Assessment • EIS Chapter 20 Hazards and Risk and Technical Paper 12 Bushfire Impact Assessment • EIS Chapter 13 Landscape Character and Visual Amenity and Technical Paper 5 Visual and Landscape Character Impact
Wentworth Shire Council	• Management of water resources (including allocations) • Waste management • Road infrastructure maintenance and other Council assets	• EIS Chapter 16 Hydrology, Flooding and Water Quality and Technical Paper 8 Hydrology, Flooding and Water Quality • EIS Chapter 22 Waste Management and Resource Use • EIS Chapter 19 Traffic and Transport and Technical Paper 11 Traffic and Transport Impact Assessment

7.4.3. General stakeholder feedback

A summary of the key feedback, issues and topics raised during consultation with the community, industry and special interest groups is provided in Table 7-8. Further detail is included in Appendix D.

Table 7-8 Stakeholder feedback

Theme	Topics raised	Issue raised by/discussed with	Addressed in EIS
Design	• Impact of proposal on productive land and farm businesses	Multiple stakeholders	Impacts on productive land and farm businesses is discussed in Chapter 12.
Design	• Maximise use of existing easements and other property features, such as fence boundaries, road reserves, rail corridors and travelling stock routes	Multiple stakeholders, specifically landholders	The use of existing easements and other features was considered as part of the development of the proposal. Refer to Section 3.3 of this EIS.
Design	• Land use constraints and co-existence	Multiple stakeholders	Land use constraints are discussed in Chapter 12.
Design	• Potential impacts on GPS enabled equipment and telecommunications devices	Landholders	The potential impacts on GPS enabled equipment and telecommunications devices is discussed in Chapter 12 and Section 20.5.4.
Design	• Potential visual and spatial impact of transmission towers	Multiple stakeholders	The potential visual impacts of the proposal are discussed in Section 13.5.
Design	• Proximity of transmission line to local township, dwellings and infrastructure	Multiple stakeholders	Consideration of the proximity of the proposal to local township, dwellings and infrastructure was considered as part of the options assessment (Section 3.3) and the landscape and visual assessment (Chapter 13)
Design	• Transmission towers	Landholders	The design of the transmission towers is discussed in Section 5.3.2.
Design	• Interaction with other/ existing utilities	Utility providers	Interaction with other/existing utilities is discussed in Section 20.4.3.
Environment	• Biodiversity protection (flora and fauna)	Multiple stakeholders	Biodiversity impacts is discussed in Chapter 9.
Environment & property	• Biosecurity and weed management procedures	Multiple stakeholders	Biosecurity and weed management procedures are identified in the mitigation measures in Table 9-6.
Environment	• Flood plains	Community members	Consideration of flood plains within the proposal study area is provided in Chapter 16.

Theme	Topics raised	Issue raised by/discussed with	Addressed in EIS
Heritage	• Protection of artefacts and sites of significance (Aboriginal and non-Aboriginal)	Multiple stakeholders	Consideration of potential impacts to Aboriginal and historic heritage is discussed in Chapter 10 and 11.
Property	• Compensation to adjacent landholders	Community members	Compensation to land holders is discussed in Section 5.5 and Chapter 12.
Property	• Land valuations and easement compensation	Landholders	Land valuations and easement compensation is discussed in Section 5.5 and Chapter 12.
Property	• Property and easement access	Multiple stakeholders	Property and easement access is discussed in Section 5.5 and Chapter 12.
Safety	• Bushfire management	Multiple stakeholders	Consideration of bushfire risk and management is discussed in Chapter 20.
Safety	• Potential impacts from electric and magnetic fields (EMF)	Multiple stakeholders	Potential impacts from EMF is discussed in Chapter 20.
Safety	• Project response to COVID-19 and community safety	Multiple stakeholders	Although not specifically addressed as a requirement in the EIS, Transgrid has developed COVIDSafe Plans to ensure community safety.
Socio-economic	• Aboriginal employment / participation (including skills development and training)	Multiple stakeholders	Consideration of potential opportunities for Aboriginal employment and participation is discussed in Chapter 10.
• **Socio-economic**	• Local business and supplier opportunities	Multiple stakeholders	Consideration of local business and supplier opportunities is discussed in Chapter 14.
• **Socio-economic**	• Prioritising Australian-based procurement	Multiple stakeholders	The nominated construction contractor would determine the potential to utilise localise procurement options as part of the finalisation of the construction methodology for the proposal (refer also to Chapter 14)

7.5. Public exhibition of the EIS

During the public exhibition period, the community and other stakeholders will be able to review the EIS and make a written submission to the Department for consideration in its assessment of the proposal.

During this time, Transgrid will undertake further consultation with the community and stakeholders using several of the consultation methods implemented prior to and during preparation of the EIS, including those summarised in the sections below. This would allow the community and other stakeholders to be informed about the proposal and the opportunity to provide a submission.

7.5.1. Display of the EIS

Electronic copies of the EIS will be available to be viewed:

- on the DPIE Major Projects website (www.majorprojects.planning.nsw.gov.au)
- on the EnergyConnect website (transgrid.com.au/energyconnect).

7.5.2. Interactive EIS map

An interactive EIS map will be available through the EnergyConnect website (transgrid.com.au/energyconnect). This provides an online tool to explore the key outcomes of the EIS through interactive mapping and provides another way to view the EIS.

7.5.3. Proposal notifications and updates

To promote the EIS exhibition, Transgrid will continue to inform stakeholders through a variety of engagement tools, either in person or via digital platforms, including:

- stakeholder briefings
- community information sessions
- EnergyConnect webpage
- traditional media and advertisements
- social media.

Separate notifications would also be provided to directly affected landholders via email, informing them of the public exhibition process and providing details of the EnergyConnect telephone number (1800 49 06 66) and EnergyConnect website (transgrid.com.au/energyconnect) to find out more information.

Engagement opportunities proposed may be amended to remain in accordance with the NSW State Government Public Health Orders in response to the COVID-19 pandemic.

7.5.4. Consideration of stakeholder and community feedback

At the completion of the display period the DPIE will provide Transgrid with a copy of all submissions and a summary of issues raised. A submissions report will be prepared responding to the issues raised and will be made available for viewing on the DPIE website. If changes to the proposal need to be made, a preferred infrastructure report (or an amendment report) would also be prepared.

7.6. Consultation during delivery of the proposal

Consultation with the community and key stakeholders would be ongoing in the lead up to and during construction of the proposal. The consultation activities would aim to provide:

- the community and stakeholders with a high level of awareness of all processes and activities associated with construction of the proposal
- accurate and accessible information and a timely response to issues and concerns raised by the community
- opportunities for feedback and input.

The EnergyConnect phone number and email address will continue to be available during construction. Targeted consultation methods, such as letters, notifications, signage and face-to-face communications, will also continue to occur. The Transgrid webpage and social media platforms will also include updates on the progress of the proposal.

SecureEnergy, the construction contractor, has prepared a community engagement and communication strategy. The strategy outlines the continued engagement approach with all members of the community and providing information on the proposal, upcoming impacts and answering enquiries.

The engagement team will continue to build on the constructive relationships formed by providing:

- true and clear information
- complying with all commitments made to the community
- opportunities to collaborate, work together and generate shared experiences.

The strategy also includes a feedback management procedure to manage communications with the community such as enquiries, complaints or disputes. Any feedback provided by the community will be managed with respect and be responded to efficiently and in a timely manner, with each stakeholder interaction being treated as an opportunity for a positive experience.

Part C – Environmental impact assessment

8. Approach to impact assessment

8.1. Overview

As discussed in Chapter 5 (Proposal infrastructure and operation) and Chapter 6 (Proposal construction), some aspects of the proposal design would continue to be refined as part of the finalisation of the proposal design as opportunities. The intent of this refinement would be to reduce environmental impacts, and would be aimed at producing better environmental outcomes/performance by improving the proposal design and construction methodology. Opportunities for refinement relate to:

- micro-siting of the transmission line towers along the proposed transmission line alignment
- final siting and arrangement of the proposed Dinawan 330kV substation within the identified parcel of land
- construction facilities along the transmission line alignment.

For example, there are likely to be opportunities for refinement of the transmission line tower locations along the identified alignment during ongoing field validation of constraints, design development or as a result of government, landholder, community or other stakeholder feedback. This would also inform the final placement of access tracks and ancillary construction support facilities.

The final design and construction methodology and construction impact area would be reviewed for consistency with the assessment contained in this EIS, and would be guided by:

- the hierarchy of constraints to avoid and/or minimise impacts (refer to Section 3.3)
- the mitigation measures identified in this assessment (refer to Section 23.1).

Further detail on the design and construction methodology refinement process is provided in Section 24.1.2.

8.1.1. Assessment approach

To achieve a level of flexibility while undertaking a rigorous level of impact assessment, the approach adopted for this EIS has been to assess a potential 'worst case' impact. Most of the impact assessments (with the exception of biodiversity and heritage for the reasons outlined below) have conservatively assumed that any area could be impacted by the proposal within the whole of the construction impact area. This area would comprise the following elements:

- areas for construction of all proposal infrastructure elements including the proposed transmission line alignment, transmission line easement, substation site works (at both the proposed Dinawan 330kV and upgraded and expanded Wagga Wagga substations), optical repeater infrastructure, and other ancillary works

- locations for construction elements such as construction compounds and accommodation camps (including options for some sites at Balranald and Lockhart), access tracks (excluding public roads proposed to be used for access routes), site access points, water supply points, laydown and staging areas, concrete batching plants, brake/winch sites and site offices.

8.1.1.1. Biodiversity and heritage

For biodiversity and heritage, more refined disturbance areas within the construction impact area have been assessed to provide a greater understanding of the likely magnitude of direct impacts expected from the proposal (within the broader construction impact area). This approach was adopted to avoid a 'worst case' approach that would result in substantial overestimation of the likely biodiversity and heritage impacts (for example, assuming the whole of the transmission line easement would be cleared of vegetation when this is known to not be the case), but to adopt as realistic an assessment as possible.

The refined disturbance areas comprise varying degrees of physical disturbance along the transmission line alignment to reflect construction and operational requirements – specifically:

- **disturbance area A** – this is the area where ground disturbance and vegetation removal would be required. It refers to an area at and around the transmission line towers, areas for brake and winch sites and for new/upgraded access tracks. The area also includes the proposed Dinawan 330kV substation site, the existing Wagga Wagga substation site and each of the main construction compounds and accommodation camps at Balranald, the Cobb Highway, Dinawan (Kidman Way), Lockhart and Wagga Wagga. It would include potential sub-surface impacts through construction activities such as grading, excavation, and full tree removal.

  Except in areas where only temporary disturbance is required (i.e. temporary access tracks and brake and winch sites), this area would also be subject to ongoing maintenance during operation (i.e. removal to ground level) for operational and safety requirements (including bushfire).

  For the impacted areas associated with the tower footprints, this EIS has assessed a conservative impact footprint which would be applicable for any of the tower type options proposed (refer to Section 5.3.1). It is noted that for a number of the final tower proposed, the final footprint would be smaller and clearing impacts would therefore be reduced.

- **disturbance area A (centreline)** – this is the area where ground disturbance would be minimised wherever possible. It refers to centreline areas between the proposed transmission line towers in which all vegetation would be removed during construction to ground however topsoil materials and ground material would be retained (where possible) and would not likely result in sub-surface impacts. This area would also be subject to ongoing maintenance during operation (i.e. removal to maintain vegetation clearance requirements) for operational and safety requirements (including bushfire).

  Where areas of sensitive environmental constraints have been identified within the centreline area (such as habitat for Plains Wanders or areas of identified potential archaeological deposits), opportunities would be considered to further avoid the requirement for centreline in these locations such as refined construction methodologies (including the use of drones for stringing transmission lines).

- **disturbance area B** – this is the area between the transmission line towers in the easement in which removal of vegetation (including trees) would be undertaken where they have the potential to exceed vegetation clearance heights. It is assumed to have no ground disturbance except in circumstances associated with the operational requirements for vegetation maintenance to meet the vegetation clearance heights. Vegetation that is to be removed would have root balls removed except where practicable to retain. It refers to an area between transmission towers in which vegetation growth heights have the potential for infringing on Transgrid's vegetation clearance requirements, including bushfire risk management (refer to Section 5.4.1 for explanation of transitional approach).

The clearance requirements within disturbance area B have been defined for each of the different line voltages as follows:

- for the 330kV section of the proposal, this area has been assessed as including removal of vegetation using a transitional approach scaling from a four metre growth height potential at the middle of the easement, extending to a 10 metre growth height potential or higher at the outer extents of the easement

- for the 500kV section of the proposal, this area has been assessed as including removal of vegetation using a transitional approach scaling from a four metre growth height potential at the middle of the easement, extending to a maximum 10 metre growth height potential at the outer extents of the easement.

Figure 8-1 and Figure 8-2 provides an overview of the key assumptions associated with the indicative disturbance areas for both a typical transmission line section at 330kV and 500kV.

The disturbance areas for these impact assessments also includes areas identified for the proposed Dinawan 330kV substation (allowing for a larger area than required to allow final siting), the Wagga Wagga substation upgrade and expansion area and each of the proposed main construction compounds and accommodation camps within the construction impact footprint (including options for some sites at Balranald and Lockhart). These are contained within disturbance area A.

Further, where options have been considered in the EIS for construction compound and accommodation camp facilities the impacts associated with all of these options being implemented is considered in totality. As a result, once the final option is confirmed the impact of the unselected location would not be required or realised.

Following finalisation of the proposal design, if the indicative disturbance areas are not consistent with what has been assessed in this EIS, and/or would impact on areas with notably different biodiversity or heritage value, the biodiversity and heritage assessments would be revised accordingly.

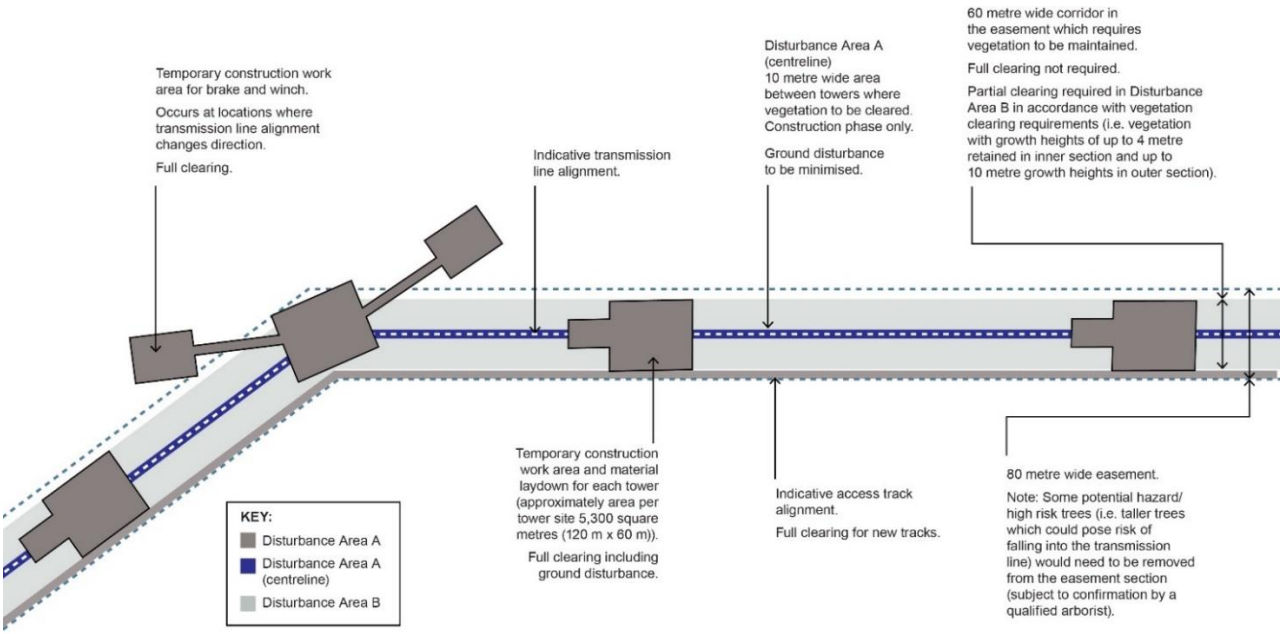

Figure 8-1 Indicative disturbance area definition for a typical 330kV transmission line section

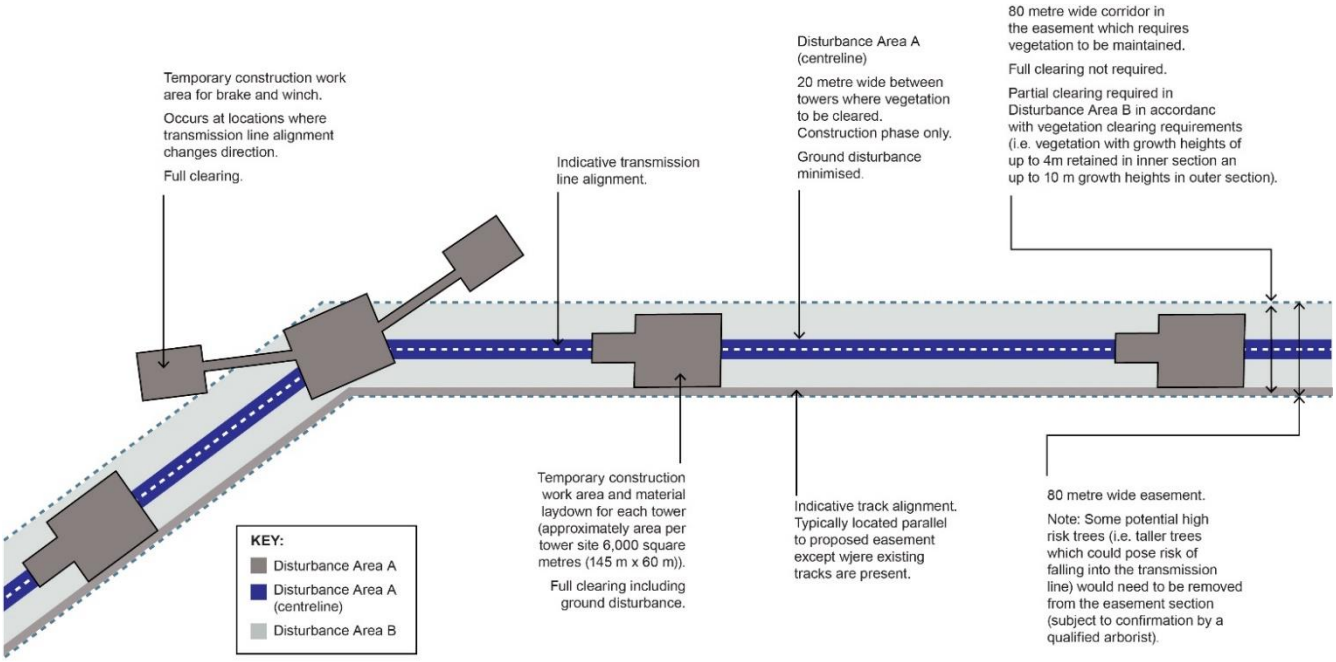

Figure 8-2 Indicative disturbance area definition for a typical 500kV transmission line section

8.1.1.2. 500kV transmission line between the proposed Dinawan 330kV substation and the Wagga Wagga substation

As identified in Section 5.3 the section of line between Dinawan 330kV substation and Wagga Wagga substation would initially only be operated at a 330kV capacity and not the full 500kV capacity. In the future once other network upgrades and their associated planning approvals are completed (including potentially the upgrade of the Dinawan 330kV substation to a 500kV operating facility) this line would operate at 500kV capacity. The impacts associated with the construction of the infrastructure and operating parameters of the full 500kV capacity line are presented in this EIS. That is, this EIS assesses the impacts of both the construction of this section of transmission line infrastructure for a 500kV capacity and its operation at that capacity which presents the potential worst case scenarios of the potential impacts of the line.

8.2. Unsurveyed areas

As part of the preparation of the EIS, field surveys were undertaken to inspect the study area for a range of issues with a focus on biodiversity and heritage. Due to landowner access restrictions, it was not possible during the assessment period of these environmental matters to survey the full length and extent of the proposal. With respect to biodiversity and heritage matters, a summary of the potential field validated uncertainties has been identified below:

- For the biodiversity assessment, the restricted access to some properties meant that full survey of these properties has not been undertaken. In relation to native vegetation survey around 11 percent of the alignment has not been available for survey access. With respect to full flora and fauna seasonal requirements, varying access restrictions has limited completed of all of these requirements thereby potentially missing a particular species' during its specific seasonal survey period. To address this particular uncertainty, existing Government mapping and assumed presence has been adopted as a precautionary approach where survey access during the required seasonal period or at all for any

survey has not been available. Further detail regarding the unsurveyed areas relating to biodiversity is provided in Technical paper 1.

- For Aboriginal heritage, around 65 kilometres of the total 537 kilometre proposal alignment has not yet been surveyed. Of the unsurveyed area, around 49 kilometres (75 percent) is co-located with an existing transmission line easement. Further detail regarding the unsurveyed areas relating to Aboriginal heritage is provided in (refer to Figure 1.4 and Appendix 5 of Technical paper 2).

Further survey efforts for both biodiversity and Aboriginal heritage are ongoing for the remaining sections of the proposal. Where additional field surveys are able to be undertaken prior to approval, this information would be presented in the response to submissions report to be prepared following exhibition of the EIS.

9. Biodiversity

This chapter provides an assessment of potential biodiversity impacts of the proposal, identifies mitigation measures to address these impacts and the requirements to offset these impacts. This chapter summarises *Biodiversity Development Assessment Report* (BDAR) (WSP, 2021a) (refer to Technical paper 1).

9.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to biodiversity and where these requirements are addressed in this EIS are outlined in Table 9-1.

Table 9-1 Secretary's environmental assessment requirements – biodiversity

Ref.	Secretary's environmental assessment requirements	Where addressed
Biodiversity		
Key issues	The EIS must address the following matters:	
	• an assessment of the biodiversity impacts of the project, in accordance with the NSW *Biodiversity Conservation Act 2016*, the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR);	The chapter provides a summary of the BDAR (referred to as Technical paper 1) which has been prepared in accordance with the BC Act and BAM.
	• the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and	The proposal has applied the avoid, minimise and offset principles as outlined in Chapter 4 of Technical paper 1 (the BDAR).
	• a strategy to offset any residual impacts of the development;	Discussion regarding the proposed offset strategy for the proposal is provided in Section 9.7.4.
	• an assessment of the impacts of the project on aquatic ecology including impacts on key fish habitat and threatened species of fish.	Section 9.4.7 provides the assessment outcomes for impacts on aquatic habitat, which have been largely avoided.

On 26 June 2020, the Australian Minister for the Environment (under delegation) determined that the proposal was a controlled action under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in respect to impacts on EPBC Act listed threatened species and communities (Sections 18 and 18A of the EPBC Act). It was also determined that the proposal (being a controlled action) would be assessed in accordance with the bilateral assessment agreement (refer to Section 1.4.2 for further detail).

Appendix A of the SEARs outlined the matters which must be addressed under the EPBC Act and EPBC Regulations. Appendix A of the SEARs identified the need to undertake an assessment of protected matters relating to listed threatened species and communities, and listed species. This included the species that needed to be considered as part of the assessment. Appendix A of the EIS outlines these requirements and where these requirements have been addressed in the EIS and Technical paper 1.

Based on the results of detailed field surveys and assessment provided in the BDAR, it is considered that there are likely to be significant impacts to the following communities and species:

- endangered Grey Box (*Eucalyptus microcarpa*) Woodland
- endangered Weeping Myall Woodlands
- critically endangered Natural Grasslands of the Murray Valley Plains
- critically endangered White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- endangered Mossgiel Daisy (*Brachyscome papillosa*)
- vulnerable Chariot Wheels (*Maireana cheelii*)
- vulnerable Slender Darling Pea (*Swainsona murrayana*).

9.2. Assessment approach

9.2.1. Legislative and policy context

Potential biodiversity impacts resulting from the proposal were assessed in line with the following legislation (including associated guidelines):

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth), that provides protection for matters of national environmental significance including listed threatened species and ecological communities, listed migratory species and wetlands of international importance.

- *Environment Planning and Assessment Act 1979* (EP&A Act), that provides the statutory controls that establish a framework governing what development is permitted or prohibited, and the processes for how assessment and gaining approval for development is undertaken in NSW.

- *Biodiversity Conservation Act 2016* (BC Act) outlines the framework for assessment, and offsetting, of biodiversity impacts in NSW. The Biodiversity Assessment Method (BAM) (Office of Environment and Heritage (OEH), 2017) is established under section 6.7 of the BC Act. The purpose of the BAM is to assess impacts on threatened species and threatened ecological communities, and their habitats, and the impact on biodiversity values, where required under the BC Act. The BC Act also introduced the Biodiversity Offsets Scheme (BOS), which has been addressed as part of the proposal.

- *Biosecurity Act 2015* (BS Act), that provides for risk based management of biosecurity in NSW through prevention, elimination and minimisation of biosecurity risks. This assessment considers the presence of priority weeds and any control measures to minimise any risks.

- *Fisheries Management Act 1994* (FM Act) regulates protection of fish and aquatic habitats in NSW, and applies to waterways within the proposal study area. Although certain provisions of the Act do not apply to CSSI (section 201, 205 and 219 of that Act), this assessment does consider potential impacts to threatened aquatic entities listed under the Act as required by the SEARs.

- *Local Land Services Act 2013* (LLS Act). This Act excludes clearing of native vegetation and loss of habitat on category 1 – exempt land (previously cleared, contains low conservation value grasslands, contains regrowth vegetation or is identified as exempt land) from the BAM assessment. Some potential category 1 lands have been identified as part of the proposal (refer to Figure 4-2 of Technical paper 1).

Importantly, as noted in Section 9.1, on 26 June 2020, a delegate of the Australian Minister for the Department of Agriculture, Water and the Environment (DAWE) determined that the proposal was a controlled action under section 75 of the EPBC Act. The EPBC Act controlling provisions for the proposal are listed threatened species and communities (Sections 18 and 18A). The proposal is therefore to be assessed in accordance with the bilateral assessment agreement Amending Agreement No. 1, and as such, is required to be assessed in the manner specified in Schedule 1 of that Agreement, including, addressing the matters outlined in Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000* (EPBC Regulations). This means that both Commonwealth and State matters have been addressed in this EIS and separate reporting for Commonwealth and State matters is not required.

9.2.2. Methodology

The methodology adopted for the assessment is detailed in Technical paper 1, and was supported by:

- a desktop assessment, including a review of relevant databases, vegetation maps, aerial photography, published literature and species expert assessments, to identify threatened species, populations, communities and their habitats with a likelihood of occurrence in areas that may be impacted by the proposal. This included searches of PlantNet, Bionet Atlas of NSW Wildlife, EPBC Act Protected Matters Search Tool, Threatened biodiversity profile search and the Threatened aquatic fauna database. The database searches were carried out for an area of 10 kilometres around the proposal study area

- field surveys between mid 2019 and late 2021 within the construction impact area, including vegetation integrity plots, targeted flora and fauna surveys, fauna habitat assessments, diurnal bird surveys, fauna trapping and Anabat surveys. Field survey techniques that were used were in general accordance with the relevant NSW and Commonwealth guidelines, including but not limited to the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (Department of Environment and Conservation 2004), *NSW Guide to Surveying Threatened Plants* (Office of Environment and Heritage, 2016) and *Surveying threatened plants and their habitats; NSW guide for the BAM* (Department of Planning, Industry and Environment, 2020).

As discussed in Chapter 8 (Approach to impact assessment), the assessment has considered subset disturbance areas within the construction impact area to provide a greater understanding of the likely magnitude of direct impacts expected from the proposal (within the broader construction impact area). The subset disturbance areas comprise varying degrees of physical disturbance along the transmission line alignment to reflect construction and operation requirements, specifically:

- Disturbance area A – assumed for complete removal of vegetation, including disturbance A (centreline)
- Disturbance area B – assumed to have no ground disturbance except in circumstances associated with achieving the operational requirements for vegetation maintenance to meet the vegetation clearance heights separated into two subcategories:
    - disturbance area B4 – assumed partial vegetation clearing is restricted to clearance of vegetation with potential growth heights above four metres in the inner maintenance zone
    - disturbance area B10 – assumed partial vegetation clearing is restricted to clearance of vegetation with potential growth heights above 10 metres in the outer maintenance zone.

The width of the disturbance areas A, B4 and B10 areas for transmission line components vary for the 330kV and 500kV transmission lines based on their vegetation clearing requirements and construction methodologies (refer to Figure 5-10 and Figure 5-11 in Chapter 5).

For impacts that could not be avoided, the assessment has considered:

- impacts due to the removal of native vegetation and habitat, including direct and indirect impacts on native vegetation and threatened flora
- the potential for serious and irreversible impacts on identified threatened species and ecological communities
- the prescribed impacts on biodiversity impacts under the BAM
- the potential for impacts on threatened species, ecological communities or their habitats listed under the FM Act and EPBC Act
- the potential for impacts to Groundwater Dependant Ecosystems (GDEs)
- the requirement for any offsets where impacts cannot be avoided or managed through mitigation measures, with offset obligations calculated using the Biodiversity Assessment Method Calculator (BAM-C).

9.3. Existing environment

9.3.1. Landscape context

The landscape features outlined below were used to inform the assessment of habitat suitability of the proposal study area for threatened species and the potential movement of species across the landscape. The proposal study area occurs within three broad IBRA bioregions in western NSW that are comprised of five IBRA subregions, being:

- Murray Darling Depression region
  - South Olary Plain subregion
- Riverina
  - Lachlan subregion
  - Murrumbidgee subregion
- NSW South Western Slopes region
  - Lower slopes subregion
  - Inland slopes subregion.

An overview of the broad IBRA bioregions and subregions is shown in Figure 9-1. Further detail on the IBRA bioregions and subregions is presented in Technical paper 1. A full set of detailed IBRA bioregions and subregions maps within the proposal study is provided in Appendix A-1 of Technical paper 1.

Key landscape features of the proposal study area and surrounds include:

- The Murrumbidgee River and a number of named and unnamed creeks occur in the proposal study area.

- No nationally or internationally important wetlands were recorded within the proposal study area. However, nearby wetlands include Lake Gol Gol (around 2.2 kilometres south west), Dry Lake (around 700 metres south), Lake Benanee (around 1.5 kilometres south), Waldaira Lake (around 1.5 kilometres south west), Lake Urana (around seven kilometres south/south west), Lake Yanga (around six kilometres north) and Lake Cullivel (around 300 metres north).

- There are large areas of connected native vegetation within the proposal study area, which connect to other key landscape features beyond the proposal study area, such as conservation areas (e.g. Mallee Cliffs National Park, Yanga State Conservation Area, Murrumbidgee Valley National Park, Cullivel State Forest, Brookong State Forest, and Yanga National Park (to the north of the proposal)). Fringing vegetation along rivers and creeks, such as Colombo Creek, the Murrumbidgee River, Yanco Creek, Bullenbong Creek, Burkes Creek, Brookong Creek, Boiling Down Creek, Crooked Creek and Sandy Creek, also provide connectivity within the broader landscape. A number of travelling stock reserves (TSRs) would also be intersected by the proposal which provide additional areas of existing vegetation connectivity across the alignment of the proposal (refer to Section 12.3.4 for details of these stock reserves).

- No areas of geological significance or soil hazard features that could impact biodiversity values were recorded within the proposal study area.

- No legislated areas of outstanding biodiversity values have been declared within the proposal study area.

- At the western end of the proposal study area the landscape is generally well connected in terms of habitat connectivity, being a mostly naturally vegetated open isolated part of NSW, albeit subjected to ongoing grazing and agricultural clearing impacts. The centre and eastern parts of the proposal study area have been more obviously impacted by clearing for agriculture, as the soils and rainfall patterns improve. This has impacted habitat connectivity to the point where in large portions of the proposal study area, only fragments of the original native vegetation and habitat remain.

An overview of the broad landscape features is shown in Figure 9-2. Further detail on the landscape features is presented in Technical paper 1. A full set of detailed landscape feature maps within the proposal study is provided in Appendix A-2 of Technical paper 1.

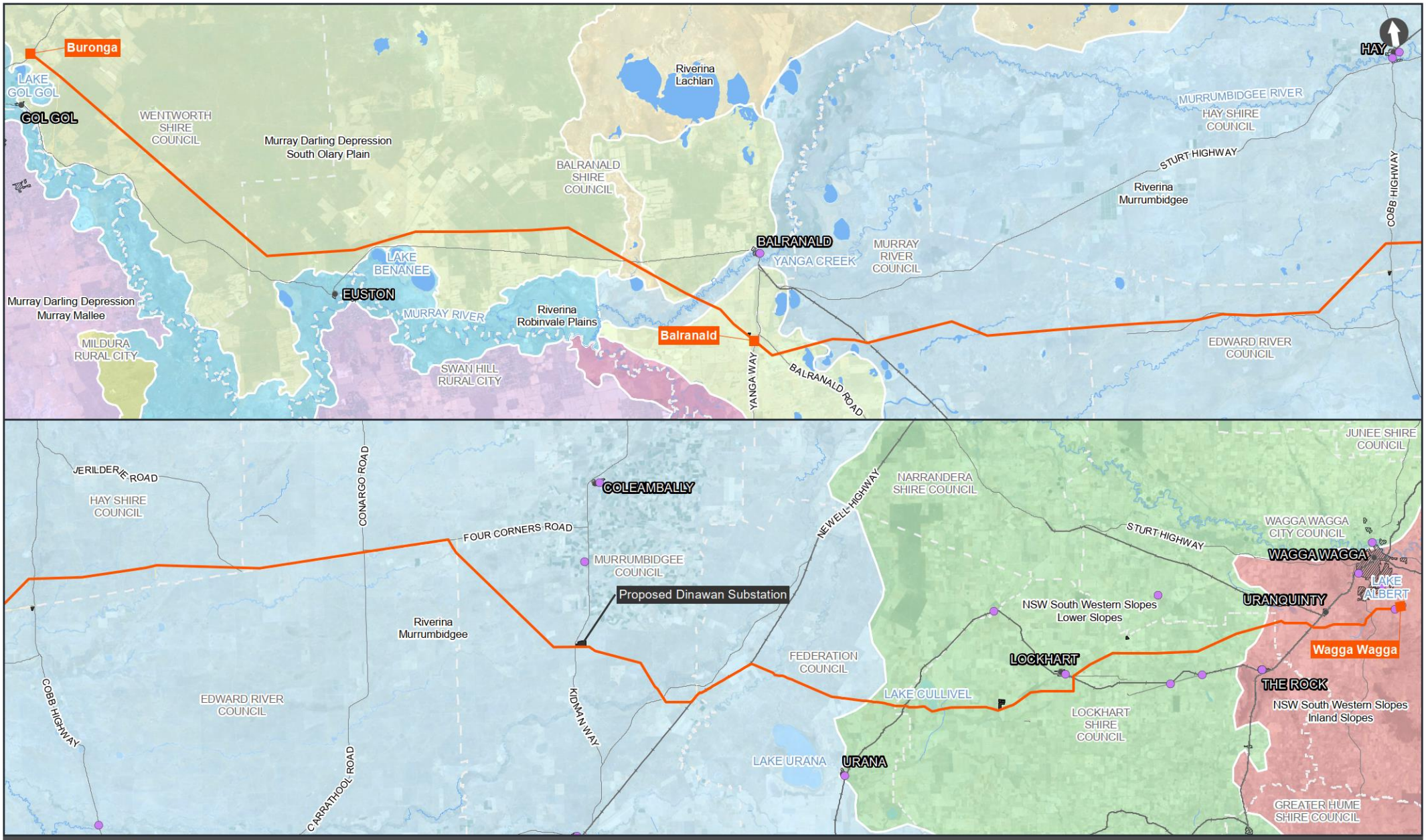

Figure 9-1

Overview of IBRA Regions and Subregions

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Existing Railway
- Local Government Areas
- Built Up Areas
- Waterbody

IBRA Regions and Subregions
- Murray Darling Depression - Lowan Mallee
- Murray Darling Depression - Murray Mallee
- Murray Darling Depression - South Olary Plain
- NSW South Western Slopes - Inland Slopes
- NSW South Western Slopes - Lower Slopes
- Riverina - Lachlan
- Riverina - Murray Fans
- Riverina - Murrumbidgee
- Riverina - Robinvale Plains

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Source: NSWSS, ESRI, Transgrid, WSP

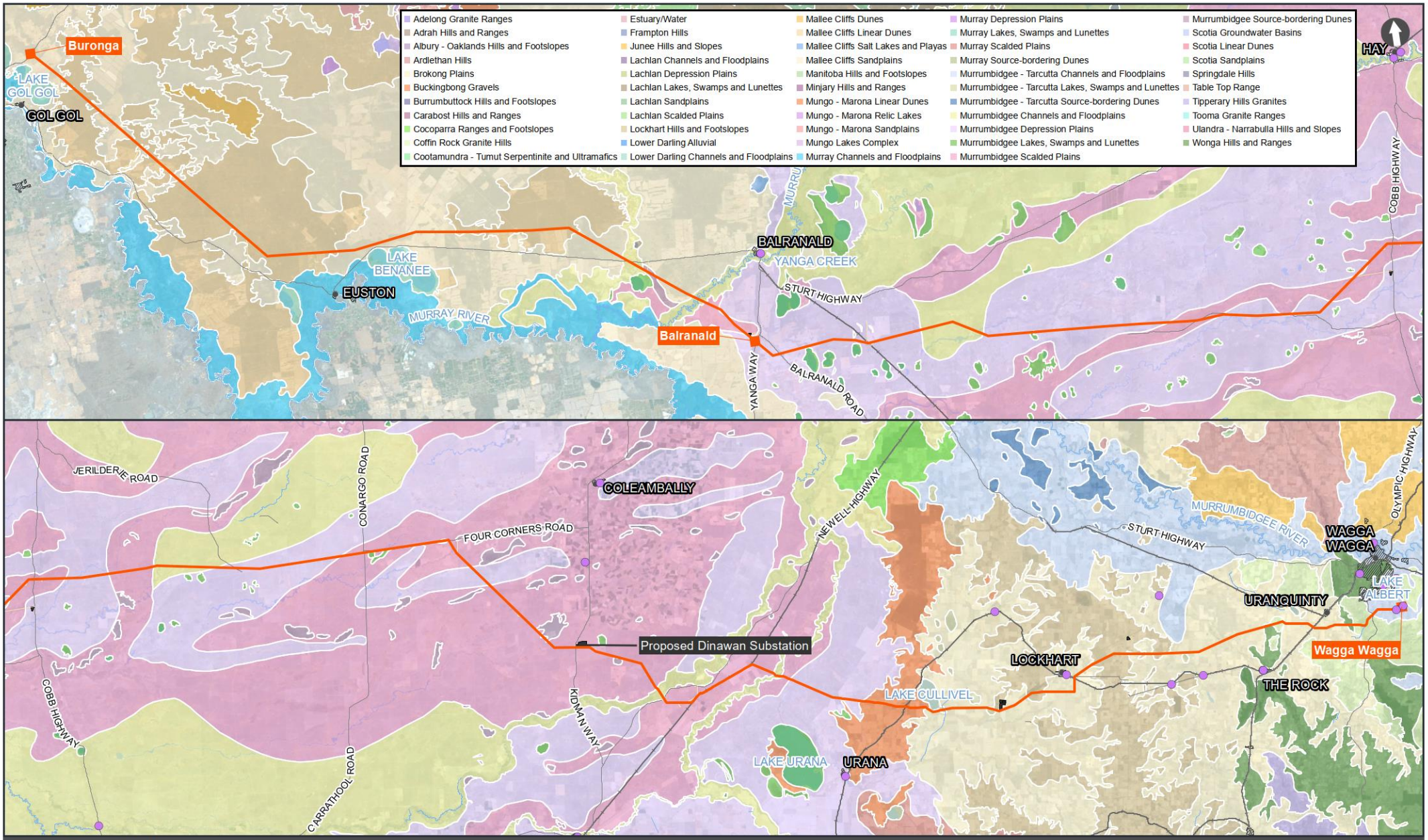

Figure 9-2

Overview of Landscape Features

Source: NSWSS, ESRI, Transgrid, WSP

9.3.2. Native and exotic vegetation

Within the South Olary Plain, Lachlan and Murrumbidgee subregions native vegetation generally exceeds 70 per cent native cover. While in the Lower Slopes and Inland Slopes subregions the effects of intensive agriculture combined with grazing (sometimes in drought conditions) has resulted in an overall landscape with native vegetation cover comprising 17 and eight per cent respectively. The native vegetation in this area is not high quality undisturbed native vegetation or habitat. The majority of the subregions containing disturbed intensive agriculture are considered to be cleared of native vegetation (for the purposes of LLS Act), and therefore were excluded from the BAM.

Native vegetation recorded within the indicative disturbance area is diverse and has been assigned to ten vegetation formations that occur within five IBRA subregions. The recorded vegetation formations are:

- Arid Shrublands (Acacia sub-formation)
- Arid Shrublands (Chenopod sub-formation)
- Dry Sclerophyll Forests (Shrubby sub-formation)
- Forested Wetlands
- Freshwater Wetlands
- Grasslands
- Grassy Woodlands
- Saline Wetlands
- Semi-arid Woodlands (Grassy sub-formation)
- Semi-arid Woodlands (Shrubby sub-formation).

Thirty-nine plant community types (PCTs) were identified in the proposal study area across the five IBRA subregions, including six threatened ecological communities under the BC Act and seven threatened ecological communities under the EPBC Act.

An overview of the native vegetation cover along the proposal study area is shown in Figure 9-3. Further detail on the native vegetation is presented in Technical paper 1. A full set of detailed PCT maps within the proposal study area refer to Appendix B-5 of Technical paper 1.

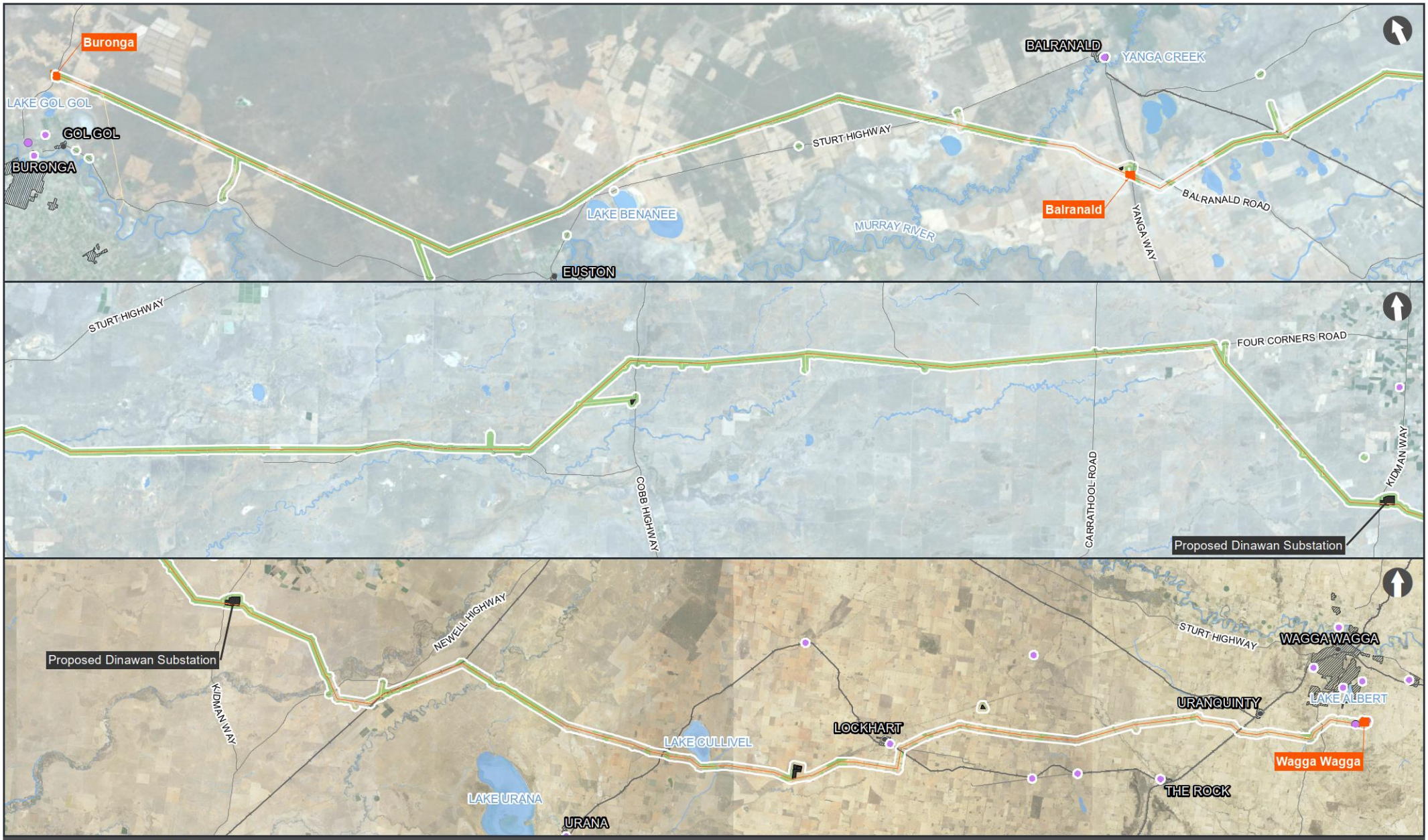

Figure 9-3

Overview of Native Vegetation Cover

Project Components

- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Existing Railway
- Built Up Areas
- Waterbody
- Disturbance Area Buffer
- Native Vegetation

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Source: NSWSS, ESRI, Transgrid, WSP

9.3.3. Habitat types

The seven habitat types, or habitat stratification units are:

- Arid woodland/shrublands
- Chenopod shrublands
- Grasslands
- Grassy woodlands
- Riverine
- Rocky woodlands
- Wetlands.

The Arid Woodland Shrublands habitat stratification unit is broadly associated with arid interior areas. This habitat stratification unit mostly occurs in the western part of the proposal study area between Buronga and Balranald. It is dominated primarily by Mallee vegetation. The Mallee is dominated by spinifex or chenopod understorey. Typically, it is highly or partially modified as a result of agricultural and grazing use, which relies on intensive grazing, especially in dry times. Due to its disturbed condition, while it still provides habitats for those fauna that primarily rely on tree canopies, those species that require complex shrub layer and groundcovers are less likely to be present. Tree hollows generally do not occur within this fauna stratification unit at a high density, even in the older Mallee areas as Mallee generally needs to be very old to form hollows.

The Chenopod Shrublands habitat stratification unit occurs in the arid and semi-arid interior parts of the proposal study area. They do not contain a dense or dominant tree canopy but are dominated by dense shrubs such as Dillon Bush, Cotton Bush and Saltbush. Like the other fauna habitat stratification units, these have generally also been impacted by agriculture and grazing, with few extensive areas of dense shrublands suitable for a diverse community of native fauna species to persist throughout this unit.

The Grasslands habitat stratification unit occurs south of Hay and represents the key home range of a critically endangered specialist grassland bird species, the Plains-wanderer. The Plains-wanderer is one of the most conservation significant bird species in Australia and has highly specific habitat preferences for grassland structure, due to their inability to navigate through dense grassland habitats. Where the construction impact area traverses the plains south of Hay, several landholders have adopted grazing regimes in liaison with recovery officers to manage pasture for Plains-wanderers. Much of the open grassy areas have remnants of Weeping Myall stands, providing open woodland habitats for woodland birds and supporting mistletoe communities for mistletoe foraging birds, such as Superb Parrot and Painted Honeyeaters.

The Grassy Woodlands habitat stratification unit occurs throughout the eastern portion of the proposal study area with patches of State forests east of the Hay Plains at Cullivel State Forest and Brookong State Forest with agricultural land-uses, largely cropping and grazing dominating the landscape east of Lockhart. Vegetation is largely dominated by box/gum woodland communities, interspersed by riparian habitats along water courses. Box/gum woodland communities are the most evident native vegetation throughout the region east to Uranquinty with occasional patches of White Cypress Pine (*Callitris glaucophylla*). While there are a number of threatened species that continue to use these patches where strata complexity is sufficient, such as Superb Parrot and Squirrel Glider, many other threatened species which use box/gum woodlands are absent or very sparsely distributed due to the paucity of cover, general degradation of the communities in terms of plant diversity – particularly understorey strata, dominance of adjacent open country fauna and limited connectivity for establishing territories.

The Riverine habitat type is broadly associated with riverine environments. These are dominated by Black Box and River Red Gum woodlands and forests. The vast majority of this fauna habitat stratification unit occurs in association with the Great Darling Anabranch, the Darling River and the Murray River. It is highly modified, mostly consisting of a tree canopy layer with generally a highly disturbed understorey and groundcover, owing to the historical agricultural and grazing use for over 140 years. The association with the permanent or semi-permanent rivers still lends this stratification unit regional importance as it is a habitat that provides water within an arid or semi-arid landscape. Tree hollows occur within older River Red Gums and Black Box and these are an important nesting resource for species such as parrots, microchiropteran bats, arboreal fauna and reptiles.

The rocky woodlands habitat stratification unit occurs east of Uranquinty and the foothills surrounding Wagga Wagga. The rocky geology influences variation in the vegetation community and contains larger areas of retained woodland habitats. While the construction impact area occurs at the edges of woodland patches, the presence of relatively large patches gives opportunities for the smaller threatened woodland birds and the rocky substrates offer niches for small reptile species inhabiting the ranges further east.

The wetland habitat stratification unit is very small, and only small areas would be directly impacted by construction. Although wetland habitats directly associated with the proposal study area are relatively sparse there are wetlands habitats in the regions through which the proposal study area traverses. These areas can be important within the arid and semi-arid region by providing a water source and in particularly providing habitat for amphibians, waterfowl and other birds in wet times.

9.3.4. Threatened ecological communities

A total of six threatened ecological communities listed under the BC Act were recorded within the proposal study area. These were:

- *Acacia melvillei* shrubland in the Riverina and Murray-Darling Depression bioregion – listed as endangered under the BC Act
- *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression bioregions – listed as endangered under the BC Act
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South bioregions – listed as endangered under the BC Act
- Myall woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions – listed as endangered under the BC Act
- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions – listed as endangered under the BC Act
- White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland – listed as critically endangered under the BC Act.

A total of seven threatened ecological communities listed under the EPBC Act were recorded within the proposal study area. These were:

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions – listed as endangered under the EPBC Act
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia – listed as endangered under the EPBC Act
- Natural Grasslands of the Murray Valley Plains – listed as critically endangered under the EPBC Act

- Plains mallee box woodland of the Murray Darling Depression, Riverina and Naracoorte Coastal Plains bioregions – listed as endangered under the EPBC Act
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains – listed as critically endangered under the EPBC Act
- Weeping Myall Woodlands – listed as endangered under the EPBC Act
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – listed as critically endangered under the EPBC Act.

9.3.5. Threatened flora species

A total of forty-five candidate threatened flora species were considered to have potential habitat associated within the proposal study area, twenty listed as vulnerable, twenty-one listed as endangered and three listed as critically endangered under the BC Act. Of these, nine threatened flora species were recorded on field surveys. These were:

- Mossgiel Daisy (*Brachyscome papillosa*) – listed as vulnerable under the BC Act
- Winged Pepper-cress (*Lepidium monoplocoides*) – listed as endangered under the BC Act
- Lanky Buttons (*Leptorhynchos orientalis*) – listed as endangered under the BC Act
- Chariot Wheels (*Maireana cheelii*) – listed as vulnerable under the BC Act
- Austral Pillwort (*Pilularia novae-hollandiae*) – listed as endangered (SAII) under the BC Act
- Thyme Rice-Flower (*Pimelea serpyllifolia*) – listed as endangered (SAII) under the BC Act
- Bitter Quandong (*Santalum murrayanum*) – listed as endangered under the BC Act
- Slender Darling Pea (*Swainsona murrayana*) – listed as vulnerable under the BC Act
- Silky Swainson-pea (*Swainsona sericea*) – listed as vulnerable under the BC Act.

Of the nine recorded threatened flora species, eight are considered affected by the proposal. Impacts to Bitter Quandong (*Santalum murrayanum*) have been avoided and the species would not be impacted by the proposal. Due to limitations in the seasonal surveys, one further species has been assumed to be present and considered to be affected by the proposal, Small Scurf-pea (*Cullen parvum*), listed as endangered under the BC Act.

There is predicted habitat within the proposal study area for 36 threatened flora species listed under the EPBC Act. Of the 36 threatened flora species, 20 have been identified to have a moderate likelihood of occurrence and were the subject of targeted surveys. Of these, four threatened flora species were recorded. These are:

- Mossgiel Daisy (*Brachyscome papillosa*) – listed as vulnerable under the EPBC Act
- Winged Pepper-cress (*Lepidium monoplocoides*) – listed as endangered under the EPBC Act
- Chariot Wheels (*Maireana cheelii*) – listed as vulnerable under the EPBC Act
- Slender Darling Pea (*Swainsona murrayana*) – listed as vulnerable under the EPBC Act.

An overview of the identified threatened flora species is shown on Figure 9-4. Further detail on the impacts to threatened flora species is presented in Technical paper 1. A full set of detailed threatened flora species maps within the proposal study is provided in Appendix C-7 of Technical paper 1.

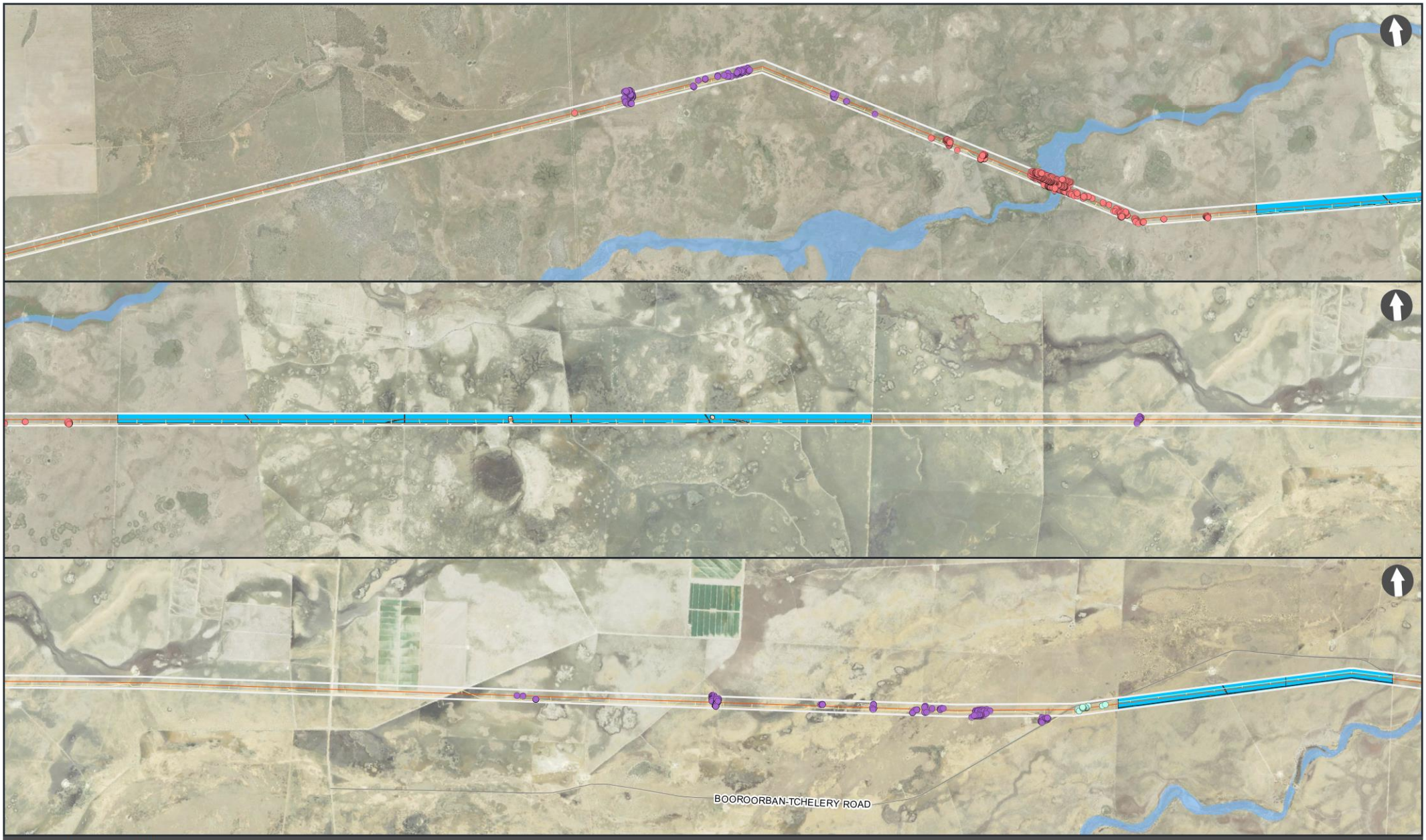

Figure 9-4

Overview of threatened flora species

Sheet 1 of 4

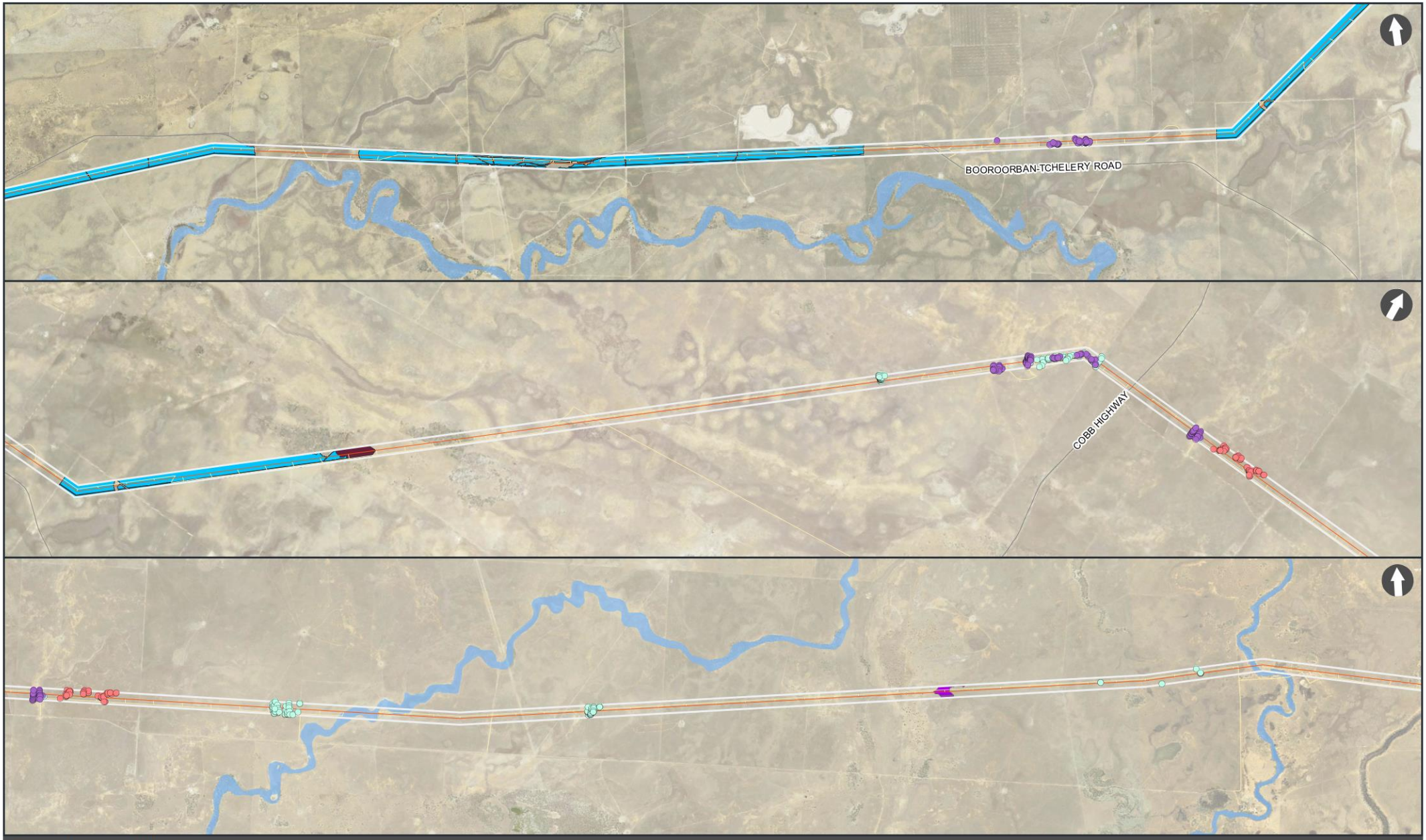

Figure 9-4

Overview of threatened flora species

Sheet 2 of 4

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accommodation Sites
- Water Supply Point
- Existing Substation
- Existing Railway
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Brachyscome papillosa*
- *Maeriana cheelii*
- *Swainsona murrayana*

Threatened Flora Species Polygons
- *Brachyscome papillosa*
- *Maeriana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Cullen parvum*
- *Maireana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

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Source: NSWSS, ESRI, Transgrid, WSP

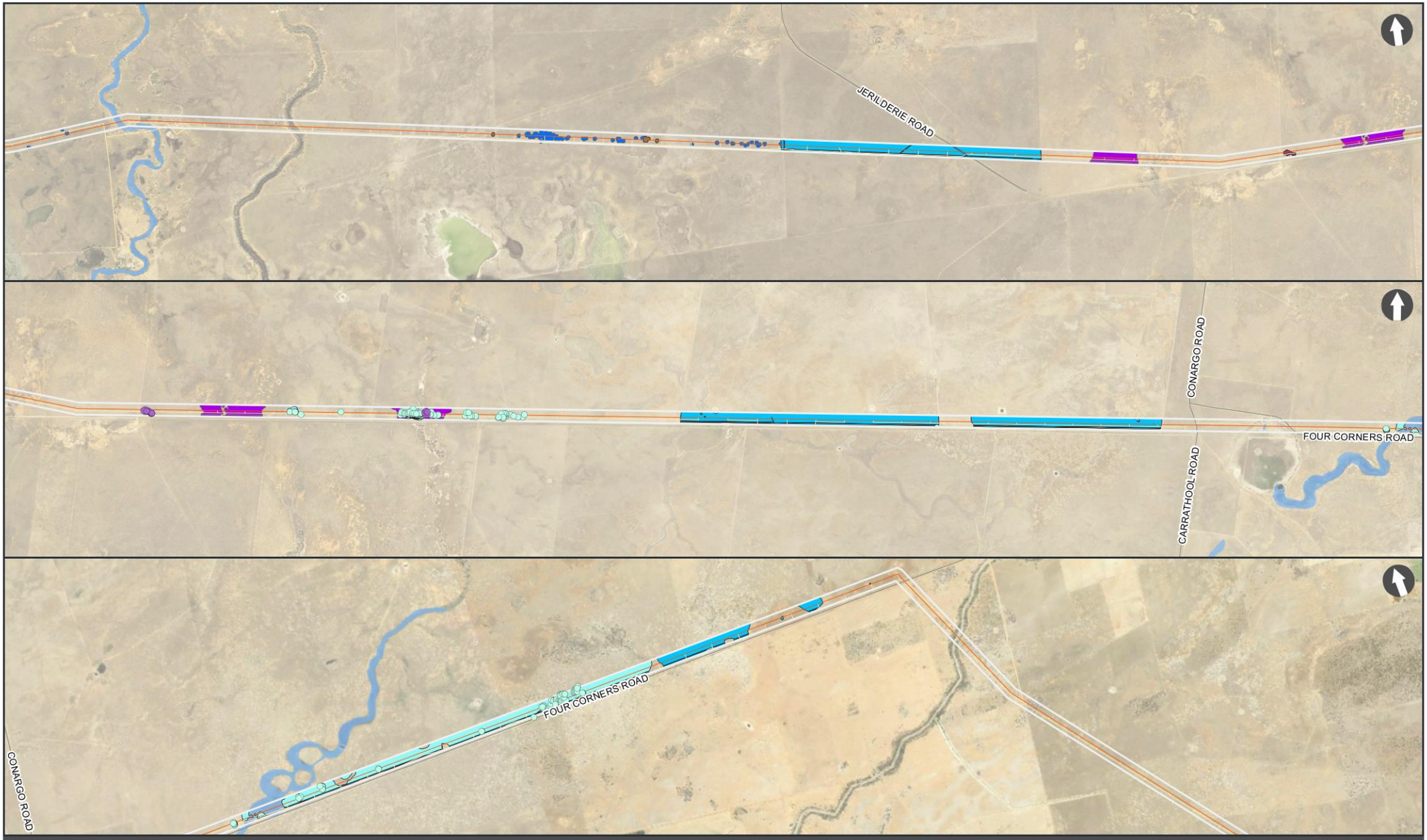

Figure 9-4

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accommodation Sites
- Water Supply Point
- Existing Substation
- Existing Railway
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Maeriana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

Threatened Flora Species Polygons
- *Maeriana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Cullen parvum*
- *Maireana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

Overview of threatened flora species

Sheet 3 of 4

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Source: NSWSS, ESRI, Transgrid, WSP

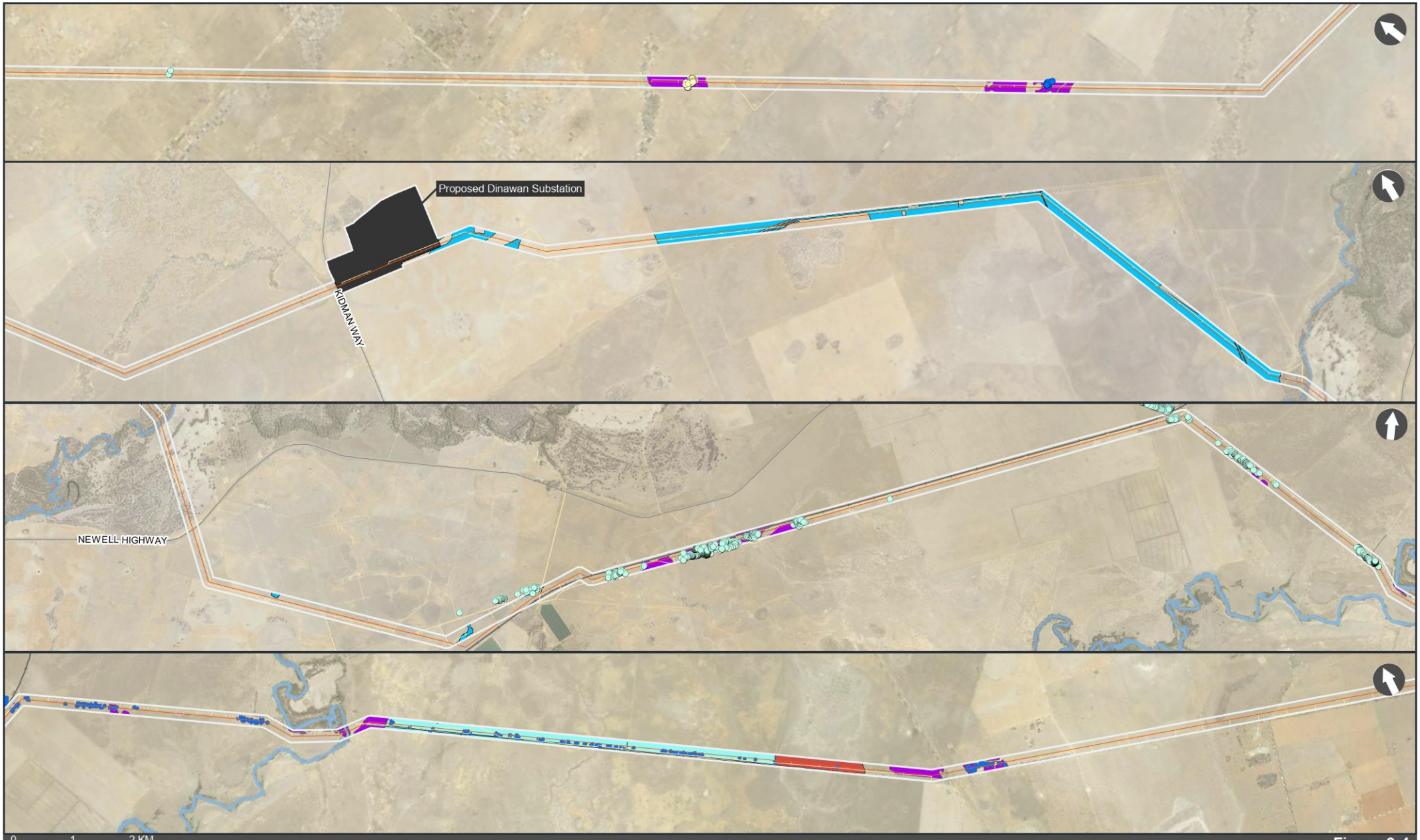

Figure 9-4

Overview of threatened flora species

Sheet 4 of 4

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accommodation
- Water Supply Point
- Existing Substation
- Existing Railway
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Brachyscome papillosa*
- *Leptorhynchos orientalis*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Cullen parvum*
- *Leptorhynchos orientalis*
- *Maireana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

Threatened Flora Species Polygons
- *Brachyscome papillosa*
- *Leptorhynchos orientalis*
- *Swainsona murrayana*
- *Swainsona sericea*

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Source: NSWSS, ESRI, Transgrid, WSP

9.3.6. Threatened fauna species

Eighty-one threatened fauna species listed under the BC Act and/or the EPBC Act were identified as having a potential for occurrence within the proposal study area given the presence of suitable habitat and are classified as ecosystem credit species. Forty-four of these species were considered to have associated habitat within the proposal area and were the subject of targeted field surveys.

An overview of the identified threatened fauna species is shown on Figure 9-5. Further detail on the impacts to threatened fauna species is presented in Technical paper 1. A full set of detailed threatened fauna species maps within the proposal study is provided in Appendix C-8 of Technical paper 1.

Of these, six candidate species that generate specific credits are considered affected by the proposal, being:

- Southern Myotis (*Myotis macropus*) – listed as vulnerable under the BC Act
- Plains-wanderer (*Pedionomus torquatus*) – listed as endangered under the BC Act and EPBC Act
- Squirrel Glider (*Petaurus norfolcensis*) – listed as vulnerable under the BC Act.
- Regent Parrot (eastern subspecies) (*Polytelis anthopeplus monarchoides*) – listed as endangered under the BC Act
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) – listed as vulnerable under the BC Act
- Superb Parrot (*Polytelis swainsonii*) – listed as vulnerable under the BC Act.

Four EPBC Act-listed threatened fauna species were considered to be affected by the proposal, being:

- Corbens's Long-eared Bat (*Nyctophilus corbeni*) – Vulnerable under the EPBC Act
- Plains Wanderer (*Pedionomus torquatus*) – Critically Endangered under the EPBC Act (refer to Figure 9-6 for an overview of existing Plains Wanderer habitat mapping)
- Regent Parrot (eastern subspecies) (*Polytelis anthopeplus monarchoides*) – Vulnerable under the EPBC Act
- Superb Parrot (*Polytelis swainsonii*) – Vulnerable under the EPBC Act.

Other ecosystem credit threatened fauna species listed under the BC Act and recorded (and to be offset via ecosystem credit requirements) were:

- Black Falcon (*Falco subniger*) – Vulnerable
- Brolga (*Grus rubicunda*) – Vulnerable
- Bolam's Mouse (*Pseudomys bolami*) – Endangered
- Chestnut Quail-thrush (*Cinclosoma castanotum*) – Vulnerable
- Corbens's Long-eared Bat (*Nyctophilus corbeni*) – Vulnerable
- Diamond Firetail (*Stagonopleura guttata*) – Vulnerable
- Dusky Woodswallow (*Artamus cyanopterus*) – Vulnerable
- Gilbert's Whistler (*Pachycephala inornata*) – Vulnerable
- Hooded Robin (Melanodryas cucullata cucullata) – Vulnerable
- Inland forest bat (*Vespadelus baverstocki*) – Vulnerable
- Little Eagle (*Hieraaetus morphnoides*) – Vulnerable
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) – Vulnerable
- Mallee Worm-lizard (*Aprasia inaurita*) – Endangered
- Purple-crowned Lorikeet (*Glossopsitta porphyrocephala*) – Vulnerable
- Spotted Harrier (*Circus assimilis*) – Vulnerable.

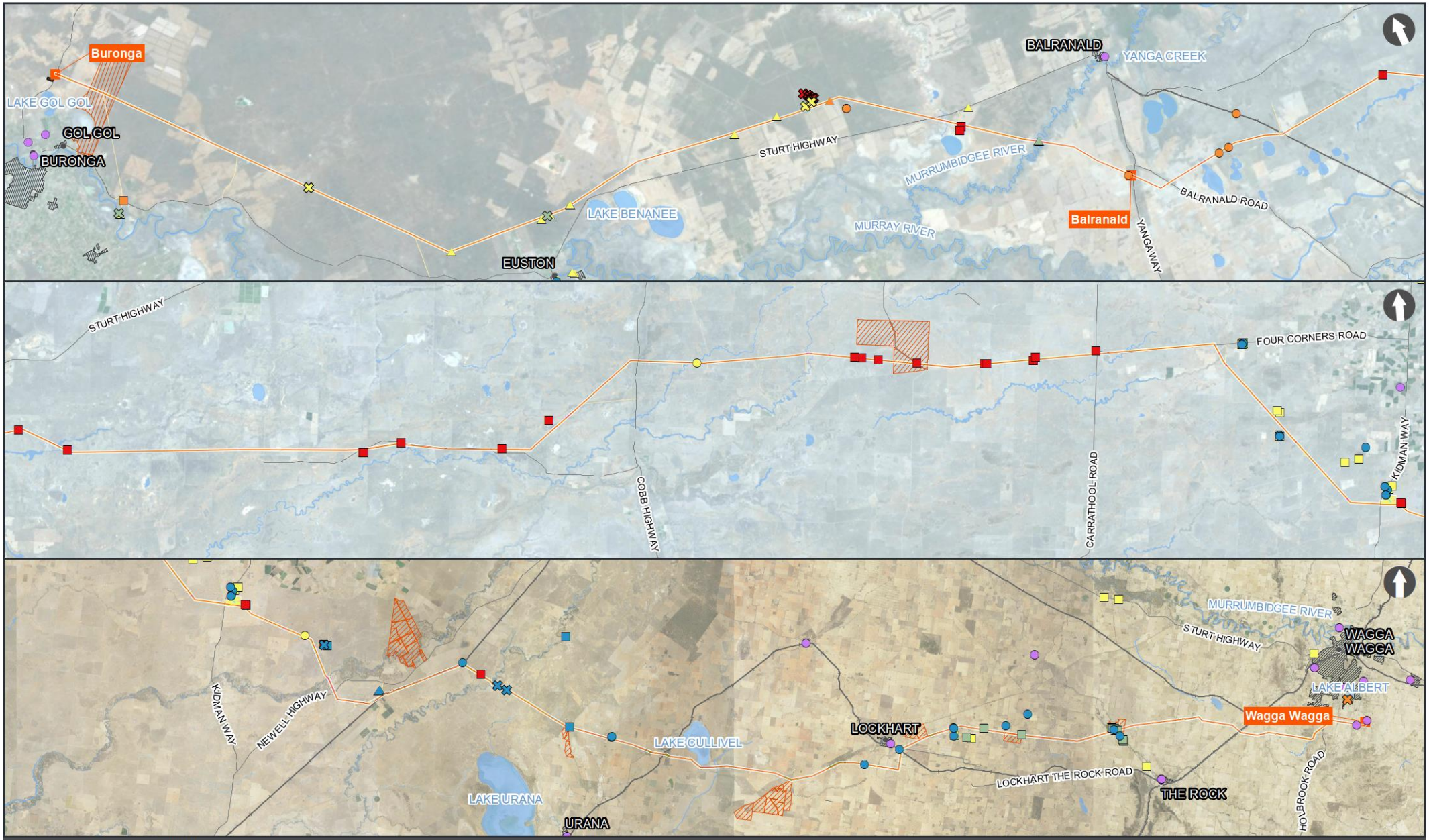

Figure 9-5

Overview of Identified Threatened Fauna Species and Fauna Stratification

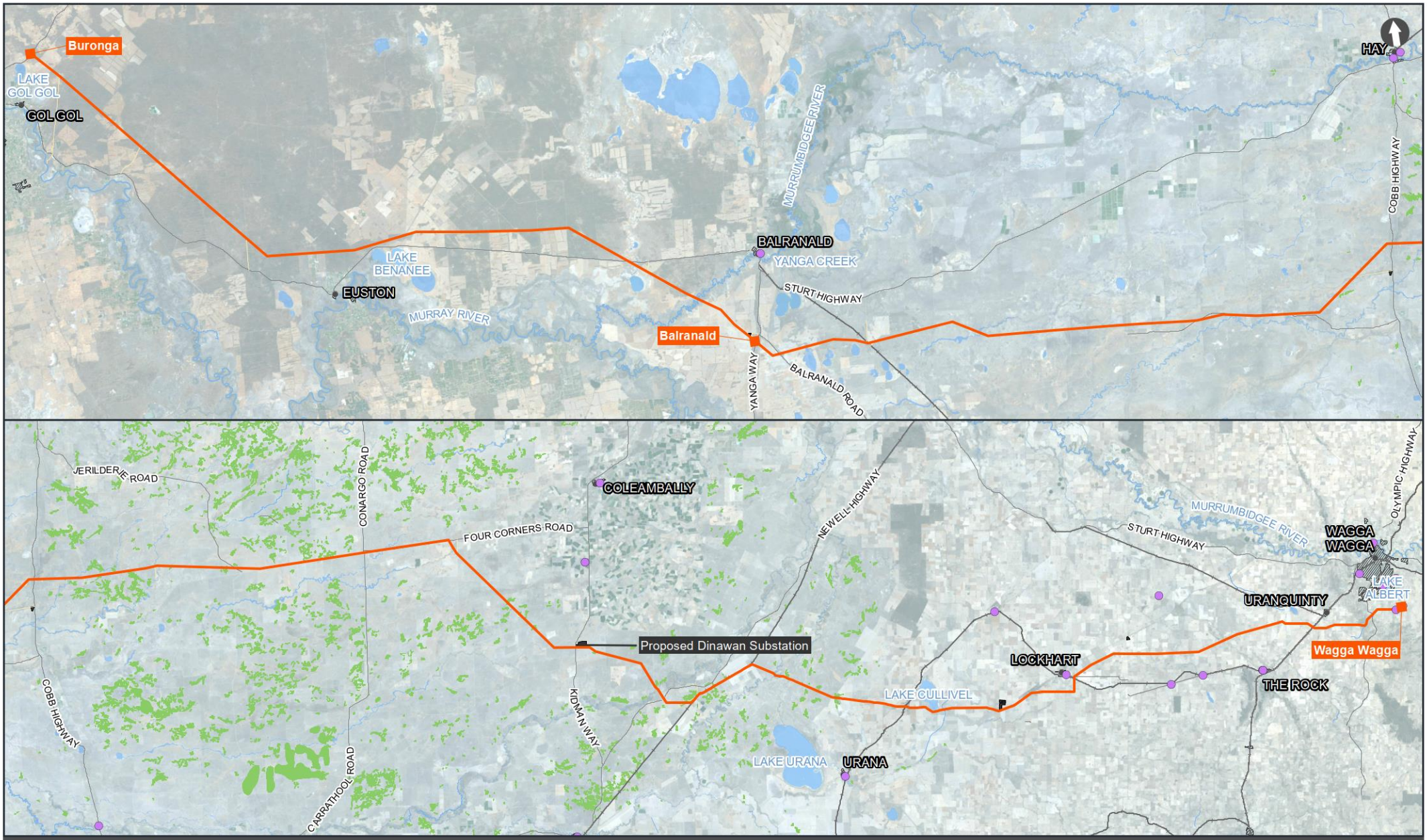

Figure 9-6

Plains Wanderer Habitat Mapping

Project Components

- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Existing Railway
- Built Up Areas
- Waterbody
- Plains Wanderer Important Habitat

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Source: NSWSS, ESRI, Transgrid, WSP

Four threatened fauna species were also conservatively considered to be potentially indirectly impacted by line strike and electric and magnetic fields, being:

- Little Eagle (*Hieraaetus morphnoides*) – listed as vulnerable under the BC Act
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) – listed as vulnerable under the BC Act
- Regent Parrot (eastern subspecies) (*Polytelis anthopeplus monarchoides*) – listed as endangered under the BC Act and vulnerable under the EPBC Act
- Superb Parrot (*Polytelis swainsonii*) – listed as vulnerable under the BC Act and vulnerable under the EPBC Act.

9.3.7. Migratory species

Nineteen migratory species listed under the EPBC Act were predicted or are known to occur within the proposal locality. An additional seventeen migratory species listed under the EPBC Act are considered to have a moderate to high likelihood of occurrences within, or adjacent to, the proposal study area. Twenty-nine marine bird species may occur in habitats on occasion within the proposal study area.

It is important to note that listed marine bird species under the EPBC Act are only afforded protection in Commonwealth Marine areas, not within state or territory waters such as those within the vicinity of the proposal study area.

9.3.8. Aquatic species

Within the proposal study area, threatened aquatic habitat occurs in the form of fresh and saline wetlands, rivers and creeks that contain mapped key fish habitats (Strahler 4th and 5th order streams) and other open water bodies such as agricultural dams, irrigation canals, road table drains and low depressions that periodically pond water.

Areas of mapped key fish habitat have been considered to provide moderate likelihood of occurrence for four threatened species:

- Murray Hardyhead (*Craterocephalus fluviatilis*) listed as critically endangered under the FM Act
- Silver Perch (*Bidyanus bidyanus*) listed as vulnerable under the FM Act
- Flathead Galaxais (*Galaxais rostratus*) listed as critically endangered under the FM Act
- Macquarie Perch (*Macquaria australasica*) listed as endangered under the FM Act.

One endangered ecological community (EEC) listed under the FM Act has potential to occur within the proposal study area:

- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Murray River Lowland.

9.3.9. Groundwater dependent ecosystems

At the time of writing, no public information on the location of high priority groundwater dependent ecosystems (GDEs) was available for water sharing plans that are applicable to groundwater sources within the proposal study area. No high priority GDEs were documented in historical water sharing plans that were superseded on 1 July 2020.

A search of the National Groundwater Information System (NGIS) (BOM, 2020) identified seventeen GDEs, seven aquatic and ten terrestrial, with high potential for groundwater interaction within the proposal study area.

The proposal overlies the following three defined groundwater hydrostratigraphic units (groundwater systems):

- Murrumbidgee Alluvium groundwater system – associated with one aquatic and six terrestrial GDEs in the proposal study area.
- Porous rock ground water system – connected to three terrestrial GDEs in the proposal study area.
- Lachlan fractured rock groundwater system – connected to seven aquatic and one terrestrial GDE in the proposal study area.

9.3.10. Wetlands of national and international importance

No nationally important wetlands occur within the proposal study area. The closest nationally important wetlands are:

- Tala Lake and Yanga Lake, near Balranald (around six kilometres from the alignment)
- Black Swamp and Coopers Swamp, near Wanganella.

No RAMSAR wetlands or Wetlands of International importance are within 10 kilometres of the proposal study area. The proposal design and proposed mitigation measures would minimise potential indirect downstream impacts.

9.4. Potential impacts – construction

This section presents the potential impacts of the proposal on biodiversity during construction which have not been avoided through design development to date. Impacts that have been avoided through design are detailed in Chapter 4 of the EIS and Section 8 of Technical paper 1.

The main impacts on biodiversity during construction would be:

- direct impacts:
  - clearing of native vegetation
  - removal of threatened species and/or their habitat
- indirect impacts.

9.4.1. Direct impacts

9.4.1.1. Direct impacts to native vegetation

Around 1,555 hectares of native vegetation, consisting of 39 PCTs, would be directly impacted by the proposal, based on the disturbance area and results of field surveys completed to date. Around 445 hectares of the 1,555 hectares would not be completely modified within the easement due to vegetation with growth heights under four metres and ten metres being retained (being vegetation within disturbance areas B4 and B10, respectively).

As outlined previously, much of this native vegetation has been subject to ongoing historical agricultural use, primarily for grazing and the effects of semi-regular clearing combined with this grazing (sometimes in drought conditions) has resulted in an overall landscape that while is partially comprised of native vegetation is not high quality undisturbed native vegetation or habitat.

As discussed in Section 9.2.2, the assessment considers the construction impact area which has been refined into disturbance area A (including disturbance area A (Centreline) during construction) and disturbance area B (areas B4 and B10), which is a conservative estimate of the area subject to direct impacts. Opportunities to further reduce the impacts to native vegetation would be considered during refinement of the proposal design and construction methodology.

9.4.1.2. Direct impacts to threatened ecological communities

A total of six threatened ecological communities listed under the BC Act are considered affected by the proposal comprising up to 204.11 hectares of threatened ecological communities. These include impacts to:

- 5.18 hectares of *Acacia melvillei* shrubland (endangered)
- 2.93 hectares of *Allocasuarina luehmannii* woodland (endangered)
- 26.95 hectares of Inland Grey Box Woodland (endangered)
- 101.21 hectares of Myall woodland (endangered)
- 31.99 hectares of Sandhill Pine Woodland (endangered)
- 41.44 hectares of White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland (critically endangered).

Two of the threatened ecological communities are listed as serious and irreversible impacts (SAIIs) in the Threatened Biodiversity Data Collection, refer to Section 9.4.4. These include:

- White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland
- Sandhill Pine Woodland.

The proposal would have an impact on seven threatened ecological communities listed under the EPBC Act. These include impacts to:

- 2.93 hectares of Buloke Woodlands (endangered)
- 15.41 hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (endangered)
- 72.51 hectares of Natural Grasslands of the Murray Valley Plains (critically endangered)
- 5.98 hectares of Plains mallee box woodland (endangered)

- 3.01 hectares of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (critically endangered)
- 101.21 hectares of Weeping Myall Woodlands (endangered)
- 35.45 hectares of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (critically endangered).

Residual impacts to the following four TECs based on the current disturbance area are identified as potentially significant:

- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia – The direct impacts of the proposal on Grey Box Grassy Woodlands includes removal of around 15.41 hectares of habitat. Around 28,700 hectares of the current extent is estimated within reserves (DEWHA 2010).

- Natural Grasslands of the Murray Valley Plains – The direct impacts of the proposal on Natural Grasslands of the Murray Valley Plains includes removal of around 72.51 hectares of habitat. Around 65,151 hectares of this TEC is estimated to occur (DEACCW 2010).

- Weeping Myall Woodlands – The direct impacts of the proposal on Weeping Myall Woodland includes removal of around 101.2 hectares of habitat. The area of potential impact for Weeping Myall Woodland is mapped in Appendix D-2 of Technical paper 1. Around 220,000 to 361,000 hectares of this TEC is estimated to occur (TSSC 2009).

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – The direct impacts of the proposal on Box-Gum Grassy Woodland include removal of around 35.45 hectares of habitat. A total of around 416,326 hectares of this TEC is estimated to occur (DEACCW 2010).

9.4.1.3. Direct impacts to threatened flora species

A total of seven threatened flora species listed under the BC Act would be impacted by the proposal with impacts to:

- 71.17 hectares of Mossgiel Daisy (*Brachyscome papillosa*) known and assumed habitat (vulnerable)
- 7.0 hectares of Winged Pepper-cress (*Lepidium monoplocoides*) known and assumed habitat (endangered)
- 15.32 hectares of Lanky Buttons (*Leptorhynchos orientalis*) known and assumed habitat (endangered)
- 109.68 hectares of Chariot Wheels (*Maireana cheelii*) known and assumed habitat (vulnerable)
- 8.62 hectares of Austral Pillwort (*Pilularia novae-hollandiae*) known and assumed habitat (endangered (SAII))
- 1.7 hectares of Thyme Rice-Flower (*Pimelea serpyllifolia*) known habitat (endangered (SAII))
- 232.35.44 hectares of Slender Darling Pea (*Swainsona murrayana*) known and assumed habitat (vulnerable)
- 109.17 hectares of Silky Swainson-pea (*Swainsona sericea*) known and assumed habitat (vulnerable).

Two of the threatened flora species, *Pilularia novae-hollandiae* and *Pimelea serpyllifolia* subsp. *serpyllifolia* are listed as serious and irreversible impacts (SAIIs) in the Threatened Biodiversity Data Collection, refer to Section 9.4.4. Field surveys identified four individuals of Bitter Quandong (*Santalum murrayanum*) within the proposal study area that would not be impacted by the proposal.

A total of four threatened flora species listed under the EPBC Act would be impacted by the proposal with impacts to:

- 63.04 hectares of known and assumed habitat for Mossgiel Daisy (*Brachyscome papillosa*) (vulnerable)
- 7.0 hectares of known and assumed habitat for Winged Pepper-cress (*Lepidium monoplocoides*) (endangered)
- 109.68 hectares of known and assumed habitat for Chariot Wheels (*Maireana cheelii*) (vulnerable)
- 232.35 hectares of known and assumed habitat for Slender Darling Pea (*Swainsona murrayana*) (vulnerable).

Impacts to the following three threatened flora species based on the current disturbance area are identified as potentially significant:

- Mossgiel Daisy – *Brachyscome papillosa* –Habitat impacts associated with the proposal would total 71.17 hectares and given the disjunct nature of known patches, it is possible such impacts could cause the species to have some decline. As a precautionary measure, there is moderate likelihood that the proposed action may modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
- Chariot Wheels – *Maireana cheelii* –Habitat impacts associated with the proposal would total around 109.68 hectares and given the disjunct nature of known patches, it is difficult to discern if such impacts would cause the species to decline. As a precautionary measure, there is moderate likelihood that the proposed action may modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. refinement.
- Slender Darling Pea – *Swainsona murrayana* – Habitat impacts associated with the proposal would total 232.35 hectares and given the disjunct nature of known patches, it is difficult to discern if such impacts would cause the species to decline in the broader landscape. As a precautionary measure, there is moderate likelihood that the proposed action may modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
- For each of these threatened flora species recorded individuals or populations of this species within the construction impact area, would be avoided and or impacts minimised as far as practicable during design and construction methodology refinement.

9.4.1.4. Direct impacts to threatened fauna species

A total of six threatened fauna species listed under the BC Act as species credit species would be impacted by the proposal with impacts to:

- 32.36 hectares of habitat for *Lophochroa leadbeateri* (Major Mitchell's Cockatoo) – listed as vulnerable under the BC Act
- 4.77 hectares of habitat for *Myotis macropus* (Southern Myotis) – listed as vulnerable under the BC Act
- 0.41 hectares of habitat for *Pedionomus torquatus* (Plains-wanderer) - listed as endangered under the BC Act and EPBC Act
- 52.70 hectares of habitat for *Petaurus norfolcensis* (Squirrel Glider) - listed as vulnerable under the BC Act
- 32.36 hectares of habitat for *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subspecies)) – listed as Endangered under the BC Act
- 36.57 hectares of habitat for *Polytelis swainsonii* (Superb Parrot)).

The recorded ecosystem credit species would be offset via the ecosystem credit offset outcomes.

The Plains-wanderer is listed as serious and irreversible impacts (SAII) in the Threatened Biodiversity Data Collection, refer to Section 9.4.4.

A total of four threatened fauna species also listed under the EPBC Act would be impacted by the proposal with impacts to:

- 605.62 hectares of habitat for Corbens's Long-eared Bat (*Nyctophilus corbeni*) (vulnerable)
- 0.41 hectares of habitat for Plains Wanderer (*Pedionomus torquatus*) (critically endangered)
- 32.36 hectares of habitat for Regent Parrot (eastern subspecies) (*Polytelis anthopeplus monarchoides*) (vulnerable)
- 36.57 hectares of habitat for Superb Parrot (*Polytelis swainsonii*) (vulnerable).

None of these impacts are identified as being potentially significant.

9.4.2. Indirect impacts

Indirect impacts on native vegetation are considered unlikely due to the retention of shrub and ground stratum native vegetation to a height of between four and 10 metres reducing direct permanent loss across the broader easement (i.e. disturbance area B). Indirect impacts have been considered in terms of the nature, extent and duration of impacts on native vegetation, threatened ecological communities and threatened species habitats likely to be affected and is presented in Table 9-2.

Table 9-2 Summary of indirect impacts during construction

Indirect impact	Discussion	Consequence
Inadvertent impacts on adjacent habitat or vegetation	Construction activities have the potential to disturb soils and result in erosion, mobilisation and sedimentation of contaminants, which could impact adjoining native vegetation and aquatic habitats (if not properly managed), particularly where works are in proximity to rivers, creek lines and key fish habitats. These impacts have the potential to reduce the viability of habitat for aquatic and semi aquatic species temporarily. Any impacts would be of short-term duration. The proposal would minimise impacts to these sensitive environmental receivers by targeting narrow crossing points of the waterways and flood out areas (and their associated riparian habitats e.g. around the Murrumbidgee River, Yanco Creek and Colombo Creek). The mobilisation of sediments would be contained within the disturbance area as sediment containment measures would be implemented as part of mitigation measures (refer to Section 9.7).	Low

Indirect impact	Discussion	Consequence
Reduced viability of adjacent habitat due to edge effects	Fragmentation would be minimised where possible by utilising existing easements and areas of prior disturbance. Removal of vegetation would have a long-term impact however, indirect impacts on native vegetation and adjacent habitats are considered unlikely due to shrub and ground stratum native vegetation retention to a height of 4 and 10 m growth height in areas buffering direct permanent loss (disturbance area B). Retained native vegetation within these areas would provide a buffer to permanent impact areas such as transmission towers and access tracks. Impacts from the main construction compound and accommodation camp sites, and substation works would be comparatively minor at a local and regional scale.	Negligible
Reduced viability of adjacent habitat due to noise, dust or light spill	Noise, dust and light spill during construction would be short term and would unlikely have long term adverse impacts on the viability of adjacent habitats.	Negligible
Transport of weeds and pathogens from the site to adjacent vegetation	Any potential impacts would be long term, as it would lead to a reduction in vegetation integrity. However, biosecurity measures would be implemented to ensure risks are managed.	Negligible
Increased risk of starvation, exposure and loss of shade or shelter	Displacement of fauna species during clearing is considered relatively low due to the modified vegetation structure, and of short-term duration. Increased risk due to starvation, exposure and loss of shade and shelter is considered low given the linear nature of the proposal and mostly highly mobile nature of most potential resident fauna species. Any impacts would be of short-term duration.	Low to Moderate
Loss of breeding habitats	The loss of breeding habitat such as hollow-bearing trees, old growth bull mallee lignotubers, Triodia grass clumps and fallen timber would be long term and has the potential to affect native animals. The loss of habitat is unlikely to extend beyond the indicative disturbance area. Impacts beyond this area would be avoided through mitigation and management measures.	Moderate
Trampling of threatened flora species	Impacts could occur in areas not directly impacted by clearing, if not properly managed, and would be of short-term duration. Mitigation measures, such as through the delineation of no-go areas, would manage this risk.	Low
Increased risk of fire	Construction works may increase bushfire risk, if not properly managed. However, a Bushfire Risk Management Sub-Plan will be implemented to ensue any bushfire risk is managed during construction.	Low
Increased risk of collision impacts with new infrastructure	Although risk of collision could lead to some level of increase of bird mortality, mitigation measures would be implemented to ensure the likely impacts are minimised. The proposal is mostly located well away from waterways and wetlands which reduces the overall risk and the proposal transmission lines are likely to be below flight paths for a majority of species.	Moderate

Four threatened fauna species were also conservatively considered to be potentially indirectly impacted by line strike being:

- 11.31 hectares of habitat for Little Eagle (*Hieraaetus morphnoides*) (vulnerable – BC Act)
- 8.33 hectares of habitat for Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) (vulnerable – BC Act)
- 0.41 hectares of habitat for Regent Parrot (eastern subspecies) (*Polytelis anthopeplus monarchoides*) (endangered – BC Act and vulnerable – EPBC Act)
- 14.70 hectares of habitat for Superb Parrot (*Polytelis swainsonii*) (vulnerable – BC Act and vulnerable – EPBC Act).

9.4.3. Prescribed biodiversity impacts

Prescribed impacts are those that may affect biodiversity values in addition to, or instead of, impacts from clearing vegetation. These impacts may be difficult to quantify or offset as they often affect biodiversity values that are irreplaceable. Prescribed impacts associated with the proposal and the threatened species or communities which have the potential to utilise these features within the proposal study area are presented in Table 9-3.

Table 9-3 Prescribed biodiversity impacts relevant to the proposal

Prescribed biodiversity impacts	Description of feature characteristics and location	Potential impact	Threatened species or community using or dependant on feature	Impact assessed
Karst, caves, crevices, cliffs, rocks and other geological features of significance	No karst, caves, crevices or cliffs considered to be relevant to prescribed impacts are present. An area with rocky substrate occurs near the eastern end of the proposal and the habitat stratification unit has been mapped as “Rocky Woodlands”	Negligible, the vast majority of rocky substrate would not be impacted as it would be spanned by the powerlines.	Pink-tailed Worm Lizard potential habitat	Sections 8.2 and 9.3 of Stage 2 assessment of the BDAR
Occurrences of human-made structures	No human made structures considered to be relevant to prescribed impacts are present.	N/A	N/A	N/A
Occurrences of non-native vegetation	No non-native vegetation considered to be relevant to prescribed impacts is present.	N/A	N/A	N/A
Corridors or other areas of connectivity linking habitat for threatened entities	Yes, throughout the landscape there are habitat and aerial connections for terrestrial, aquatic and aerial species.	The proposal has the potential to impact on connectivity for habitat of threatened species that facilitates movement across species’ ranges. The nature of the potential impacts to connectivity primarily relate to impacts to aerial species such as birds or bats through interaction with the proposed towers or associated lines. Terrestrial movement (either on the ground and/or below the upper stratum of vegetation) is unlikely to be substantially altered given the majority of native vegetation under 4 metres growth height and, in some sections, under 10 metres growth height would be retained within the easement of the proposal.	• Raptors • Brolga • Major Mitchell’s Cockatoo • Regent Parrot • Migratory shorebirds • Waterfowl • Microbats • Squirrel glider	Sections 8.2 and 9.3 of Stage 2 assessment of the BDAR

Prescribed biodiversity impacts	Description of feature characteristics and location	Potential impact	Threatened species or community using or dependant on feature	Impact assessed
Water bodies or any hydrological processes that sustain threatened entities	Yes the proposal occurs nearby to Lake Gol Gol, Lake Benanee and Lake Cullivel. It also crosses the Murrumbidgee River and other more minor watercourses and low lying wet areas.	Substantial impacts to water quality to these and other water bodies are not expected to occur, with all permanent disturbance areas located outside core riparian zone areas. All construction and operation impacts would be managed to ensure ground disturbance is minimised and managed and direct impacts to the waterbodies themselves and related hydrological processes are not expected to occur.	• Amphibians • Terrestrial Species • Aerial species • Aquatic Species	Sections 8.2 and 9.3 of Stage 2 assessment of the BDAR
Protected animals that may use the proposed wind farm development site as a flyway or migration route	This project is not a wind farm.	N/A	N/A	N/A
Proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community	It is located adjoining to or crosses regional roads such as the Sturt Highway, Cobb Highway, Kidman Way and Newell Highway.	The proposal is likely to generate additional vehicular movements, particularly during construction but also during operation.	• Amphibians • Terrestrial Species	Sections 8.2 and 9.3 of Stage 2 assessment of the BDAR

9.4.4. Serious and irreversible impacts

The proposal has been identified to impact five entities currently listed as serious and irreversible impacts (SAIIs) in the Threatened Biodiversity Data Collection, including two threatened ecological communities, two threatened flora species and one threatened fauna species. These are:

- *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression bioregions
- White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland (Box Gum Woodland)
- Austral Pillwort (*Pilularia novae-hollandiae*)
- Thyme Rice-Flower (*Pimelea serpyllifolia* subsp. *serpyllifolia*)
- Plain Wanderer (*Pedionomus torquatus*).

The proposal would provide biodiversity offsets in accordance with BAM for the impacts to these SAII entities. The vast majority of the threatened ecological communities recorded would not be impacted and the proposal has been designed to maximise avoidance of these communities. The proposal is not expected to have a substantial impact on these species or communities.

Further detail is provided in Table 9-4.

Table 9-4 All entities recorded within the disturbance area

SAII entity	BC Act	Impact (ha)	Consideration
Allocasuarina luehmannii Woodland	E	2.93	Direct impacts on *Allocasuarina luehmannii* Woodland in have been avoided where possible through design refinement. The total existing area of *Allocasuarina luehmannii* Woodland is estimated to be about 1,300 hectares. Within the proposal study area, this community occurs in moderate to good condition with a vegetation integrity score of 63.9. The impact of 2.93 hectares of *Allocasuarina luehmannii* Woodland comprises 1.20 hectares of total removal (disturbance area A) and 1.73 hectares of partial removal (disturbance areas B4 and B10). Indirect impacts would be managed through mitigation measures outlined in Section 9.7.

SAII entity	BC Act	Impact (ha)	Consideration
White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland (Box Gum Woodland)	CE	41.44	Direct impacts on Box Gum Woodland have been avoided where possible through design refinement. For example, the proposed transmission line along Gums Lane was moved to the north to avoid direct impacts to a patch of moderate to good condition. Within the proposal study area, this community occurs in a range of conditions including moderate to good, poor and derived. The proposal would impact 41.44 hectares. However, in the context of management zones the proposal would impact only 20.37 hectares of the community. Where all vegetation would be removed to ground level (disturbance area A), there would be a loss of 21.07 hectares. Partial removal of 20.37 hectares (disturbance area B4 and B10) would only require taller vegetation removal to meet vegetation clearance heights and the ground cover will be undisturbed. This would change the vegetation structure, but would change the species composition to a lesser degree compared to area A. Indirect impacts would be managed through mitigation measures outlined in Section 9.7.
Austral Pillwort (*Pilularia novae-hollandiae*)	E	5.59	Direct impacts on Austral Pillwort have been avoided where possible through design refinement. Austral Pillwort was recorded from nine-shallow muddy depressions. The estimated number of individuals (mature and immature) recorded in the subpopulation is estimated to be 180-450 individuals. The NSW population is currently unknown although the recorded individuals are considered to constitute a very small percentage of the overall NSW population for this species. The current known estimated area of occupancy for Austral Pillwort in NSW is 146.40 hectares. The proposal would impact 0.32 hectares of occupied habitat which is estimated to be 0.22 per cent of habitat within NSW. The proposal would impact some habitat but would not directly impact individuals of the species. This was achieved through design refinements including micro siting of tower pads and careful track design. Indirect impacts would be managed through mitigation measures outlined in Section 9.7.

SAII entity	BC Act	Impact (ha)	Consideration
Thyme Rice-Flower (*Pimelea serpyllifolia* subsp. *serpyllifolia*)	E	0.11	Direct impacts on Thyme Rice-Flower have been avoided where possible through design refinement. This species is not common in NSW, being only known to occur in the Euston district, on the South Olary Plain IBRA subregion. The current known area of occupancy in NSW is not understood. However, the existing records of known locations of the species suggest that the species occurs in areas of high agricultural use and the area of occupancy is likely to be small, possibly less than 10 hectares. The response to management of Thyme Rice-Flower is not known. Less than 10% of this species' total population occurs within NSW (DPIE, 2021), which extends into Victoria and South Australia. Current knowledge indicates that the proposed impact to 0.11 hectares of occupied habitat is likely to equate to a low proportion of its habitat within NSW and a very low proportion of the species' total geographic range. Indirect impacts would be managed through mitigation measures outlined in Section 9.7.
Plains Wanderer	CE	0.41	Early calculations of impacts to Plains-wanderer habitat by the proposal without avoidance measures was 21.6 hectares, but that figure has been reduced to 0.41 hectares (spread across the proposal) by implementing design avoidance measures. Apart from the displacement of 0.41 hectares of habitat, there are no other impacts that are expected to have an adverse effect on Plains-wanderers in the wider locality (10 kilometres) or other Plains-wanderer habitats further afield. The total area of habitat for Plains-wanderer in NSW has not been quantified, but the area of habitat in the mapped Riverina distribution has. Within 10 kilometres of the proposal alignment there is a total of 12,676 hectares. The implementing of avoidance measures have resulted in Plains-wanderer impacts to levels that would not constitute a SAII.

9.4.5. Key threatening processes

Consideration of key threatening processes (KTP) applicable to the proposal are considered in Table 9-5.

Table 9-5 Key threatening processes

Key threatening process	Relevance	Consideration
Clearing of native vegetation	High	The proposal would result in the clearing of native vegetation and contribute to this key threatening process. Reductions in native vegetation clearing has been achieved through spanning native vegetation communities in disturbance area B. Within this area native vegetation retention below four and 10 metres (growth heights) would be achievable resulting in the overall reduction of clearing within the construction impact area. It is unlikely to significantly exacerbate this key threatening process as approaches to further minimise and avoid clearing would be considered during finalisation of the proposals design, and mitigation measures to address impacts of clearing and indirect impacts would be implemented.
Infection of native plants by *Phytophthora cinnamomi*	Low	The proposal has the potential to contribute towards these key threatening processes, however, due to the nature, location and implementation of mitigation measures there is a low likelihood that the proposal would result in these key threatened processes from being established within the proposal study area. Likewise, while the proposal has the potential to lead to a reduction of native vegetation integrity in surrounding habitats, mitigation measures would be implemented to ensure biosecurity is managed during construction. These would include plant/equipment inspection and washdown and tool and footwear disinfection.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis		
Invasion and establishment of exotic vines and scramblers		
Invasion of native plant communities by exotic perennial grasses		
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants		

Key threatening process	Relevance	Consideration
Loss of hollow-bearing trees	High	The loss of breeding habitat such as hollow-bearing trees, old growth bull mallee lignotubers, *Triodia* grass clumps and dead fallen timber has the potential to affect native animals such as: • hollow-dependent bats • hollow-nesting and canopy-nesting birds • arboreal mammals • reptiles. Approaches to further minimise these impacts would be considered during finalisation of the proposals design. However, complete avoidance of these impacts is unlikely. As such additional mitigation measures would be implemented (including [pre-clearing surveys, nest box replacement and retention of habitat features where possible). With these measures in place, the proposal is unlikely to significantly exacerbate this key threatening process.
Removal of dead wood and dead trees		

9.4.6. Assessment of impacts of groundwater dependent ecosystems

Technical paper 15 has assessed the impacts of the proposal on the groundwater systems and the seventeen GDEs identified in Section 9.3.9. The proposal would not impact on groundwater and is considered unlikely to lead to any adverse impact on the groundwater availability or status for groundwater dependent ecosystems

9.4.7. Impacts on aquatic species and habitat

Impacts from the proposal on aquatic habitats, particularly mapped key fish habitats (Strahler 4/5th Order streams) are considered likely to be negligible. Avoiding and minimising impacts on aquatic habitats has been a priority of finalisation of the proposals design and any residual indirect impacts would be subject to mitigation measures.

Transmission line structures are located around 50 to 100 metres from the waterways to minimise impact to riparian areas.

The only likely impact to occur in an area of key fish habitat would be the removal or trimming of tree canopy on the river banks to facilitate the construction and operation of the powerlines spanning each riparian area. All trunk bases and understorey would be retained in-situ adjoining the river banks. All potential indirect impacts associated with erosion and sedimentation impacts would be managed and monitored to ensure that these do not impact the riparian areas. At most, any impact to water quality would be temporary and negligible. Each riparian area would continue to function as it currently functions.

The proposal is considered unlikely to lead to a significant impact on any threatened aquatic species, ecological communities or their habitats.

9.4.8. Migratory species

The proposal is unlikely to impact migratory species. While some migratory or marine bird species are likely to use the proposal study area and locality, no important habitats for EPBC listed migratory species are located in the proposal study area, including nationally or internationally important habitats for migratory wetlands species as defined by the EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment, 2015a).

9.4.9. Wetlands of national and international importance

The proposal would not impact on wetlands of national and international importance.

9.5. Potential impacts – operational

The proposal would have limited ongoing biodiversity impacts once operational. The key potential operational impacts are the following:

- ongoing regular access requirements for maintenance of the infrastructure – impacts of infrastructure maintenance are expected to be negligible as access would occur via access tracks and would be subject to Transgrid biosecurity protocols

- ongoing vegetation maintenance to ensure that Transgrid maintenance procedures and the required bushfire protection aspects are implemented. The impacts of this activity have been factored into the construction assessment through the predicted impacts to vegetation integrity. Existing procedures would ensure retained biodiversity values are adequately protected during maintenance activities

- increased potential for bird collision is possible – impacts are expected to be low, with the proposed transmission lines likely to be below flight paths for a majority of species. New powerlines in areas that do not currently have existing powerlines (i.e. in greenfield areas) are restricted to specific sections only, not the entire proposed alignment. The greenfield sections comprise approximately 24 per cent of the overall proposed alignment

- impacts of electric and magnetic fields (EMF) to local fauna populations. However, as outlined in Technical paper 13, most studies indicate that EMF exposure of birds generally changes (but not always consistently in effect or direction) their behaviour, reproductive success, growth and development, physiology and endocrinology, and oxidative stress under EMF conditions.

Given uncertainty around the indirect operational impacts of bird collision and EMF, biodiversity offsets have been calculated for the following at risk species:

- Little Eagle (*Hieraaetus morphnoides*) – listed as vulnerable under the BC Act
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) – listed as vulnerable under the BC Act
- Regent Parrot (eastern subspecies) (*Polytelis anthopeplus monarchoides*) – listed as endangered under the BC Act and vulnerable under the EPBC Act
- Superb Parrot (*Polytelis swainsonii*) – listed as vulnerable under the BC Act and vulnerable under the EPBC Act.

9.6. Summary of impacts

The proposal would traverse a wide diversity of landscapes which have varying degrees of disturbance. The western third of the proposal is dominated by semi-arid and largely naturally vegetated Mallee rangelands and riverine floodplains. The central portion of the proposal is generally occupied by native dominated and derived grasslands/chenopod shrublands that have been largely altered by historical sheep grazing and cropping. The eastern portion largely transverses the fertile soils and intensive agricultural/ cropping areas with relatively minor intersection of remnant native vegetation in the form of roadside remnants and isolated fragmented patches.

Due to the type of design and construction methodology associated with this proposal, there would be reduced impacts compared to other typically long, linear infrastructure projects (such as a railway or road corridor). During construction the impacts would be concentrated at the tower sites, along the centreline between towers (required for safe conductor line stringing activities), the Dinawan substation location and at the limited new access track sites along the route. Impacts would be limited in the broader easement areas to generally the taller vegetation which has the potential to pose a hazard and a safety risk to the new transmission lines.

During the operational phase the impact footprint would be concentrated primarily to the permanent infrastructure footprints and easement restrictions on tall vegetation which would allow for re-establishment of much of the lower growth height vegetation between towers. The nature of this particular infrastructure would therefore result in minimal fragmentation and severance of existing to vegetation.

Maximum avoidance and mitigation have been achieved through focussed design on identified biodiversity constraints to date and this will continue to occur through design and construction methodology refinement. While some biodiversity impacts are unavoidable if the proposal is to proceed, landscape-scale biodiversity conservation measures proposed as part of the biodiversity offset strategy (refer Section 9.7.4 and Technical paper 1) would improve the conservation security for native vegetation and threatened species overall post-construction.

9.7. Management of impacts

9.7.1. Environmental management

The environmental management approach and framework has been developed to be consistent with the regulatory requirements for management of biodiversity impacts, identified as likely to be encountered during the construction and operational phases of the proposal. Further details on the environmental management approach for the proposal are provided in Chapter 24 (Environmental Management).

For construction, a Biodiversity Management sub-plan would set out measures to minimise and manage impacts on biodiversity. It would include (as a minimum):

- measures to minimise impacts to biodiversity, including measures to reduce disturbance to sensitive flora and fauna
- procedures for clearing of vegetation, including pre-clearing inspections and procedures for the relocation of flora and fauna
- procedures for the demarcation and protection of retained vegetation, including vegetation adjacent to construction areas
- weed management

- habitat supplementation measures such as nest boxes and hollow re-use/creation
- rehabilitation strategies including progressive rehabilitation, and measures for the management and maintenance of rehabilitated areas (including duration)
- procedures for unexpected EECs or threatened flora and fauna during construction, including stop work procedures
- monitoring requirements and compliance management
- an approach to relocation of nests found within the construction impact area (i.e. nests found in hazardous areas would be translocated to nearby safe areas (where practicable), direct handling of eggs and chicks would be avoided). This could include potentially new poles/nest platforms.

9.7.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to biodiversity are listed in Table 9-6.

Additional mitigation measures, as identified in other chapters of the EIS, would also be relevant to the management of potential impacts to biodiversity. This includes:

- Chapter 12 (Land use and property) with respect to biosecurity risks
- Chapter 16 (Hydrology, flooding and water quality) with respect to water quality
- Chapter 21 (Soils, contamination and groundwater) with respect to soil and erosion impacts, and groundwater management.

Table 9-6 Mitigation measures – biodiversity

Reference	Mitigation measures	Timing	Application location(s)
B1	Impacts to matters of biodiversity conservation significance would be avoided to the greatest extent practicable during finalisation of the design and construction methodology for the proposal. Micro-siting of the transmission line infrastructure and associated construction working areas and other areas of disturbance would occur to avoid impacts wherever practicable. Site features with the highest biodiversity conservation significance, in particular, threatened species recorded and their habitat would be given the highest priority. Spatial data (species polygons for species credit species) and buffered threatened species locations would be provided to the design and construction teams and considered in detailed construction planning. Associated mapping would be included on sensitive area plans and provided to the construction workforce.	Pre-construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
B2	If refinements to the proposal design and construction methodology or additional field surveys result in changed impacts to biodiversity which are not included in this BDAR, these would be assessed in accordance with the requirements of the BAM by an accredited assessor.	Pre-construction and construction	All locations
B3	Opportunities to locate site offices, compounds and ancillary facilities in areas of limited biodiversity value (e.g. cleared land or areas of native vegetation with vegetation integrity scores of less than 17 in accordance with the NSW Government Biodiversity Assessment Method Operational Manual) would be prioritised during finalisation of the design and construction methodology.	Pre-construction	All locations
B4	Existing tracks and clearings would be used, where possible, to limit the construction of new tracks. Where this is not possible, the design would seek to minimise impacts to native vegetation, including cut and fill, as a priority.	Pre-construction and construction	Transmission line corridor
B5	Transmission line structures would be located and constructed to minimise impact to vegetated riparian corridors.	Pre-construction	Transmission line within the riparian corridor as defined by “Guidelines for riparian corridors on waterfront land” (DPI – Office of Water, July 2012) of Murrumbidgee River
B6	Conductor line-marking techniques would be implemented during design refinement to minimise bird strike. Use of bird diverters, most likely consisting of the “flapper” variety, would be implemented. Positioning and exact diverter model would be finalised during design refinement but at minimum these would be used within one kilometre of wetland/riverine habitats to reduce impacts on aerial fauna species from collision and allow safer passage within these areas.	Pre-construction and Construction	Transmission line – within one kilometre of wetland/riverine habitats (i.e. Murrumbidgee River)

Reference	Mitigation measures	Timing	Application location(s)
B7	A series of 20-metre-wide connectivity corridors would be established near tower locations that occur in woodland vegetation. These would occur at strategic locations that would be developed as part of a Connectivity Strategy under the Biodiversity Management Plan, targeting the following locations (wherever practicable): • key riparian crossings • areas of the alignment joining proposed biodiversity stewardship sites and or conservation reserve estate; and • areas of existing dense mallee/belah. These connectivity corridors would involve native vegetation retention up to the 10 metre or 20 metre (for 330kV and 500kV lines, respectively) wide temporary construction centreline clearing zone to better facilitate woodland connectivity. Vegetation heights to be retained would be determined in accordance with vegetation clearing requirements at each location. Any biodiversity credit liabilities to retained vegetation such as the connectivity corridors would be considered in final BAM calculations (refer to mitigation measures B2 and Section 12.4 of the Biodiversity offset strategy.	Pre-construction	All locations
B8	Nest boxes would be provided to provide alternative roosting habitat for threatened fauna displaced during clearing in accordance with a Supplementary Hollow and Nest Strategy. The strategy would include the following requirements: • survey of tree hollows and nests within the proposed clearing extents • identify the size, type, number and location of nest boxes required based on the results of the ecological surveys and active hollow resources in adjacent areas • appropriately sized nest boxes would be installed within the vicinity of hollow-bearing trees (subject to landowner agreement and suitable existing trees being present) no more than two weeks prior to clearing of the tree • nest boxes would also include the re-use of existing hollows salvaged prior to or during clearing where practicable; and • measures to address and manage nests (such as raptor nests) prior to clearing.	Pre-construction and construction	All locations where hollow bearing trees are being removed

Reference	Mitigation measures	Timing	Application location(s)
B9	Pre-clearing surveys would be completed prior to clearing at each location by a suitability qualified ecologist. The proposed clearing extents would be marked out on site prior to the pre-clearing surveys. During the surveys, the ecologist would: • survey the proposed clearing extent • identify any fauna that would require relocation prior to clearing • confirm the location and mark out the extents of any biodiversity exclusion zones • confirm that hollow-bearing trees within and adjacent to the clearing extents are prominently marked/tagged; and • confirm that nest boxes are in place (where required) in suitable locations adjacent to areas to be cleared, or suitable locations for installation have been identified.	Pre-construction	All locations
B10	The results of the pre-clearing surveys would be used to update and confirm the accuracy of sensitive area maps.	Pre-construction	All locations
B11	Biodiversity exclusion zones for retained vegetation would be confirmed by a suitably qualified ecologist and identified as 'No disturbance' zones prior to the commencement of clearing or any site activity that could damage the vegetation within the exclusion zone. 'No disturbance' zones would consider: • identified Plains-wanderer habitat • identified threatened flora populations and • PCTs in disturbance area B that are not of a growth form height that would ever require management. Biodiversity exclusion zones would be physically marked and demarcated, and included on sensitive area maps, prior to clearing.	Pre-construction	All locations
B12	A Plains-wanderer specific protocol would be developed to ensure that all project staff are aware of the sensitivities around this critically endangered species and to ensure that all specific requirements in relation to protection, avoidance, management and observation of individual Plains-wanderers are considered, in association with BCD staff.	Pre-construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
B13	All relevant project personnel, including relevant sub-contractors would be trained on biodiversity management protocols and the requirements for the project, through inductions, toolbox talks and targeted training, and provided with sensitive area maps (showing clearing boundaries and exclusion zones) and updates as required.	Construction	All locations
B14	The predicted clearing of native vegetation by the proposal would be monitored against the recorded clearing. A revised BAM-C calculation on the project's final project disturbance post construction would be completed and any additional credit liability identified would be met as part of the biodiversity offset requirements within the biodiversity offset package.	Construction	All locations
B15	Shrub or ground stratum native vegetation within vegetated riparian zones (within the definition of *Water Management Act 2000*) of defined riparian areas would be protected to the greatest extent practicable, with vegetation clearing ideally limited to the tree stratum only, with trunk bases being retained in-situ.	Construction	Transmission line within the riparian corridor as defined by "Guidelines for riparian corridors on waterfront land" (DPI – Office of Water, July 2012)
B16	Activities within vegetated riparian zones would be managed to minimise impacts to aquatic environments. Riparian areas subject to disturbance would be progressively stabilised and rehabilitated.	Construction	Transmission line within the riparian corridor as defined by "Guidelines for riparian corridors on waterfront land"
B17	A species unexpected finds protocol would be implemented if threatened ecological communities, flora and fauna species, not assessed in the biodiversity assessment, are identified in the disturbance area.	Construction	All locations
B18	Clearing of hollow bearing trees within the mapped PCT 8 and PCT 11 vegetation at the crossing point of the Murrumbidgee River would be undertaken outside of the period between September and December to avoid key breeding periods of the Regent Parrot.	Construction	Murrumbidgee River

Reference	Mitigation measures	Timing	Application location(s)
B19	Features of high biodiversity conservation significance within the operational easement, including biodiversity exclusions zones identified during construction and retained habitat for threatened species, would be recorded in Transgrid's GIS. The GIS information will be reviewed during the planning of all maintenance or other future activities that could cause disturbance.	Operation	All locations
B20	Develop and implement guidelines and procedures for operation and maintenance of the proposal that address the following: • vegetation clearing and maintenance commitments in the BDAR and EIS • avoiding access and disturbance in biodiversity exclusion zones identified during the construction • avoiding access and disturbance in areas of high biodiversity conservation significance; and • avoiding maintenance of vegetation that does not need to be maintained during operation. Provide training to relevant Transgrid operational personnel and vegetation maintenance contractors regarding the operational and maintenance guidelines and procedures.	Operation	All locations

9.7.3. Biodiversity offset credit report

Chapter 13 of Technical paper 1 addresses Section 11 of the BAM and provides information on the application of the no net loss standard and the proposal's biodiversity offset obligations. Credit calculations were quantified using the BAM-C Version 1.2.7.2.

The proposal offset amount determined in accordance with the BAM for the indicative construction impact area has been calculated to comprise the following biodiversity credits:

- 42,426 ecosystem credits
- 33,503 species credits.

9.7.4. Biodiversity offset strategy

The biodiversity offset strategy will adopt a mix of a number of potential approaches including:

- purchasing and retirement of existing biodiversity credits currently available on the biodiversity credit register
- establishing a biodiversity stewardship site(s) on lands with like for like biodiversity values to those impacted by the proposal
- making a payment into the Biodiversity Conservation Fund
- alternative strategic offset outcomes.

The final strategy and proposed offset delivery approach would be confirmed as the design of the proposal is further refined and the final construction impact area is confirmed (as discussed below).

Delivery of the Biodiversity Offset Scheme (BOS) is proposed to be prepared for the combined EnergyConnect (Eastern and Western) projects as follows:

- the proposed program provides a commitment to establish additional BSAs and/or meet residual EnergyConnect (NSW – Eastern Section) full credit liability prior to the completion of construction of EnergyConnect (NSW – Eastern Section) by end of 2025
- it sees Transgrid meet around 10 per cent of its EnergyConnect (NSW – Eastern Section) estimated liability and at least 25 per cent of combined project liability prior to EnergyConnect (NSW – Eastern Section) commencement of disturbance.

Further details regarding the proposed biodiversity offset strategy is provided in Section 12.4 of Technical paper 1.

9.7.5. Managing residual impacts and uncertainties

The biodiversity assessment is based on the current construction impact area and subset disturbance area locations (refer to Chapter 8). During design refinement, the final location of transmission line structures and construction facilities would be located with the aim to further avoid or minimise impacts on native vegetation, where possible.

Further biodiversity investigations may be undertaken once the final construction impact area is determined. Following further surveys (if required) and design refinement, the potential for impacts on biodiversity would be confirmed.

10. Aboriginal heritage

This chapter provides an assessment of potential Aboriginal heritage impacts of the proposal and identifies mitigation measures to address these impacts. It summarises the *Aboriginal Cultural Heritage Assessment Report* (Navin Officer, 2021a) (refer to Technical paper 2).

10.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to Aboriginal heritage and where these requirements are addressed in this EIS are outlined in Table 10-1.

Table 10-1 Secretary's environmental assessment requirements – Aboriginal heritage

Ref.	Secretary's environmental assessment requirements	Where addressed
Heritage		
Key issues	The EIS must address the following matters: • an assessment of the Aboriginal and historic heritage (cultural and archaeological) impacts of the project; and	Sections 10.4 and 10.5 provide an assessment of Aboriginal heritage impacts during construction and operation respectively. Additional detail is also provided in Chapter 9 of Technical paper 2. Consideration of historic heritage impacts of the proposal is provided in Chapter 11 and Technical paper 3.
	• adequate consultation with the local Aboriginal community and other relevant stakeholders, having regard to the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH, 2010).	Section 7.3 and Section 10.2.2 outline the consultation undertaken with the local Aboriginal community and other relevant stakeholders. Additional detail is also provided in Chapter 5 of Technical paper 2.

10.2. Assessment approach

10.2.1. Legislative and policy context

Potential Aboriginal heritage impacts resulting from the proposal were assessed in line with the following legislation and key guidelines:

- (Commonwealth) EPBC Act, which provides protection for matters of national environmental significance and recognises the role of Indigenous people and their knowledge

- (NSW) *Native Title Act 1994*, which was introduced to work in conjunction with the *Commonwealth Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act. The proposal study area intersects with the Barkandji Traditional Owners #8 (Part A) native title area (determined). Barkandji Traditional Owners have been consulted with regards to their involvement in surveys undertaken to date, and this consultation would continue moving forward. There are no other native title claims.

- (NSW) *National Parks and Wildlife Act 1974,* which provides protection for Aboriginal cultural heritage in NSW, including Aboriginal objects and declared Aboriginal places, and establishes the requirement to notify the DPIE if any previously unrecorded Aboriginal object is identified. As the proposal has been declared as a CSSI project in accordance with the EP&A Act, section 90 of the *National Parks and Wildlife Act 1974*, which outlines the requirements for Aboriginal heritage impact permits, does not apply (refer to Section 5.23 of the EP&A Act)

- (NSW) *Aboriginal Land Rights Act 1983* is a NSW statute that was established to return land to Aboriginal peoples through a process of lodging claims for certain Crown lands and the establishment of Aboriginal Land Councils. Aboriginal Land Councils constituted under the *Aboriginal Land Rights Act 1983* in NSW can claim Crown land. It may be that some Crown land in the proposal has been claimed by an Aboriginal Land Council. There are however provisions to exclude land from a claim if it is required for an essential public purpose, such as a transmission line.

- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH, 2010), which outlines a process for effective consultation with Aboriginal peoples, and stipulates that where relevant, consultation have been conducted with Native title holders or registered native title claimants in accordance with the *Native Title Act 1994*

- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (NSW DECCW 2010b), which specifies minimum standards for archaeological investigation undertaken in NSW

- Australian International Council on Monuments and Sites *Charter for Places of Cultural Significance* (also known as the Burra Charter; Australian ICOMOS, 2013), which defines cultural significance as 'aesthetic, historic, scientific, social or spiritual value for past, present or future generations' and provides relevant criteria to assess cultural significance

- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (DECCW, 2011), which provides guidance on the process to follow when investigating and assessing whether Aboriginal cultural heritage values and objects are present and the harm a proposed activity may cause to them. It also includes the requirements for an Aboriginal cultural heritage assessment report.

10.2.2. Methodology

10.2.2.1. Overview

The assessment of Aboriginal heritage is based on:

- a heritage study area used for searches of relevant databases, including a 20-kilometre wide corridor (10 kilometres either side of the centreline of the proposal)
- a heritage survey area for the completion of a walkover (discussed further below), which was based on the construction impact area (refer to Chapter 8 for definition of the construction impact area).

The methodology adopted for the Aboriginal heritage assessment included the following key tasks:

- reviewing the legislative and policy context including relevant guidelines and procedures for assessing Aboriginal heritage impacts
- reviewing existing data to identify known Aboriginal sites, including the Aboriginal Heritage Information Management System (AHIMS) database (NSW Heritage), Atlas of Aboriginal Places (NSW Heritage) and archaeological reports. The results of these searches were used to develop a preliminary predictive model to assess the likelihood of Aboriginal site locations in the landscape. Additional searches were made where ongoing refinement of the proposal's design during preparation of the assessment resulted in areas not previously searched
- consulting with registered Aboriginal parties (RAPs) at various stages in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH, 2010) (refer to Chapter 7)
- undertaking a field survey between 31 May and 26 September 2021. The methodology for the survey is discussed further in this section
- developing a predictive model based on known regional and local site patterns within a broader 10 kilometre wide corridor centred on the heritage study area
- assessing potential direct and indirect impacts on Aboriginal heritage within the construction impact area and subset disturbance area categories (as defined previously in Chapter 8)
- identifying mitigation and management measures to minimise the potential impacts identified.

10.2.2.2. Field survey methodology

The field survey comprised a walkover within the heritage survey area, which generally comprised of a 100 metre wide area with some broader sections where main construction compounds and accommodation camps are proposed or where further design refinements were identified during the preparation of the assessment.

The aims of the survey were to:

- identify any archaeological sites and areas of potential archaeological deposit (PADs) not previously recorded
- assess all areas of identified archaeological sensitivity
- locate, inspect and assess the condition of known Aboriginal sites recorded on the AHIMS database.

The survey was conducted by between two and three survey teams at any one time throughout the survey period, with each team typically consisting of two archaeologists from Navin Officer Heritage Consultants and two Registered Aboriginal Parties (RAP) representatives. During the survey, the RAP representatives were encouraged to communicate knowledge regarding the cultural heritage values of the heritage study area, archaeological and cultural sites, and the overall landscape. Given the length of the proposal and the varying Aboriginal lands crossed, the RAPs included for each section of survey varied according to each LALC district.

During the survey, each of the teams conducted walking surveys with each team member spaced at around 10 to 20 metre intervals depending on the estimated probability of encountering Aboriginal sites. Extra focus was applied to locations of already recorded sites or PADs and areas yielding high ground surface visibility and exposures. Where feasible, all old-growth native trees in the survey area were inspected for the presence of culturally derived scars. All encountered surface archaeological objects, sites, potential archaeological deposits and places of Aboriginal cultural value were documented.

Due to landowner access restrictions, it was not possible during the assessment period to survey the full length and extent of the identified survey area. In addition, some lengths of the survey area were assessed visually from an adjacent road or property due to restricted access. This approach was only adopted where views of the heritage survey area were close and clear from this adjacent area (refer to Figure 1.4 and Appendix 5 of Technical paper 2 for mapping of surveyed, visually inspected and unsurveyed areas).

Some field surveys were also completed as part earlier geotechnical investigations for the proposal. These assessments followed the *Due Diligence Code of Practice* (DECCW 2010) and were conducted alongside the RAPs who monitored all geotechnical works. Geotechnical testing locations that were assessed to have a low probability of impacting Aboriginal objects were approved for disturbance by proposal archaeologists. The results of these surveys were incorporated into the assessment (where relevant).

Further detail of the methodology undertaken for the Aboriginal heritage assessment is presented in Chapter 3 of the *Aboriginal Cultural Heritage Assessment Report* (Technical paper 2).

10.2.2.3. Consultation with Aboriginal communities

As part of the development of the proposal, ongoing consultation has been undertaken with representatives of the various Aboriginal communities across the whole of the proposal study area in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2020* (Office of Environment and Heritage, 2020).

Consultation with the RAPs was undertaken in a series of stages as follows:

- notification of the proposal and registration of interest – this included notifying Aboriginal parties of the proposal and seeking their interest in being part of the development of the proposal
- presentation of information about the proposal – a preliminary survey methodology and cultural information request was sent to registered groups on 2 October 2020. A proposal update letter was sent to all RAPs in November 2020 and an additional update letter with updated details of the archaeological field survey was sent to all RAPs on 21 April 2021, for further comment
- additional briefings via videoconference in September 2021 during the survey periods with LALC groups during the COVID lockdown restriction periods to keep groups across detail in relation:
  - to the proposal
  - the assessment process and issues resulting from COVID-19 safety risks
  - the proposed alternative options for conduct of surveys to minimise potential risk to communities and field personnel
- gathering information about cultural significance – a number of Aboriginal organisations were represented in the field during the various field survey. This provided the RAPs to provide advice about the cultural significance of the various sections of the alignment
- review of draft cultural heritage assessment report – a draft copy of the *Aboriginal Cultural Heritage Assessment* was provided to the RAPs for comment prior to finalisation of the report included as Technical paper 2. The consultation period to provide comments was between 9 November 2021 and 7 December 2021
- input into the proposed archaeological testing methodology – a preliminary archaeological testing survey methodology was sent to registered groups on 9 November 2021 to allow for comment to be made on the proposed methodology for the testing of areas of potential archaeological deposits (PADs).

Further details of the consultation activities undertaken with Aboriginal representatives is presented in Chapter 5 of Technical paper 2. Transgrid would continue to consult with the Aboriginal community throughout the proposal, including (but not limited to) if any Aboriginal objects are unexpectedly found during construction.

10.2.2.4. Assessment of potential archaeological deposits

Subsurface testing of PADs which have the potential to be impacted by the proposal has not yet been undertaken. The methodology proposed to conduct these works has been prepared and consulted on with RAPs in November 2021. These works are proposed to be undertaken in the field at the start of 2022 where landholder access is made available with findings incorporated into the Response to Submissions Report which would be prepared prior to determination of the proposal.

These works would be concluded prior to any proposal-related ground disturbance occurring within the PAD.

10.3. Existing environment

10.3.1. Aboriginal heritage context

Archaeological material evidence has been identified across the regions associated with the proposal indicating a long history of Aboriginal occupation near or within the vicinity of the whole of the length of the proposal. Data has been drawn from broad cultural heritage studies and consultant reports within the heritage study area to provide a range of information about the history of the region and the types of sites found across different landscapes relevant to the proposal.

A summary of the ethnohistory of has been provided below to contextualise the lives of Aboriginal peoples in the pre- and post-contact landscape for each of the main regions identified along the length of the proposal.

10.3.1.1. Murray Darling Depression

The Murray Darling Depression landscape is defined by contrast. At the western end of the proposal, the landscape comprises a diverse setting compared to other areas along the alignment. The region contains a number of cemeteries, riverside burials and greater mortuary complexity (Bonhomme, 1990), noting these features would not be impacted by the proposal.

Further east, the Murray River corridor is a rich and relatively stable environment with permanent water and a variety of concentrated resources available throughout the year. These rich river resources are bordered by semi-arid country that is unpredictable in resource availability; resources are widely distributed (Pardoe, 2003). The Murray Darling Depression is home to the Barkanjii language group (also Barkinji, Barinji, Danggali, Maraura, and Wilyakali) to the north of the Murray and the lower Darling River, and the Kulin language group (Mathi Mathi, Wathi Wathi, Nari Nari and Wemba Wemba) to the east.

10.3.1.2. Riverine Plains

As the Murrumbidgee River moves further west, away from the western slopes of the Wagga Wagga region and through the wide plains of the Hay and Griffith areas, the landscape becomes increasingly arid with the western flow of the river shifting to an open plain dominated by grasslands and woodlands. The Aboriginal heritage of the region consists of numerous burials, mounds, campsites, artefact scatters, scarred trees, natural/mythological sites and post-contact sites such as missions, fringe camps and stations.

Within the Riverine Plains region are three major language groups, the Kulin language group (Mathi Mathi, Wathi Wathi, Nari Nari and Wemba Wemba) which cover the western side of the region, the Wiradjuri language groups which covers the northern portion of the region, and the Murray River language group (Yita Yita, Yota Yota and Pangerang) covering the southern portion of the region (Pardoe and Martin, 2011).

10.3.1.3. NSW South Western Slopes

In the eastern end of the study area the Murrumbidgee River basin would have been a focus of occupation in the region. An abundance of resource have been found along the river in addition to its waters; it supported wood and forest habitats that housed a wide range of plants and animals used by Aboriginal populations. The frequent floods of the Murrumbidgee River also provided Aboriginal peoples with an abundance of resources, as pools left by the receding floodwaters would be filled with freshwater mussels, fish, yabbies, and aquatic plants (Kabaila, 1998).

The NSW South Western Slopes are home to the Wiradjuri people. The Wiradjuri people are the largest Aboriginal group in NSW, known as 'the people of three rivers', for the Wambool (the Macquarie River), the Kalari (the Lachlan River) and the Murrumbidjeri (the Murrumbidgee River) which border their country. Within the south of Wiradjuri country three local groups are known, the Murringbulla at Murrumburrah, the Kutamundra at Cootamundra, and the Narrungdera at Narrandera. (Howitt, 1884, Wood, 1992).

Further details regarding the existing Aboriginal heritage context of the region is presented in Chapter 6 of Technical paper 2. Further detail regarding the broader Aboriginal ethnohistory and regional archaeological context of the region in which the proposal would be located is provided in Chapter 6 of Technical paper 2.

10.3.2. Aboriginal sites and archaeology

10.3.2.1. Previously recorded Aboriginal sites

A search of Aboriginal objects, sites and places registered on AHIMS identified:

- 869 sites within the broader heritage study area (consisting of 10 kilometres either side of the proposal centreline) encompassing the following archaeological site types/features (refer to Figure 10-1):
  - artefacts (both isolated finds and artefact scatters)
  - Aboriginal burials
  - hearths
  - earth mounds
  - modified trees
  - freshwater shell
  - non-human bone and organic material
  - potential archaeological deposits
- of the above 869 sites, 399 were identified within a refined five-kilometre corridor from the proposal (i.e. five kilometres either side of the proposal)
- of the 399 sites, 11 sites were identified within the heritage survey area, including:
  - two modified/scarred tree sites (48-5-0022 and 56-1-0001)
  - three isolated find sites (47-4-0331, 47-5-0047 and 47-5-0048)
  - one combined intact earth mounds, mound scatters, hearths and artefact scatters site (47-5-0008)
  - five combined scattered hearths with clay heat retainers (47-6-0603, 47-6-0604, 47-6-0605, 47-6-0606 and 47-6-0832).

10.3.2.2. New Aboriginal sites and PADs

In addition to previously recorded sites, 91 previously unrecorded Aboriginal site features were recorded during the field surveys, including:

- 40 isolated finds
- 19 artefact scatters
- 15 sites with a combination of multiple site types (e.g. combined find such as an artefact scatter and a modified tree)
- eight modified/scarred trees
- five hearths
- three earth mounds
- one midden.

Clusters of sites were generally identified in areas near and across high order perennial watercourses within the Aboriginal heritage study area. This included the following locations for clusters of the newly recorded Aboriginal sites:

- within Hay LGA, sites were concentrated in relation to Curtains Creek, Nyangay Creek and Eurolie Creek and some low order watercourses linked to the major creeks
- within Lockhart LGA several clusters of sites were identified in proximity to Lake Cullivel, Halliday's Cut, Brookong Creek, as well as low order creek lines linked to Brookong Creek and Bullenbong Creek and a large water body that intersects with the proposed easement
- sites were identified within the Federation LGA where Colombo Creek and a low order creek linked to Yanco Creek intersects with the proposed easement
- within Balranald LGA, a site was identified less than 500 metres from Box Creek while other sites were identified around 1.5 to two kilometres from low order creeks linked to Arumpo Creek and Lake Benanee
- within Edward River LGA sites were identified around three to 3.5 kilometres from the Forest Creek
- within Murray River LGA, only one site was identified within one kilometre buffer from a dry lake and Lintot Lake
- sites within the Wagga Wagga LGA were also identified less than 500 metres from low order creeks linked to Sandy Creek and Stringybark Creek.

In addition, 44 areas of PAD were defined as part of the field surveys. Of these, 27 PADs were identified to have one or more Aboriginal sites associated with them. The boundaries of PADs have generally been defined by the extent of particular micro-landforms known or predicted to have high correlations of archaeological material. All of the identified PADs are considered to have moderate to high archaeological potential. All areas of low potential were discounted as part of the assessment process. Details of the 44 PAD sites is provided in Section 7.2 of Technical paper 2.

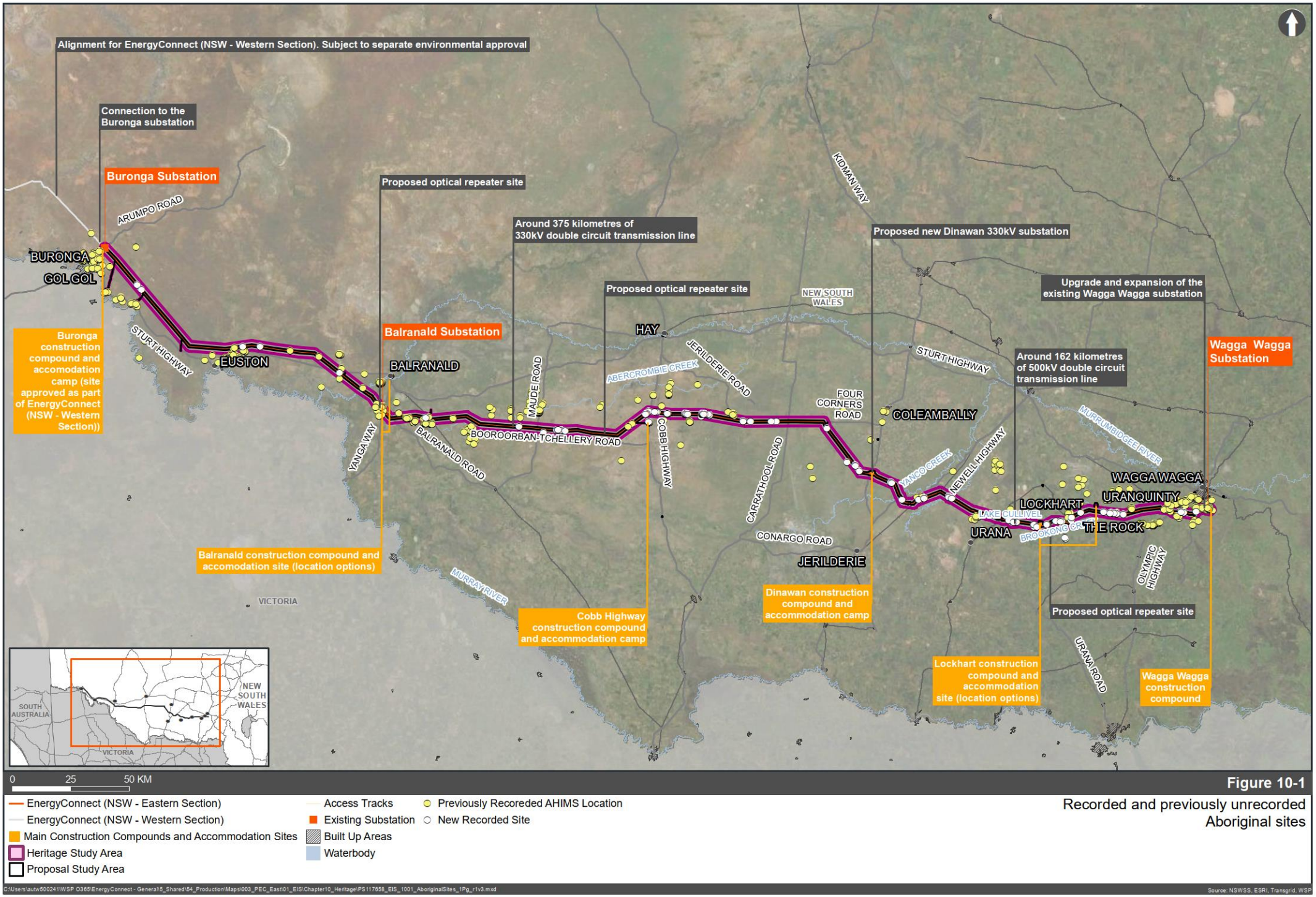

Figure 10-1

Recorded and previously unrecorded Aboriginal sites

10.3.2.3. Aboriginal site patterns

Of the previously recorded sites, the most common Aboriginal site type present in the proposal study area and the broader region is the open artefact scatter (also termed open campsite on many of the AHIMS site cards for the region). This may occur almost anywhere that Aboriginal people have travelled and may be associated with hunting or gathering activities, domestic camps, or the manufacture and maintenance of stone tools. The density of artefacts represented in these scatters can vary dramatically, based on several variables including landscape features, proximity to water, and proximity of food resources.

Isolated finds, generally defined as a single stone artefact which occurs without any associated evidence of Aboriginal occupation within a radius of 60 metres, are also common in the proposal study area. Isolated finds may be indicative of random loss or deliberate discard of a single artefact, the remnant of a now dispersed and disturbed artefact scatter, or an otherwise obscured or subsurface artefact scatter. Except in the case of the latter, isolated finds are constituent components of the *background scatter* of Aboriginal artefacts present within any landform.

While modified tree sites were located across the extent of the heritage survey area and within the searched area (as noted above), it is noted that the majority of these sites type are concentrated in the eastern half of the heritage study area, particularly towards the Wagga Wagga region. In addition, sensitive sites such as ceremonial and burial sites were also located within the searched area. While no sensitive sites were identified within the boundaries of the construction impact area, some of these sites were identified to be within close proximity to the construction impact area.

Further details regarding the types and total number of each of the identified sites within the heritage study area from the proposal is provided in Section 6.3 to Section 6.6 of Technical paper 2.

10.3.3. Assessment of significance

An assessment of significance for the recorded Aboriginal sites was undertaken in accordance with the criteria of the *Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS Burra Charter, 2013a). This assessment of significance considers the historic value, scientific (archaeological value), aesthetic value and the social (cultural) value of a place.

10.3.3.1. Historic value

No information has been provided by Aboriginal stakeholders to suggest the proposal study area is historically important in terms of persons, events, phases or activities in the Aboriginal community. If evidence of historically significant information relevant to the proposal study area becomes available, it would be discussed with relevant Aboriginal stakeholders.

10.3.3.2. Scientific (archaeological) value

Archaeological sites recorded during the archaeological surveys for the proposal and previously recorded sites that were able to be re-found were placed into the following assessment categories:

- previously recorded sites not accessed so not able to be confirmed or cannot assess the scientific significance prior to excavation – two sites (Booroorban (AHIMS #48-5-0022) and Boiling Down Road 1 (AHIMS #56-1-0001), both are recorded as modified trees) were placed into this category as they were not able to be accessed as part of the field surveys undertaken due to landholder restrictions

- low scientific significance – 37 of the surface sites were attributed as having low scientific significance. These sites have low numbers of artefacts and little potential to provide data that would substantially add to our understanding of Aboriginal occupation and land-use in the local area

- moderate (local) scientific significance – 53 of the surface sites were attributed as having moderate (local) scientific significance or associated with areas of moderate to high or, high potential for subsurface archaeological deposits and rarer site types such as modified trees and middens. Any subsurface deposits at these sites are predicted to contain a higher number of artefacts compared to the other sites in the survey area and, therefore, have potential to provide a large enough sample to enable analyses of assemblage compositions that could be used to derive statements on the technological systems being employed by Aboriginal groups living in this region

- moderate to high (local) scientific significance – one of the surface sites was attributed to being of moderate to high (local) scientific significance. This site is predicted to contain a higher number of artefacts compared to the other sites in the survey area and, therefore, have potential to provide a large enough sample to enable analyses of assemblage compositions that could be used to derive statements on the technological systems being employed by Aboriginal groups living in this region.

No sites identified have been assessed to have national or scientific significance.

10.3.3.3. Aesthetic value

As noted in the OEH *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage* (OEH, 2011), aesthetic value is often closely associated with social values. Culturally significant places outside the survey area, such as Lake Victoria, are of high aesthetic value to the local Aboriginal community and expectations are that any development in the area would be sympathetic to such vistas.

To date, no cultural landscape values/aesthetic values in the proposal area have been identified.

10.3.3.4. Social (cultural) value

All archaeological objects and sites have cultural value for present-day Aboriginal people, as they were created by ancestral Aboriginal people and provide tangible evidence of past occupation of the landscape. All sites have cultural significance to present-day Aboriginal groups as manifestations of their ancestors' past occupation of the landscape.

Further details regarding the cultural heritage values and statement of significance assessment is provided in Chapter 8 of Technical paper 2.

10.4. Potential impacts – construction

The assessment of potential impacts described below is based on the currently available information gathered from desktop research, field surveys undertaken to date and engagement with relevant LALCs and RAPs. As described in Section 10.2.2.4 above, test excavations and additional field surveys are proposed to be undertaken in early 2022 where landholder access is available. This additional survey and test excavation of the currently identified PADs is intended to confirm the extent/numbers of significant heritage items within these PADs, and refine/confirm their spatial extent. The development of the design and construction methodology of the proposal has utilised these existing identified areas of PAD to refine and reduce potential impacts where possible. Following the test excavation program, the design and construction methodology would continue to be refined to further reduce impacts.

The proposal study area has been subject to varying degrees of disturbance by European (post-contact) activities. The native vegetation in the proposal study area has been identified as being variably cleared in the historic period and is now a mixture of cleared open pastures for grazing, mallee scrub and open forest. In addition, the introduction of stock has contributed significantly to degradation of landscapes in the proposal study area, with properties subject to overstocking and/or dryland cropping being mostly heavily degraded. A combination of overstocking and vegetation clearance has intensified erosion in sections, which can move archaeological material across ground surfaces, and can mix material together that was initially separated, as the intervening sediment is stripped away.

10.4.1. Aboriginal sites and archaeology

Impacts on known and previously unrecorded Aboriginal items can occur through the following processes:

- direct harm or disturbance to all surface and/or subsurface features at an item. This would generally result a total loss of heritage value at a site (such as is the installation of transmission towers).
- partial direct harm or disturbance, where direct impacts would occur to only some of the surface and/or subsurface features at an item. Partial direct harm generally results partial loss of value at a site (such as where part of a site is impacted due to the installation of an access track or transmission line infrastructure)
- potential direct harm or disturbance (total or partial), where direct impacts are occurring adjacent to sites, or where vegetation clearance/maintenance requires the use of heavy machinery to be active near sites.

As discussed in Chapter 8, direct impacts from the proposal have been categorised as:

- direct impacts associated with works at tower locations, the construction of the Dinawan 330kV substation and site establishment at camp and compound sites, in Disturbance area A
- potential direct impact to ground surface from brake and winch sites, and upgrading of existing or construction of new vehicle tracks, within Disturbance area A
- potential direct impacts associated with vegetation clearance in the Disturbance area A – centreline area (with retention of vegetation of heights up to around 30 centimetres in height in this area) for stringing lines, which extend between the transmission towers
- potential direct impacts to some sites and scarred trees where vegetation clearance to certain heights are required in Disturbance area B (i.e. in the easement area where vegetation is required to be cleared to meet vegetation clearing requirements which stipulate clearing of vegetation with growth heights above four metres in the centre areas of the easement and 10 metre growth heights on the outer sections of the easement (refer Section 8.1.1 for definitions)
- indirect impacts including inadvertent direct impacts during vegetation clearance activities, disturbance from surface water drainage and workers driving over sites.

The potential impacts described below are based on the current identified construction impact area and have been minimised based on consideration of tower location and access track refinement to avoid identified, known or potential sites and utilise disturbed areas wherever possible. Further detail on how this has been achieved is provided in Technical paper 2 section 9.4. During the ongoing design and construction methodology refinement, the locations of recorded Aboriginal sites and PADs would be used to inform the final location of transmission line structures and construction facilities, with an aim to:

- protect, conserve and/or manage the heritage significance of Aboriginal objects and places to ensure the proposal does not diminish the cultural understanding of Aboriginal people in New South Wales
- avoid or minimise impacts on areas of archaeological potential and scientific significance, where feasible and reasonable. Where this is not possible, areas of moderate or high archaeological potential and significance would be prioritised for avoidance or impact minimisation.

10.4.1.1. Potential direct impacts

The potential for direct impacts to Aboriginal heritage from construction of the proposal has been determined by assessing the location of Aboriginal sites and PADs against the identified construction impact area which includes the indicative locations for the transmission line structures and associated allocation of subset disturbance area categories (i.e. Disturbance A, A-centreline and B categories).

No sites have been located at the existing Wagga Wagga substation or the proposed Dinawan 330kV substation site so no construction phase impacts are anticipated to occur to Aboriginal heritage at these locations.

Table 10-2 summarises the direct and potential direct impacts to recorded Aboriginal heritage sites during construction of the transmission line and associated components, based on the current construction impact area and subset disturbance area category locations. The number of sites effected, based on the above type of impact, are summarised in Table 10-2, this table includes all sites including previously recorded sites and new sites. The number of sites to be impacted would be confirmed during finalisation of the design and construction methodology which would be considerate of opportunities to avoid or minimise impacts.

Impacts to a number of these sites also include impacts to the identified PADs. The significance of the PADs would be confirmed as part of the ongoing test excavations which are currently being conducted.

Table 10-2 Summary of potential Aboriginal heritage impacts within the construction impact area and indicative subset disturbance area categories

Site features and significance	Number of sites impacted based on impact type					Total sites impacted
	Direct (Area A)	Potential direct impact (Area A centreline clearing/ track upgrade)	Potential direct impact only (Area B)	Direct and potentially direct (Area A & B)	Potential direct impact only (A centreline clearing/track upgrade & B)	
Artefact scatter						
Low scientific significance	–	2	–	–	1	3
Moderate scientific significance	–	4	–	3	1	8
Artefact, Hearth						
Moderate scientific significance	–	–	1	3	2	6
Artefact Scatter, hearth, modified tree						
Moderate to high scientific significance	–	–	–	1	–	1
Artefact scatter, Earth Mound, Hearth						
Moderate scientific significance	–	–	–	1	–	1
Earth Mound						
Moderate scientific significance	–	–	1	–	–	1
Hearth						
Moderate scientific significance	–	1	1	–	1	3
Isolated find						
Low scientific significance	1	9	3	–	1	14
Moderate scientific significance	–	3	2	–	–	5
Isolated find, hearth						
Moderate scientific significance	1	1	–	1	–	3

Site features and significance	Number of sites impacted based on impact type					Total sites impacted
	Direct (Area A)	Potential direct impact (Area A centreline clearing/ track upgrade)	Potential direct impact only (Area B)	Direct and potentially direct (Area A & B)	Potential direct impact only (A centreline clearing/track upgrade & B)	
Midden						
Moderate scientific significance	–	–	1	–	–	1
Modified tree						
Moderate scientific significance	1	1	5 [1]	–	–	7
Potential Archaeological Deposit						
PADs	–	2	3	22	14	41
Total	**3**	**23**	**17**	**31**	**20**	**94**

Note:

1. Disturbance Area B impacts may or may not be direct for scarred trees depending on their height, and the vegetation clearance height required for their position relative to the final design of proposal infrastructure

Design refinements including tower location refinements would be completed to further reduce impacts, where possible. While the proposal would aim to avoid heritage items as a first principle, where this is not possible, design would prioritise the avoidance/minimisation of impacts and harm at locations of moderate and above scientific significance, as well as moderate and high archaeological potential.

10.4.1.2. Potential indirect impacts

Indirect impacts, depending on the site type, site context, and its archaeological and cultural significance, may not result in a loss of heritage value. Indirect impacts may occur to areas beyond the indicative disturbance area, however, the impact would be dependent on several factors, including spatial extent of the site, depth of deposits, and the works being conducted adjacent to these areas. For this reason, the number of sites that may be potentially indirectly impacted have not been quantified and would need to be managed during construction. Construction planning and management for the proposal would minimise the potential for indirect impacts that could potentially result in a loss of heritage values due to physical disturbance (including physical disturbance from surface water drainage or other mechanism).

Further information on the potential impacts to Aboriginal heritage is provided in Chapter 9 of Technical paper 2.

10.5. Potential impacts – operation

Operation of the proposal is not anticipated to result in direct impacts to known or previously unrecorded Aboriginal sites. Whilst some disturbance may be required as part of routine maintenance and repair activities, these activities would be contained within areas previously disturbed during construction. Recorded sites remaining after the construction period would be mapped and potential impacts avoided.

Indirect impacts from the presence of infrastructure, including visual impacts, would continue during operation of the proposal.

It is unlikely that direct harm or disturbance to any known Aboriginal sites remaining within the transmission line easement would occur as a result of maintenance activities, as these sites would be mapped and mitigation measures would be implemented to protect them from accidental harm (refer to Section 10.6).

No sites have been located at Wagga Wagga substation or the proposed Dinawan 330kV substation sites so no operational impacts would occur to Aboriginal heritage at these locations.

10.6. Management of impacts

10.6.1. Environmental management

Environmental management for the proposal would be carried out in accordance with the approach detailed in Chapter 24 (Environmental management). For construction, this would include a detailed construction heritage management sub-plan.

This sub-plan would be based on the final construction methodology, and would detail (as a minimum):

- appropriate heritage mitigation measures, including identification, protection and/or management of heritage items/sites within or adjacent to construction areas (including additional investigations, recordings, or measures to protect items/sites that would not be directly impacted in the vicinity of construction works)
- procedures for unexpected finds, including procedures for dealing with human remains
- heritage monitoring and compliance management
- induction requirements for construction personnel.

10.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to Aboriginal heritage are listed in Table 10-3.

Table 10-3 Mitigation measures – Aboriginal heritage

Reference	Mitigation measure	Timing	Applicable location(s)
AH1	The finalisation of the proposal design and construction methodology, and associated final disturbance areas, would be developed to avoid harm to features/items of Aboriginal heritage significance as far as practical. The objective is to further reduce potential impacts through tower location and design refinement and construction methodology. Avoidance and minimisation of harm to features/items and Potential Archaeological Deposits (PADs) are to be prioritised.	Pre-construction impacts	All locations
AH2	Aboriginal stakeholder consultation would be carried out in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a). Engagement with Registered Aboriginal Parties (RAPs) would consist of the following: • Aboriginal heritage site surveys (AH3) – review of proposed methodologies and involvement in the survey activities in the field (for ground or vegetation disturbance outside of previously surveyed areas) • test excavation activities (AH4) – review of proposed methodologies and involvement in the test excavation activities in the field • review of the draft addendum report/s to the ACHAR (relating to surveys (AH3), test excavations (AH4) and scar trees (AH5)), and consultation on the draft reports • provision of final addendum report/s to the ACHAR to RAPs (AH3, AH4, AH5) • involvement in establishment of Aboriginal heritage exclusion zones prior to construction commencing at each location (AH7). Further cultural information would be gathered during consultation undertaken in association with these activities.	Pre-construction impacts	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
AH3	Additional assessment would occur in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW* (2010) for areas where ground activities are required in locations outside of the previously surveyed heritage survey area. Where required, additional heritage surveys would be carried out with the RAPs prior to ground disturbing activities occurring in any such areas. If no Aboriginal objects are found or if Aboriginal objects are found and they would not be impacted, then a letter report would be prepared by an archaeologist that documents the findings and gives clearance to proceed. Where Aboriginal objects or area of PAD are located and would be impacted, a draft survey addendum report/s to the ACHAR would be prepared for the survey areas. The report(s) would: • detail findings of the survey activities • detail where test excavation is required in accordance with AH4 • outline any additional mitigation strategies beyond those required by AH4 to AH14 • be presented to the RAPs for comment. Final reports would be provided to RAPs and to Heritage NSW for their information prior to the commencement of ground disturbing activities in these locations.	Pre-construction impacts	All locations (outside of the previously surveyed heritage survey area)
AH4	A test excavation program would be carried out in the parts of any PADs where direct impact is likely. The purpose of the test excavations would be to determine the presence or absence and significance of subsurface archaeological deposits to inform design development and construction planning. Test excavations works would be carried out in accordance with a methodology that is presented to and consulted on with the RAPs. Test excavation addendum report/s to the ACHAR which would detail findings of the test excavation activities.	Pre-construction impact	PEC-E-PAD01 PEC-E-PAD02 PEC-E-PAD03 PEC-E-PAD04 PEC-E-PAD05 PEC-E-PAD06 PEC-E-PAD08 PEC-E-PAD09 PEC-E-PAD17 PEC-E-PAD18 PEC-E-PAD19 PEC-E-PAD20 PEC-E-PAD21 PEC-E-PAD22 PEC-E-PAD23 PEC-E-PAD24 PEC-E-PAD25

Reference	Mitigation measure	Timing	Applicable location(s)
			PEC-E-PAD26 PEC-E-PAD27 PEC-E-PAD29 PEC-E-PAD35 PEC-E-PAD40
AH5	Harm to scarred trees (including those of cultural significance) would be avoided where possible through design development and construction planning. Scarred trees must only be removed to directly facilitate construction of permanent infrastructure and/or to meet *Vegetation Clearance Requirements at Maximum Line Operating Conditions* (Transgrid, 2003). If the removal of a scarred tree cannot be avoided, the tree would be subject to 3D scanning, followed by salvage of the scarred trunk. The results of this assessment would be reported on in addendum reports. Reports would be provided to RAPs for comment and to Heritage NSW.	Pre-construction impacts	PEC-E-03 PEC-E-42 PEC-E-77 PEC-E-76 PEC-E-17 PEC-E-48 PEC-E-49 Boiling Down Road 1 (AHIMS #56-1-0001) D-B#22; Booroorban (AHIMS #48-5-0022) (confirmation required may already be destroyed)
AH6	All portions of artefact scatters and isolated finds that are to be directly impacted would require surface collection and salvage prior to construction commencement in those areas. Hearths would be the subject of photographic recording and samples taken of hearth material prior to disturbance. Additionally, based on the outcomes of the test excavation, PADs would be subject to surface collection or salvage prior to the commencement of ground disturbing activities within the PAD. The activities would be documented in a salvage report.	Pre-construction impacts	All artefact scatters

Reference	Mitigation measure	Timing	Applicable location(s)
AH7	Aboriginal heritage exclusion zones would be established to protect sites, including: • known features/items of significance that have been identified to remain in-situ throughout construction (and not subject AH6) • scarred trees that are to remain in-situ. • any portions of PADs that become a known site following subsurface testing and which are identified for no impact. Suitable controls would be identified in the heritage management sub-plan, which may include temporary site fencing and sediment control. Aboriginal heritage zones would be demarcated by a suitably qualified archaeologist in consultation with the RAPs prior to the commencement of construction at each location. PADs in locations where vegetation clearing is required but there would be no ground disturbance would be managed through construction methodologies and would not be delineated as exclusion zones. These methodologies would be developed in the heritage management sub-plan.	Pre-construction impacts	All sites confirmed with the final construction impact area and disturbance areas to not be directly impacted
AH8	Any existing access tracks in areas of PAD that require upgrading for use during construction would not be the subject of direct ground disturbance such as grading. The methodology to be used for the upgrade would be designed to avoid this disturbance and may include laying of geotextile on the surface. If avoidance is not possible then additional test excavation would be required and salvage completed as necessary prior to works commencing (in accordance with AH4 and AH6).	Construction	Locations where existing access tracks are required to be upgraded in areas of sites and PADs
AH9	Construction planning and management would make sure that indirect impacts that could potentially result in a loss of known heritage values due to harm would not occur. Indirect harm could result from physical disturbance from surface water drainage or construction workers driving over sites that are to be protected.	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
AH10	Cultural heritage awareness training would be carried out for all personnel working on the proposal prior to the personnel participating in construction activities. The training shall cover features of heritage significance within and adjacent to proposal locations and proposal protocols that must be complied with to minimise and manage potential impacts to those features.	Construction	All locations
AH11	If at any time during construction, any items of potential Aboriginal archaeological or cultural heritage significance, or human remains are discovered outside of previously recorded sites or PAD, they would be managed in accordance with the Aboriginal heritage unexpected finds protocol (refer to Appendix 3 of Technical Paper 2).	Construction	All locations
AH12	A temporary repository of any retrieved archaeological material and Aboriginal objects would be appropriately secured under the care of the archaeological consultant. The strategy for the long-term conservation of salvaged or collected Aboriginal objects would be determined in consultation with the RAPs.	Construction	As relevant
AH13	Features/items of heritage significance that would remain in-situ within the transmission line easement would be mapped and recorded within GIS systems managed by Transgrid and would be entered on the NSW Aboriginal Heritage Information Management System (AHIMS). Relevant Transgrid systems and procedures would be updated as required with protocols that would be implemented during operation to ensure that impacts to the features/items of significance do not occur during maintenance activities.	Operation	Transmission line

10.6.3. Managing residual impacts or uncertainties

The Aboriginal heritage assessment is based on the current identified construction impact area. The assessment aims to develop an understanding of the nature of potential impacts from the proposal and retain a level of flexibility during design refinement relating primarily to final tower locations along the alignment (refer to Chapter 8). During design refinement and finalisation of the construction methodology, the locations of recorded Aboriginal sites and PADs would be used to inform the final location of transmission line structures and construction facilities, with an aim to:

- protect, conserve and/or manage the heritage significance of Aboriginal objects and places to ensure the proposal does not diminish the cultural understanding of Aboriginal people in New South Wales
- avoid or minimise impacts on areas of archaeological potential and scientific significance, where feasible and reasonable. Where this is not possible areas of moderate or high archaeological potential and significance are prioritised for avoidance or impact minimisation.

As discussed in Section 10.2.2, further archaeological investigation such as subsurface testing is proposed to be undertaken by Transgrid prior to the end of the EIS assessment process to confirm the potential for impacts on Aboriginal sites. A methodology has been prepared and has been provided to RAPs for comment. Following further archaeological investigation and design refinement, the potential for direct impacts on known Aboriginal heritage sites would be better understood.

Where known Aboriginal sites are be located close to construction or maintenance activities for the proposal, mitigation measures to protect the sites from accidental impacts would be implemented such as clear mapping of sites on construction plans and use of high visibility fencing to mark exclusion zones.

Where direct impacts to sites cannot be avoided during design and construction methodology refinement, mitigation measures would be implemented to minimise the potential impacts on Aboriginal heritage, such as surface salvage of artefacts or a program of salvage excavations in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010).

11. Historic heritage

This chapter provides a summary of the assessment of potential historic heritage impacts of the proposal, and identifies mitigation measures to address these impacts. This chapter summarises relevant sections of the *Historic Heritage Assessment Report,* which has been prepared by Navin Officer Heritage Consultants (Navin Officer, 2021b) (refer to Technical paper 3).

11.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to historic heritage and where these requirements are addressed in this EIS are outlined in Table 11-1.

Table 11-1 Secretary's environmental assessment requirements – historic heritage

Ref.	Secretary's environmental assessment requirements	Where addressed
Heritage		
Key issues	The EIS must address the following matters: • an assessment of the Aboriginal and historic heritage (cultural and archaeological) impacts of the project.	Sections 11.4 and 11.5 and Technical paper 3 provide an assessment of historic heritage impacts. Consideration of Aboriginal heritage impacts of the proposal is provided in Chapter 10 and Technical paper 2.

11.2. Assessment approach

11.2.1. Legislative and policy context

The *Heritage Act 1977* (Heritage Act) provides for the protection of heritage items within NSW and establishes the State Heritage Register and associated heritage assessment criteria for assessing State or local heritage significance. The EPBC Act also provides for the protection of heritage items of national significance, or matters of national environmental significance (MNES).

The assessment of potential impacts to historic heritage was completed with consideration to the following guidelines:

- *Assessing Heritage Significance* (OEH, 2015)
- *Assessing Significance for Historical Archaeological Sites and 'Relics'* (NSW Department of Planning (Heritage Branch, 2009)
- *Altering Heritage Assets* (Heritage Council, undated)
- The Australian International Council on Monuments and Sites Charter for Places of Cultural Significance (also known as the Burra Charter; Australian ICOMOS, 2013), which defines cultural significance as 'aesthetic, historic, scientific, social or spiritual value for past, present or future generations' and provides relevant criteria to assess cultural significance.

11.2.2. Methodology

The study areas for the assessment of historic heritage included:

- an historic heritage study area used for searches of relevant databases, including a one kilometre buffer on the centreline of the proposal study area (refer to Chapter 8)
- an historic heritage survey area for the completion of a walkover (discussed further below), which was based generally on the construction impact footprint (refer to Chapter 8 for definition of the construction impact footprint) noting that some areas adjacent to the construction impact area were also surveyed in some areas.

The methodology for the assessment of historic heritage included the following key tasks:

- reviewing the legislation and policy context relevant to assessing historic heritage
- reviewing relevant historical information including regional and local histories, heritage studies and theses, historical maps to understand the historical heritage context
- undertaking desktop searches of relevant heritage registers and schedules including:
  - World Heritage List
  - National Heritage List (Department of Agriculture, Water and the Environment)
  - Commonwealth Heritage List (Department of Environment and Energy)
  - State Heritage Register (Heritage NSW, Department of Premier and Cabinet)
  - Section 170 Heritage and Conservation Registers, including the DPIE Historic Heritage Information Management System (HHIMS)
  - relevant local environmental plans (LEPs) for the Wentworth Shire, Balranald Shire, Murray River, Edward River, Hay Shire, Murrumbidgee, Federation, Lockhart Shire and Wagga Wagga City LGAs
- undertaking a field walkover survey to validate the results of the desktop assessment and identify any potential areas of archaeological sensitivity. Due to landowner access restrictions, it was not possible during the assessment period to survey the full length and extent of the identified survey area. Figure 1.4 of Technical paper 3 shows areas that have not been physically surveyed. Overall, 470 kilometres of the around 537 kilometres route has been surveyed. In the case of the remaining areas where physical survey was not able to be completed, relevant locations of interest were viewed from the nearest available vantage point such as a road, maps and aerial photos
- assessing potential direct and indirect impacts to historic heritage based on the construction impact area (refer to Chapter 8)
- recommending mitigation and management measures to minimise the potential impacts identified.

Further discussion of the methodology for the historic heritage assessment is provided in Chapter 3 of Technical paper 3.

11.3. Existing environment

11.3.1. Historic heritage context

European explorers first travelled through the Wagga Wagga area in 1824-25, with exploration of the NSW river systems in 1829. The Surveyor General passed through the area noting that much of the areas were settled in 1836. From the late 1830s to the 1850s, large tracts of land along the Murrumbidgee and Murray Rivers began to be taken up by European settlers, who, like the explorers, followed the rivers inland. Pastoral runs were established along river and creek frontages.

Until the mid-1850s, the primary means of transporting goods and supplies to inland pastoral properties was by cart and dray, or wagons drawn by horse or bullock teams, with wool and other produce carried on the return trip. Steamboat navigation of the Murray River commenced in mid-1853, and the Murrumbidgee by mid-1858 Pastoral leases were granted along the length of the study area with the management of them changing in 1884.

The importance of river transport declined following the advent of the railways, which opened up new social and economic opportunities for rural communities. The Southern Line, also known as the Southern Main Branch Line, was constructed in stages between 1855 and 1881, from Parramatta Junction (Granville) to Albury near the Victorian border and was connected to the Victorian Railways in 1883. The Tocumwal branch line ran between Narrandera to Tocumwal. It opened to Jerilderie in 1884, and was extended to Berrigan (in 1896), Finley (1898) and Tocumwal (1914).

The towns and villages, due to the marginal climatic conditions across much of the heritage study area, have swelled and shrunk over the years due to changes in economic production, drought and transport changes. The town of Buronga has developed as part of the Tapio lease which was originally granted in 1847, and officially declared a village in 1939. Gol Gol was proclaimed as a township in 1866 and became an important coach and steamer stop. Lockhart was settled in 1878 with the railway reaching in 1899. Uranquinty, first known as the village of Glenrouth, was originally a railway siding. Stores and services developed around the railway station, where local farmers would bring their wheat to be shipped to Sydney.

Wagga Wagga was gazetted as a village on 23 November 1849. Before that during the 1830s and 1840s many of the first settlers to the Wagga Wagga area were convicts. The extension of the NSW railway line to Wagga Wagga during the late 1870s and early 1880s increased wheat production. The extension of the railway line made it possible to export wheat, as wheat is bulky and heavy, out of the region for sale in Sydney. The wheat belt was established by 1901 as the main producer of the grain in NSW.

11.3.2. Listed heritage items

No items of World, National, Commonwealth or State Heritage significance were identified in the historic heritage study area. One item that is on the DPIE Historic Heritage Information Management System (HHIMS) is partially located within the heritage study area. An additional five items of local heritage significance are also located within this area. Table 11-2 and Figure 11-1 provide further detail on these items.

Table 11-2 Heritage listed items within the historic heritage study area

Item name	Listing	Category	Location relevant to the historic heritage study area	Summary of heritage significance
Burial Ground	Balranald LEP 2010 (I7)	Item – Aboriginal	Within	Pre-contact burial ground on the northern shore of Lake Benanee. No heritage listing sheet for the site is available. The item is of local heritage significance.
Yanga Pastoral Station Complex	s170 National Parks and Wildlife Service (HHIMS Item ID 10607)	Complex	Partially within	The complex has been divided into different precincts; the historic heritage study area crosses two of these, the Yanga Homestead and Willows precincts. The HHIMS identifies that the item meets the threshold for State significance although the item is not currently listed on the State heritage register. The Yanga homestead group demonstrates the full range of buildings, gardens and infrastructure needed for self-sufficiency. This is a rare example, intact and publicly accessible with educational and research potential. The main building shows aesthetic excellence as an Australian homestead with refined overall design and detailing. The sheep yards within the Willows Precinct (HHIMS #10626) are described as "wooden fences with wire fences, pine, hand axed". The sheep yards have not previously been assessed as an element of this heritage item. It is considered to have moderate heritage significance. The yard is similar to other sheep yards within the complex and is representative of the pastoral history of the property. While it does not fulfill the criteria for local significance on its own, it contributes to the overall significance of the site.

Item name	Listing	Category	Location relevant to the historic heritage study area	Summary of heritage significance
Wyadra Grave Site	Wagga Wagga LEP 2010 (I285)	Item – General	Within	No supporting evidence is recorded. The item is of local heritage significance.
Liquid Explosive Store	Wagga Wagga LEP 2010 (I287)	Item – General	Within	Recorded as a brick building with gable ended walls (forming parapets) at either end, and a corrugated iron roof. There are bands of horizontal windows with frosted glass. The Explosives Store is of brick and timber with a hip roof supported on timber brackets. The site is also recorded as having a mass of piles of debris and concrete slabs. The historical significance is as a remnant of the RAAF School and Migrant Camp which were previously located here. The item is of local heritage significance.
Ivydale Woolshed	Wagga Wagga LEP 2010 (I73)	Item – General	Within	No supporting evidence is recorded. The item is of local heritage significance.
Ivydale	Wagga Wagga LEP 2010 (I72)	Item – General	Within	No supporting evidence is recorded. The item is of local heritage significance.

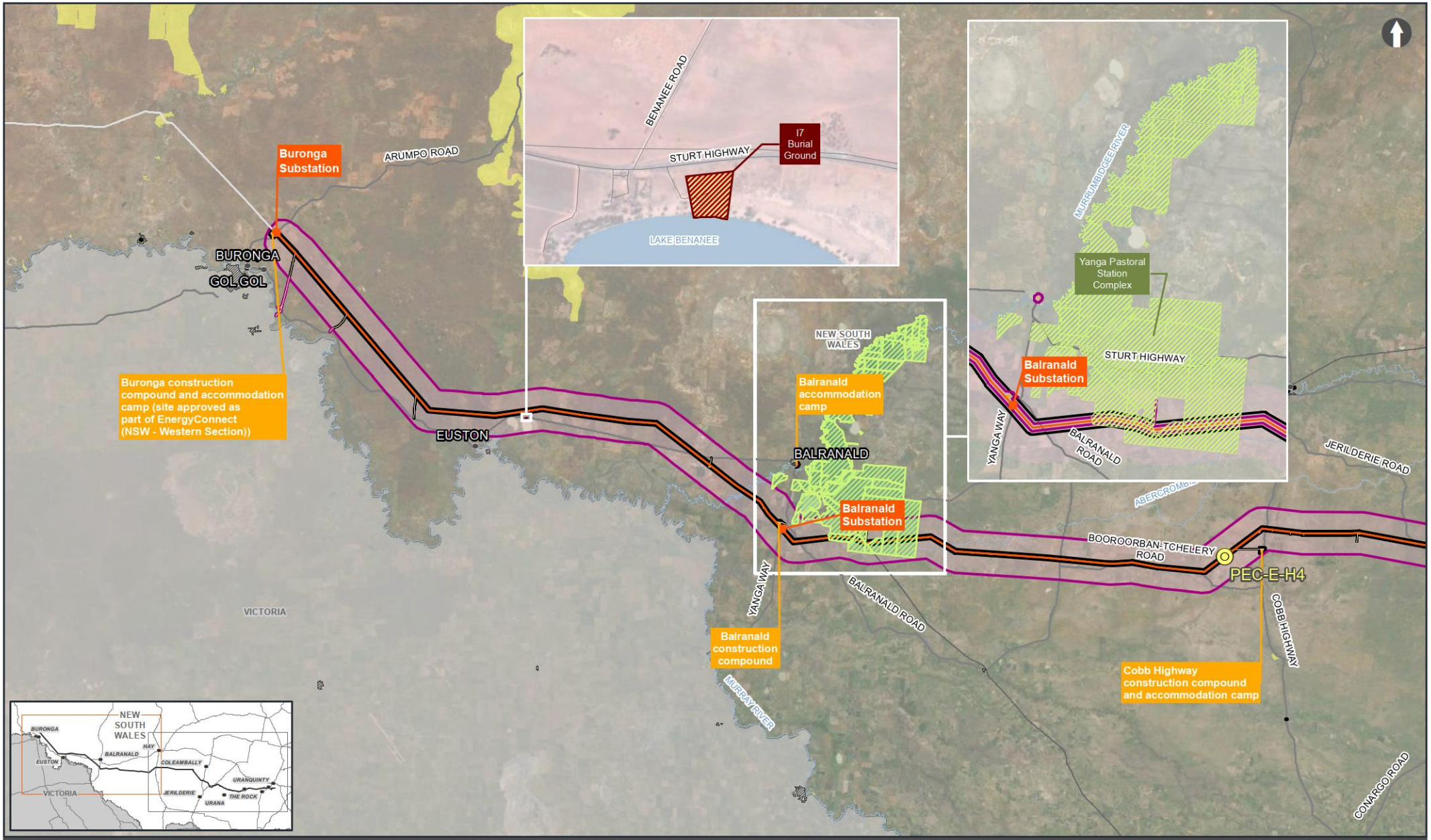

Figure 11-6

Location of listed and previously unrecorded heritage items relevant to the proposal study area

EnergyConnect (NSW - Eastern Section)
EnergyConnect (NSW - Western Section)
Main Construction Compounds and Accommodation Sites
Heritage Study Area
Proposal Study Area
Access Tracks
Existing Substation
Built Up Areas
Waterbody
Potential Historical Item
Listed Heritage Item Curtilage
LEP Sites
Historic Heritage Information Management System Site

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Source: NSWSS, ESRI, Transgrid, WSP

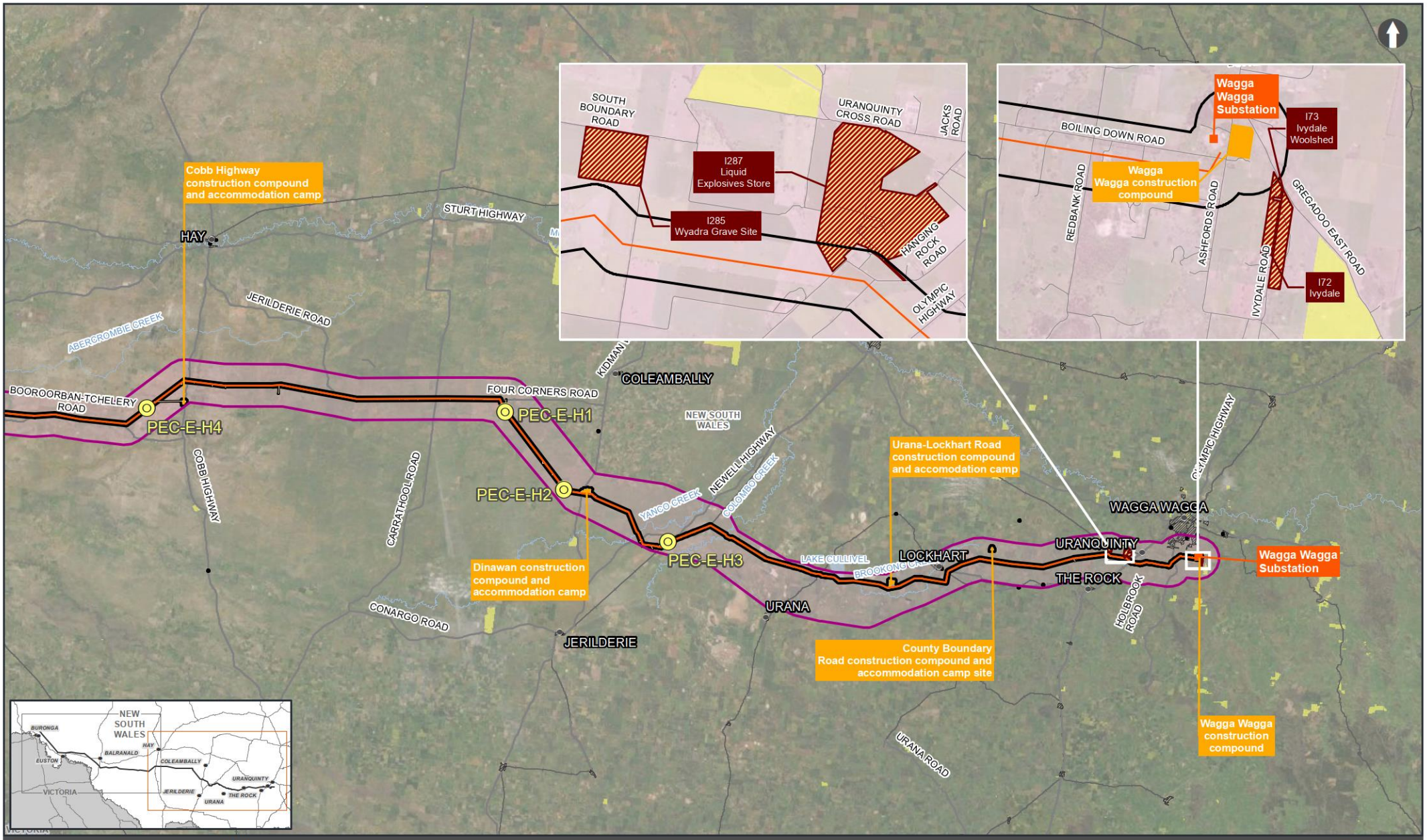

Figure 11-6

Location of listed and previously unrecorded heritage items relevant to the proposal study area

Sheet 2 of 2

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Source: NSWSS, ESRI, Transgrid, WSP

11.3.3. Previously unrecorded heritage

In addition to the listed heritage items identified, three new potential historical heritage items and two new historical archaeological sites were identified during the field survey and historical research as being located within the historic heritage survey area.

11.3.3.1. Survey marker tree (PEC-E-H1)

A survey marker tree (PEC-E-H1) (refer Figure 11-2) was identified within the historic heritage survey area in the locality of Mabins Well. The tree is a eucalypt species of an estimated eight metres height and is dead. The tree has a scar with “BM 196 CN” on it, the scar measures 55 x 40 centimetres and faces southeast.

The scar also has hatchet marks on it. “BM” indicates it is a benchmark tree and is likely associated with Murrumbidgee irrigation district. BM trees usually refer to features surveys such as for terrain or river surveys.

Figure 11-2 Photos of heritage survey marker tree (PEC-E-H1)

An assessment of the significance of this item was completed in accordance with the Assessing Heritage Significance (OEH, 2015) guidelines and determined to achieve the criteria for local significance due to its increasingly rare occurrence and being uncommon within the landscape.

11.3.3.2. Survey marker tree (PEC-E-H2)

Another survey marker tree (PEC-E-H2) was identified within the historic heritage survey area. The tree is a black box of an estimated 10 metres high. The tree has a scar with “BM FH 445” on it, the scar measures 64 x 29 centimetres and faces south. The scar also has hatchet marks on it, shown in Figure 11-3.

Figure 11-3 Photos of heritage survey marker tree (PEC-E-H2)

An assessment of the significance of this item was completed in accordance with the Assessing Heritage Significance (OEH, 2015) guidelines and determined to achieve the criteria for local significance due to its increasingly rare occurrence and being uncommon within the landscape.

11.3.3.3. Bundure railway station artefact scatter (PEC-E-H3)

Bundure railway station artefact scatter (PEC-E-H3) covers an area of approximately 15 x 15 metres. It comprises fragmented artefacts including glass, ceramics, buttons, and building material (stone and brick fragments) and rail spikes exposed along the current fence line and around the base of a pepper tree was observed (Figure 11-4). This is the possible location of a residence associated with the former railway station located near the disused Tocumwal railway line. It is located approximately 300 metres northeast of the Bundure station, which opened in 1884. The remnants of the station platform and identification sign are still visible (Figure 11-5).

Figure 11-4 Photos of an artefact scatter (PEC-E-H3)

Figure 11-5 Photo of the station platform and identification sign at Bundure railway station (PEC-E-H3)

An assessment of the significance of this item was completed in accordance with the Assessing Heritage Significance (OEH, 2015) guidelines and determined that the artefact scatter has moderate potential to yield information about the people who lived and worked adjacent to the Bundure railway station from the late 19th century to the mid-20th century.

11.3.3.4. Hut site, Nyangay pastoral holding (PEC-E-H4)

A review of the Nyangay pastoral map, identified the site of two huts, a tank and cultivation paddock (PEC-E-H4) on the Bald Hill Run (Portions 5 and 12, Parish of Quandong, County of Townsend) (refer Figure 11-6). It is located within a section of the historic heritage study area which has not been surveyed due to landholder access restrictions.

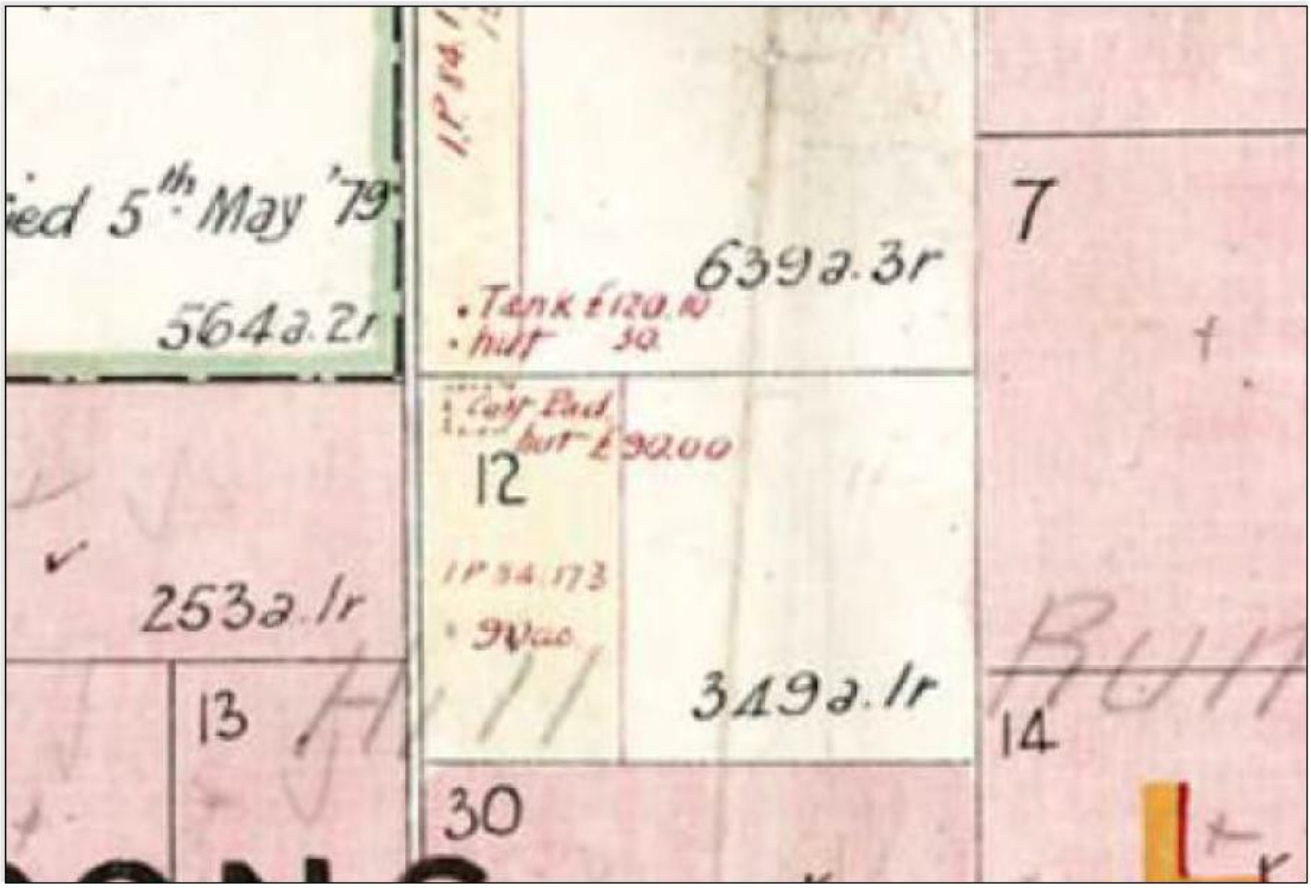

Figure 11-6 Details of plan showing two huts, tank and cultivation paddock on Bald Hill Run (PEC-E-H4)

The site was identified from archival research reviewing historical maps of pastoral runs and consequently there is insufficient data to assess the significance of the site at this stage. It is likely to present as an archaeological site only and visual inspection is required once site access is available to confirm status of the item.

11.3.4. Archaeology

Based on the review of the historical context of the historic heritage study area and that no previously unrecorded archaeology was identified during the field survey, the potential for archaeology is considered to be low. The archaeological survey area included the construction impact area defined in Chapter 8, where land access was available. Further survey would be required to determine the likelihood of occurrence and significance of archaeology in areas outside of the historic heritage survey area.

11.4. Potential impacts – construction

11.4.1. Listed and previously unrecorded heritage items

Impacts to heritage items from construction of the proposal can include direct (disturbance) and indirect impacts. Direct impacts generally result from changes to site environment, including vegetation removal, excavation or impacts from vibration caused by construction plant and equipment, which can result in a loss of heritage value.

Indirect impacts may occur where views to and from significant sites are altered, resulting in a loss of the heritage value of the site.

A summary of the listed and previously unrecorded heritage items identified above, and the potential direct and indirect impacts from the proposal is outlined in Table 11-3.

Table 11-3 Impact assessment of historic heritage items

Site name	Item ID	Significance	Potential impacts
Burial Ground	Balranald LEP 2010 (I7)	Local	No impact expected. This heritage item is 250 metres away from the construction impact area and would not be impacted by the proposal. No visual impact is expected due to the existing vegetation screening.
Yanga Pastoral Station Complex	HHIMS Item ID 10607	Local (State threshold met but not formally listed)	Potential partial impact. The construction impact area traverses the Willows and Yanga Homestead precincts of this heritage listed property. The major historical elements such as the homestead complex would not be directly impacted by the proposal and would only have a minor impact on the heritage significance of this item. The sheep yards within the Willows Precinct (items not specifically listed on the HHIMS) would be located within the construction impact area (disturbance area A and B) and there would be an impact on the significance of the item. The sheep yards would be located in the proposed easement section (disturbance area B subset). The item is identified as being set back from the proposed tower locations based on the current design however depending on the finalisation of design and easement requirements direct impact to this item is possible. The proposed alignment would avoid visual impact to the Yanga homestead which is some distance away and its location adjacent to the existing easement means that any long-term visual impact is minimised and confined to the southern portion of the property.

Site name	Item ID	Significance	Potential impacts
PEC-E-H1 (survey marker tree)	Previously unrecorded	Local	Potential partial or full (significant) impact. The tree is within the construction impact area and on the boundary between the disturbance area A and B subset areas. Depending on the design finalisation this tree may require removal or trimming to a height required to meet vegetation clearing requirements (noting that the tree is dead and future growth not expected). The transmission line would be visible following construction, however the impact would have negligible impact which would further reduce over time as revegetation occurs.
PEC-E-H2 (survey marker tree)	Previously unrecorded	Local	No impact expected. This tree is about 50 metres outside the construction impact area and would be protected from accidental damage during construction. Visual impact is considered negligible.
PEC-E-H3 (Bundure Railway Station dwelling artefact scatter)	Previously unrecorded	Local	Potential full (significant) impact (subject to design finalisation). The site is located on the edge of the construction impact area, impact would be avoided by creating a fenced exclusion zone around the artefacts scatter during construction. If impact cannot be avoided as a result of design finalisation the site should be subject to archaeological salvage. The visual impact would not affect the significance of the archaeological deposit.
PEC-E-H4 (Hut site, Nyingay pastoral holding)	Previously unrecorded	Local	Potential full impact. Significance of impact is still to be determined. The site is located within the construction impact area. Finalisation of the design and construction methodology would attempt to avoid or minimise direct impacts to this item. The design finalisation would include options for siting the tower and access track design to minimise impacts.
Wyadra grave site	Wagga Wagga LEP 2010 (I285)	Local	No impact expected. This site is located within a rural paddock and could not be sighted from the nearest vantage point along the paddock boundary. It is over 500 metres from the construction impact area. The proposal would, as is the case with the current transmission line X5 in the area, be barely visible from this heritage item resulting in no indirect impacts.

Site name	Item ID	Significance	Potential impacts
Liquid explosives store, Uranquinty	Wagga Wagga LEP 2010 (I287)	Local	No impact expected. The item is 40 metres from the construction impact area. The survey team did not have access to this property so was unable to confirm whether or not the physical structure still exists. The property was however viewed from the road/property fence line and no structure as described on the heritage listing was visible. Regardless of whether or not the structure still exists, the proposal location would have no direct or indirect impact (including visual) on this item.
Ivydale woolshed	Wagga Wagga LEP 2010 (I73)	Local	No impact expected. The woolshed is located close to the existing Wagga Wagga substation which is proposed for expansion. The property is 340 metres from the construction impact area. The item would not be directly or indirectly impacted by the proposal.
Ivydale	Wagga Wagga LEP 2010 (I72 & I73)	Local	No impact expected. The homestead is close to the existing substation which is proposed for expansion. The property is 150 metres away from the construction impact area. The item would not be directly or indirectly impacted by the proposal. The substation is likely to be visible from parts of the Ivydale property, however due to existing vegetation it would not be visible from the homestead.

11.4.2. Archaeology

Historic heritage archaeology was not identified within the archaeological survey area, and the potential for archaeology is considered to be low to nil. Mitigation measures would be implemented to manage unexpected finds for the proposal.

Should the construction impact area of the proposal extend beyond the archaeological survey area, further assessment would be required to determine the likelihood of occurrence and significance of potential archaeology and impacts from the proposal.

11.5. Potential impacts – operation

The indirect (visual) impacts of the proposal has been considered in Table 11-3.

Maintenance activities required for operation of the proposal would not be expected to result in any additional disturbance to the identified items. No additional direct impacts to historic heritage would therefore be expected to occur during operation of the proposal.

11.6. Management of impacts

11.6.1. Environmental management

Environmental management for the proposal would be carried out in accordance with the approach detailed in Chapter 24 (Environmental management). For construction, this would include a detailed construction heritage management sub-plan. This sub-plan would be based on the final construction methodology, and would detail (as a minimum):

- appropriate heritage mitigation measures, including identification, protection and/or management of heritage items/sites within or adjacent to construction areas (including additional investigations, recordings, or measures to protect items/sites that would not be directly impacted in the vicinity of construction works)
- procedures for unexpected finds, including procedures for dealing with human remains
- heritage monitoring and compliance management
- induction requirements for construction personnel.

11.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to non-Aboriginal heritage are listed in Table 11-4.

Table 11-4 Mitigation measures – Historic heritage

Reference	Mitigation measure	Timing	Applicable location(s)
NAH1	The final construction methodology would be developed to avoid or minimise harm to heritage items PEC-E-H1 (Survey Marker Tree) and the sheep yards on the Yanga Pastoral Station Complex as far as practicable. If harm to these items can be avoided, temporary exclusion fencing would be installed to protect any elements of these items to be retained during construction. If harm to the sheep yards on the Yanga Pastoral Station Complex cannot be avoided, consultation would occur with NPWS. Where requested, archival recording of the sheep yards would occur, and the records would be provided to NPWS.	Pre-construction and construction	Transmission line

Reference	Mitigation measure	Timing	Applicable location(s)
NAH2	The final construction methodology would be developed to avoid ground disturbance within the curtilage of PEC-E-H3 (Bundure railway station dwelling artefact scatter) where practicable. If ground disturbance within the curtilage can be avoided, temporary exclusion fencing would be installed to protect relevant parts of the item from harm during construction. If ground disturbance within the curtilage cannot be avoided during construction, the parts of the artefact scatter that could be harmed would be salvaged and analysed and managed in accordance with their determined significance, prior to the commencement of any activity that could harm the heritage items present.	Pre-construction and construction	Transmission line
NAH3	The locations of known heritage items in close proximity to the construction impact area and the relevant protocols to avoid and manage any potential harm to the items would be communicated to all relevant construction personnel prior to construction commencing in that area.	Pre-construction and construction	Transmission line
NAH4	PEC-E-H4 would be subject to heritage survey and assessment when site access is available. If the site is found to contain or has the potential to contain features of heritage conservation significance, the final construction methodology would be adjusted as far as practicable to avoid harm. If harm can be avoided, temporary exclusion fencing would be installed to protect relevant parts of the site during construction. If parts of the site that contain or have the potential to contain features of heritage conservation significance would be subject to ground disturbance during construction, an archaeologist would recommend appropriate measure mitigation/management measures, which might include archaeological excavation and salvage (where appropriate). The archaeologist's recommendations would be implemented prior to the commencement of any activity that could harm the features of heritage conservation significance.	Pre-construction and construction	Transmission line
NAH5	During design refinement, the final location of transmission line structures and construction facilities would be determined with the aim to avoid or minimise impacts on all items assessed as having heritage significance, where feasible and reasonable. Items of moderate or high significance would be prioritised for avoidance or impact minimisation. Where impacts are not avoided, further assessment by an archaeologist would occur and be documented in an addendum non-Aboriginal heritage assessment.	Pre-construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
NAH6	If at any time during construction, any items of potential historic heritage archaeological significance, or human remains are discovered, they would be managed in accordance with an unanticipated discovery protocol that is aligned with the protocol in Appendix 1 of Technical paper 3.	Construction	All locations
NAH7	Features/items of heritage significance that would remain in-situ within the transmission line easement and along access tracks would be mapped and recorded within GIS systems managed by Transgrid to reduce the potential for inadvertent impacts to occur during maintenance activities.	Operational	Transmission line and access tracks
NAH8	Relevant Transgrid systems and procedures would be updated as required with protocols to avoid harm to heritage items and implemented during operation.	Operational	Transmission line and access tracks

11.6.3. Managing residual impacts or uncertainties

Following the implementation of mitigation measures, further impacts to heritage items identified in this assessment are not anticipated.

Whilst the assessment concluded there is a low risk of impacts to historical archaeology, some potential for relics to be encountered during construction of the proposal would remain. In these instances, the process of mitigation outlined above would be implemented for the proposal to prevent residual impacts occurring.

The historical heritage impact assessment is based on several assumptions to develop an understanding of potential impacts to heritage and retain flexibility during design refinement. This includes consideration of the construction impact area. During design refinement, the final location of transmission line structures and construction facilities would be determined with the aim to avoid or minimise impacts on all areas assessed as having heritage significance, where feasible and reasonable. Where impacts are not avoided, further assessment by an archaeologist would occur and be documented in an addendum non-Aboriginal heritage assessment.

12. Land use and property

This chapter considers the potential land use and property implications of the proposal and identifies mitigation measures to address these impacts. This chapter also includes a summary of the *Agricultural impact assessment* (Tremain Ivey Advisory, 2021) (refer to Technical paper 4).

12.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to land use and property and where these requirements are addressed in this EIS are outlined in Table 12-1.

Table 12-1 Secretary's environmental assessment requirements – land use and property

Ref.	Secretary's environmental assessment requirements	Where addressed
Land		
Key issues	The EIS must address the following matters:	
	• an assessment of impacts of the project on soils and land capability of the site and surrounds	Section 12.3.6 discusses the land capability of the site and surroundings Chapter 21 provides a further assessment of impacts of the proposal on soils.
	• assessment of impact of the project on agricultural land, Crown lands, travelling stock reserves, mineral resources and exploration licenses, rail reserves and pipeline corridors	Sections 12.4 to 12.5 discuss the impacts on agricultural land, Crown lands, travelling stock reserves, mineral resources and exploration, rail reserves and pipeline corridors. An existing pipeline corridor for a high pressure gas main is also discussed in Section 20.4.3.

12.2. Assessment approach

12.2.1. Legislative and policy context

Potential land use and property impacts resulting from the proposal, including potential agricultural impacts, were assessed in line with the following legislation and key guidelines:

- *Crown Lands Management Act 2016*, which sets out the requirements for ownership, use and management of Crown Land, including land which is subject to perpetual Western land leases. This includes the permissions and authorisations needed when planning the development of activities on Crown land.

- *Land Acquisition (Just Terms Compensation) Act 1991*, which provides a mechanism for the compulsory acquisition of land and the payment of compensation on just terms, in line with market value for the acquisition of land (including easements). The Act encourages the acquisition of land by agreement rather than compulsory processes, where possible.

- *Biosecurity Act 2015*, which provides a framework for the prevention, elimination and minimisation of biosecurity risks on public and private land and establishes that all people have a general biosecurity duty. The NSW DPI holds the primary responsibility for management of biosecurity under this Act.

- *Soil Conservation Act 1938*, which makes provisions for the conservation of soil resources and farm water resources, enables areas to be designated as 'areas of erosion hazard' and allows the Soil Conservation Commissioner to issue notices aimed at preventing soil erosion or land degradation.

- *Local Land Services Act 2013*, which establishes regional LLS who are responsible for the integrated management of LLS including agricultural production, biosecurity, travelling stock reserves (TSRs) and other related aspects.

- *Murray Regional Environmental Plan No 2—Riverine Land 1994,* which aims to conserve and enhance the riverine environment of the River Murray for the benefit of all users. The EIS is consistent with the objectives of the plan, as it ensures appropriate consideration of potential environmental impacts of the proposal.

- *State Environmental Planning Policy (Primary Production and Rural Development) 2019* (the Rural SEPP), which aims to reduce land use conflicts and sterilisation of rural land. State significant agricultural land is listed under Schedule 1, however, the schedule does not list any state significant agricultural land at present.

- relevant LEPs for the Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart Shire and Wagga Wagga LGAs which provide land zoning and local development controls for each LGA. However, as the proposal is subject to assessment under Division 5.2 of the EP&A Act, the proposal is not subject to environmental planning instruments such as the LEPs or the Rural SEPP (refer to Appendix C for details).

- other policies and guidelines that provide more specific guidance including:

    - NSW Invasive Species Plan 2018-2021 (DPI, 2018)
    - Western Regional Strategic Weed Management Plan 2017-2022 (Western LLS, 2017)
    - Western Regional Strategic Pest Animal Management Plan 2018-2023 (Western LLS, 2018)
    - Far West Regional Plan 2036 (DPE, 2017b)
    - Riverina Murray Regional Plan 2036 (DPE, 2017c)
    - Murray Regional Strategic Weed Management Plan 2017-2022 (Murray LLS, 2018a)
    - Murray Regional Strategic Pest Animal Management Plan 2017-2022 (Murray LLS, 2018b)
    - Riverina Strategic Weed Management Plan 2017-2022 (Riverina LLS, 2018a)
    - Riverina Strategic Pest Animal Management Plan 2018-2023 (Riverina LLS, 2018b)
    - Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land (OEH, 2013a).

12.2.2. Methodology

The land use and agriculture study area comprises a generally four-kilometre-wide corridor between the Buronga substation and the Wagga Wagga substation.

The methodology adopted for the land use and property assessment included:

- reviewing the legislation and policy context for assessing land use and property impacts
- identifying and mapping existing land uses within the land use and agriculture study area based on a desktop review of spatial data, aerial photography, land use zoning maps and other available information
- analysing and describing the existing environment including:
  - geographical factors such as climate, topography and soils that influence land use within the land use and agriculture study area
  - measures such as land and soil capability, land use and value of production, that can help evaluate the nature and productivity of agricultural enterprises in the land use and agriculture study area, which is the dominant land use
- consulting with relevant stakeholders and landholders including:
  - landholder consultations and property inspections at six representative properties occurred on 26, 27 and 28 July 2021 to understand landholder's perspectives of the potential impacts of the proposal on agricultural land uses
  - consulting with biosecurity officers from Western (Wentworth), Murray and Riverina LLS as well as Wentworth Shire Council, Hay Shire Council, Murrumbidgee Council, Federation Council and Wagga Wagga City Council to understand potential biosecurity risks within and surrounding the land use and agriculture study area
  - general consultation with potentially affected landholders to encourage feedback on potential land use and property impacts (refer to Chapter 7)
- assessing land use and property impacts, with a specific focus on agricultural land uses
- recommending mitigation and management measures to minimise the potential impacts identified.

12.3. Existing environment

12.3.1. Existing land uses and zoning

12.3.1.1. Primary land uses

The land use and agriculture study area is primarily zoned as RU1 Primary Production. Additional land zones which the proposal would pass through include:

- one small area is zoned E1 National Parks and Nature Reserves within Yanga State Conservation Area (also alternatively referred to as the Murrumbidgee Valley State Conservation Area)
- two small areas are zoned E2 Environmental Conservation north of the Sturt Highway towards the western end of the land use and agriculture study area
- two small areas zoned RU3 Forestry
- three roads zoned SP2 Infrastructure where they are intersected by the land use and agriculture study area.

Wentworth, Balranald, Hay, Jerilderie and Lockhart act as local centres for business, retail, some health care and recreation for the surrounding smaller settlements and villages. Wagga Wagga is dubbed the largest inland city of NSW and services the larger regional community.

Land use within and surrounding the land use and agriculture study area is mainly for agricultural purposes (over 93 per cent of the land use and agriculture study area), which is dominated by sheep grazing for wool and meat, cattle grazing and dryland cropping. To the west of Urana grazing livestock is the dominant agricultural use, while to the east of Urana, agricultural land is dominated by mixed dryland cropping and livestock grazing. Aerial agriculture (such as aerial spreading of fertilisers and aerial spraying) is extensively used in the mixed dryland farming areas east of the Urana area, and on irrigated cropping lands. Aerial agriculture is considered to be less common in the western part of the land use and agriculture study area. Additionally, the use of drones for mustering and monitoring in rangeland areas is increasing. The use of drones for monitoring crops (including horticulture) is also increasing.

Existing land uses within the land use and agriculture study area are summarised in Table 12-2 and shown on Figure 12-1.

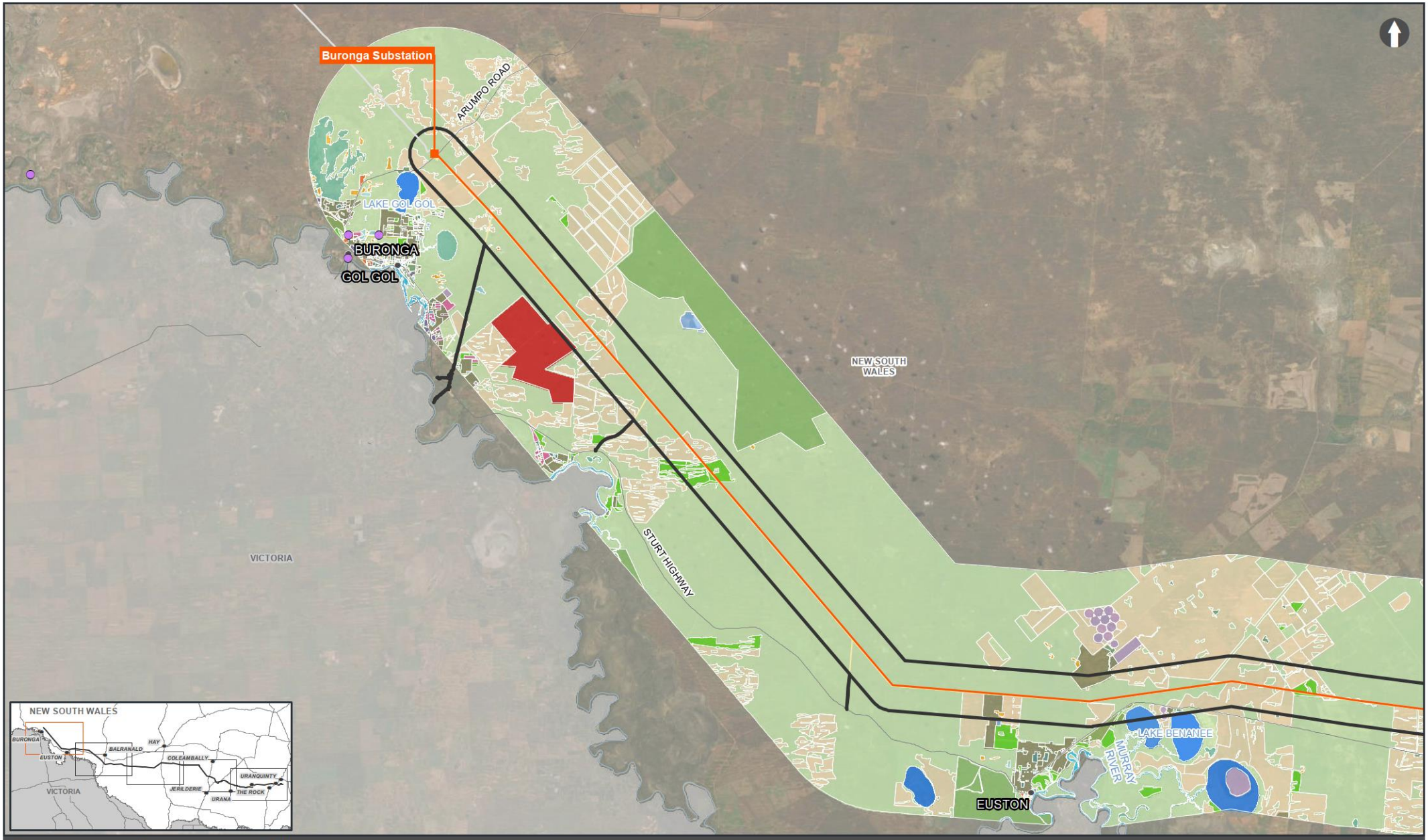

Figure 12-1

Land use within the proposal study area

Sheet 1 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

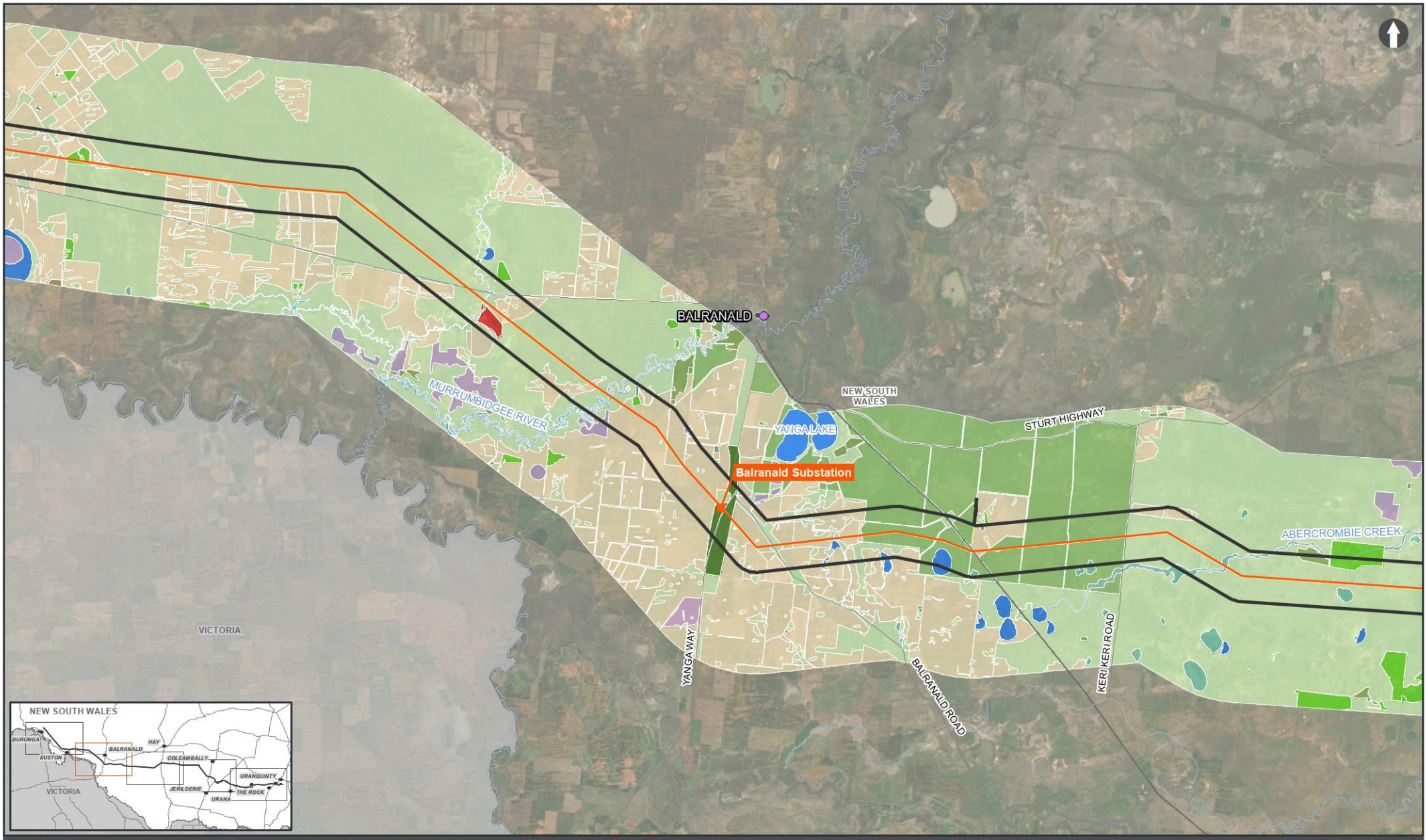

Figure 12-1

Land use within the proposal study area

Sheet 2 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

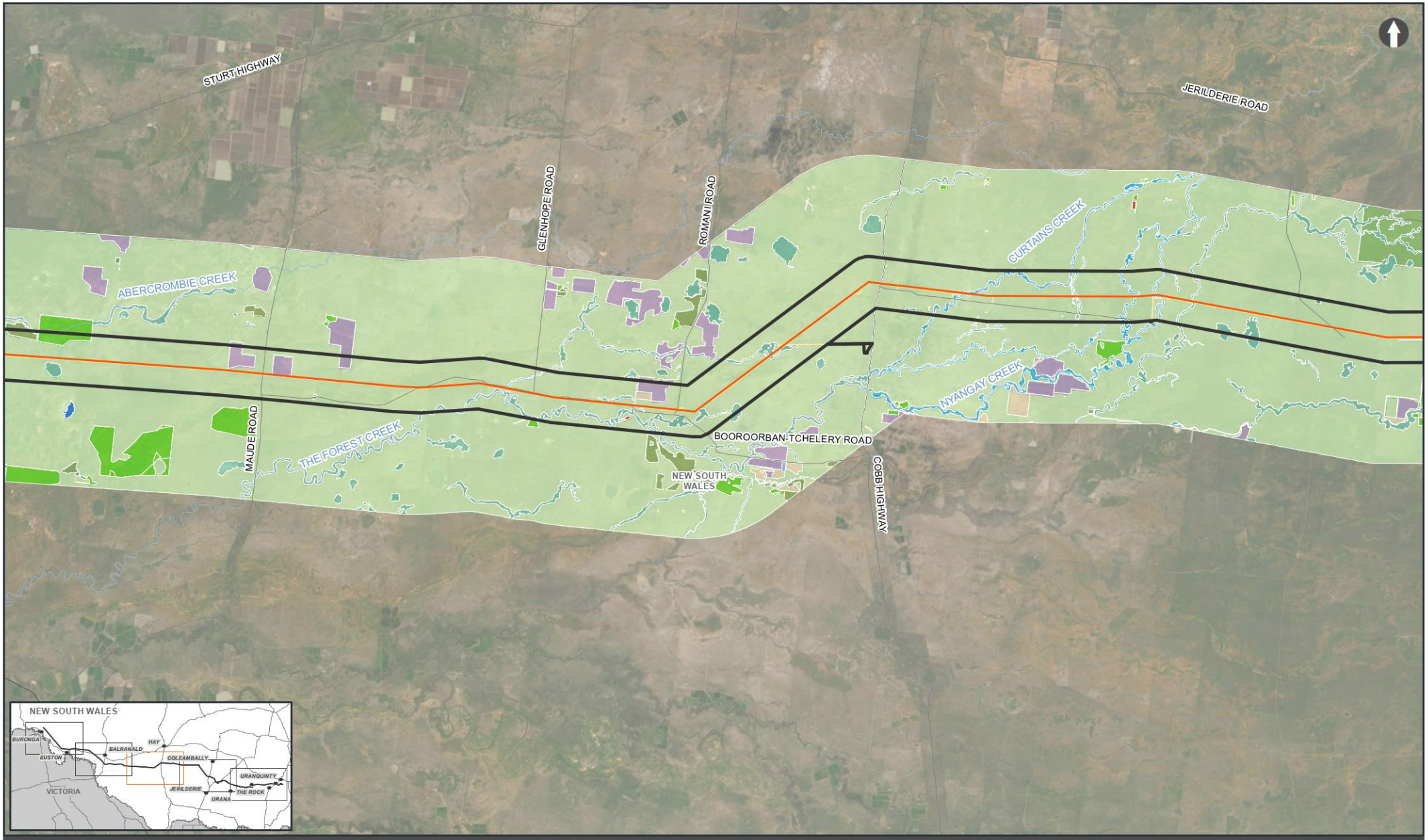

Figure 12-1

Land use within the proposal study area

Sheet 3 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

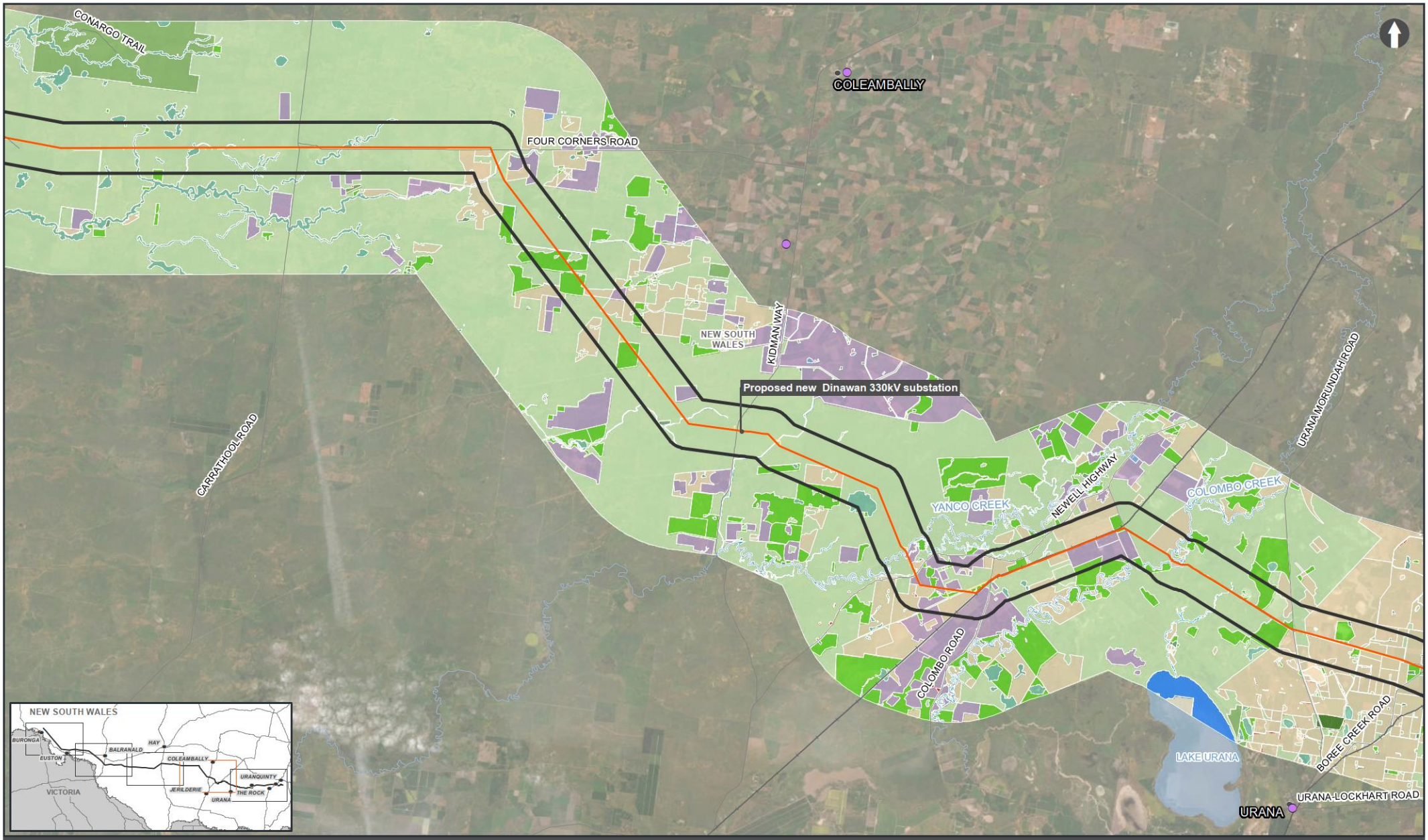

Figure 12-1

Land use within the proposal study area

Sheet 4 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

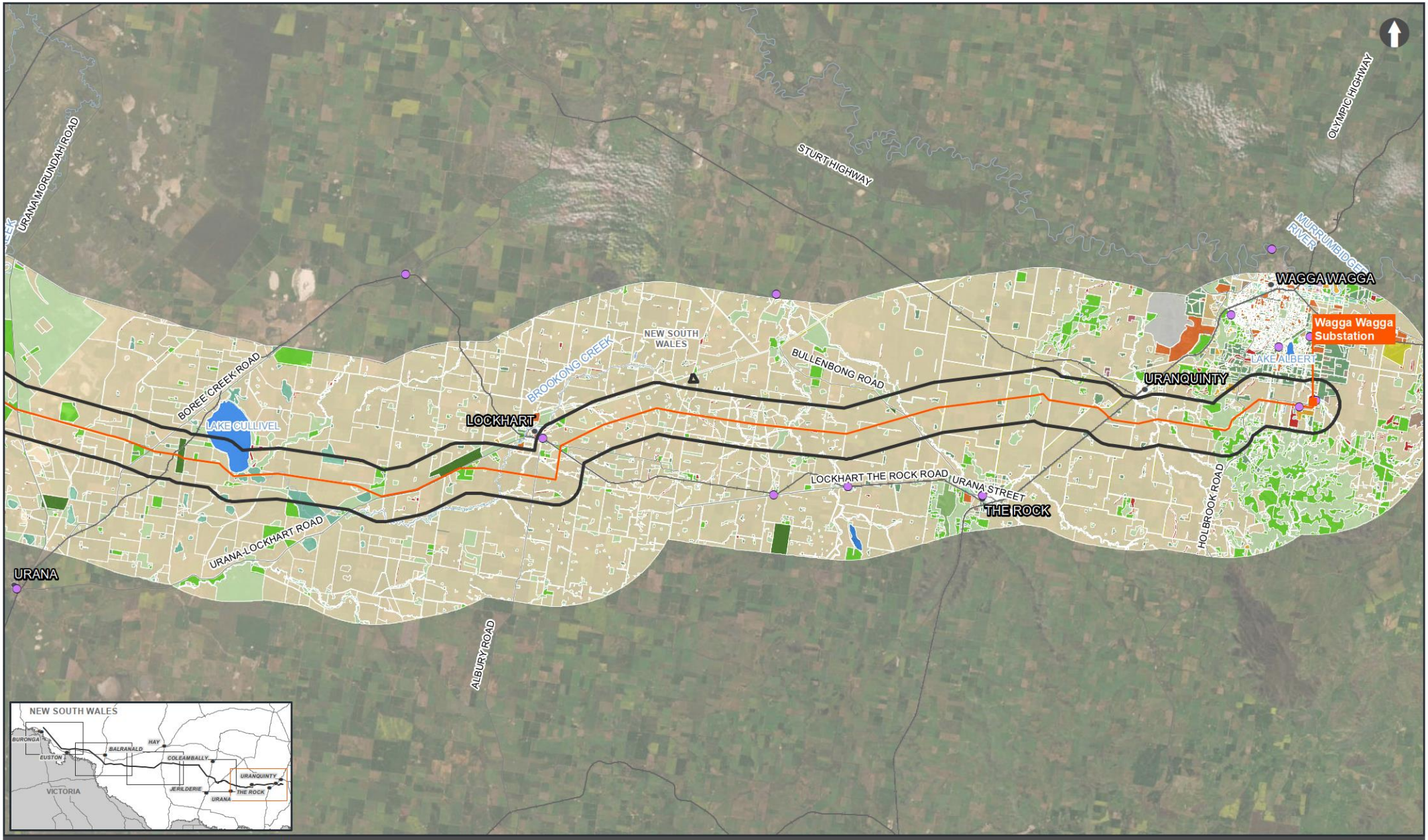

Figure 12-1

Land use within the proposal study area

Sheet 5 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

Table 12-2 Summary of land use in the land use and agriculture study area

Land Use	Area (ha)[1]	Proportion of the study area (%)[2]
Grazing native vegetation	129,561	60.1
Grazing modified pastures	6,125	2.8
Cropping	59,536	27.6
Irrigated land	4,487	2.0
Residential and farm infrastructure	1,074	0.5
Transport and communication	603	0.3
Water (lakes, rivers, marsh/wetland)	5,730	2.7
Other	8,632	4.0
Total	**215,750**	**100.0**

Source (DPIE, 2020)

1. Hectares and percentages have been rounded

The total gross value of agricultural production across the nine LGAs that the proposal covers in 2015-16 (Australian Bureau of Statistics (ABS), 2017a) was $1.78 billion. Total gross value of agricultural production is lower in the LGAs of Wentworth, Balranald and Hay (average of $71 per hectare), compared to Murray River and Edward River ($233 per hectare) and remaining LGAs ($610 per hectare) due to rainfall increasing west to east.

12.3.1.2. Additional land uses

Other land uses within and surrounding the land use and agriculture study area include farm buildings and infrastructure, roads including a section of the Holbrook Road, Olympic Highway, Lockhart-The Rock Road, Newell Highway, Kidman Way, Cobb Highway, Sturt Highway, and waterways including the Murrumbidgee River, Box Creek, Yanco Creek and Colombo Creek. The land use and agriculture study area would cross rail corridors at five locations, with only two locations currently operational. The five existing rail corridors are:

- Moama Balranald Railway, around 25 kilometres southeast of Balranald (non-operational)
- Narrandera Tocumwal Railway, near intersection of Colombo Road and Crutchs Road, Bundure (non-operational)
- The Rock Oaklands Railway, around nine kilometres northeast of Urana (non-operational)
- The Rock Oakland Railway, around two kilometres southeast of Lockhart (operational)
- Main Southern Railway, around three kilometres southwest of Uranquinty (operational).

The land use and agriculture study area intersects one aerodrome at Uranquinty, a further six aerodromes are within proximity to the land use and agriculture study area:

- Wagga Wagga (two aerodromes around five kilometres and 6.5 kilometres)
- Narrandera (around 57 kilometres)
- Hay (around 28 kilometres)
- Balranald (around 12 kilometres)
- Mildura (around 19 kilometres).

A limited number of private and active airstrips for agricultural activities are present within or in proximity to the land use and agriculture study area.

No defence or Commonwealth lands are located within the land use and agriculture study area. The proposal has sought to avoid Defence's Morundah Receive Station and buffer area, refer to Section 20.5 for further discussion.

Existing mining and mining lease areas have also been identified within the vicinity of the proposal. The periphery of mining operations (licences for exploration) EL9097 (metallic minerals), EL7626 (mineral sands), EL 9105 (metallic minerals) and EL 9117 (metallic minerals) all intersect the land use and agriculture study area. One mining exploration application, ELA 6266 (mineral sands), also intersects the study area.

One high pressure gas pipeline has also been identified within proximity to the proposal, being the Wagga Wagga to Culcairn high pressure pipeline. The potential impacts of the proposal on this pipeline are considered further in Section 20.4.3 of this EIS.

12.3.2. Far West Regional Plan 2036 and Riverina Murray Regional Plan 2036

The Far West Regional Plan 2036 (DPE, 2017b) and Riverina Murray Regional Plan 2036 (DPE, 2017c) set out the NSW Government's vision, goals and land use priorities over the next 20 years for the Far West and Riverina Murray regions of NSW. The plans identify a number of directions to achieve the goal in diversifying the economy with the efficient use of infrastructure and infrastructure networks. This includes:

- protecting productive agricultural land and planning for greater land use compatibility
- diversifying energy supply through renewable energy production. This includes actions to identify areas and project sites with renewable energy potential, and infrastructure corridors with access to the electricity network to inform land use planning. Both regions have the capacity for high renewable energy generation, which is consistent with the NSW Government's *Renewable Energy Action Plan* (2013) and the REZ identified in the AEMO's 2020 ISP (refer to Chapter 2)
- promoting tourism opportunities in the region.

12.3.3. Land ownership and property information

The underlying land tenure within the land use and agriculture study area from Buronga to the Balranald-Kyalite area is mostly Crown Land perpetual Western land leasehold (Figure 12-2). East of the Balranald-Kyalite area is mostly freehold agricultural land. Refer to Section 12.3.4 for discussion of TSRs.

The predominant land use across the region is grazing, with grazing of sheep and cattle common across the study area as discussed in Section 12.3.1. To the west of the Urana area grazing livestock is the dominant agricultural use, while to the east of Urana, agricultural land is dominated by mixed dryland cropping and livestock grazing. However, cropping areas also includes substantial land which is in a pasture phase of the cropping rotation. Small areas of modified pastures, and irrigated horticulture or cropping are also found. The average size of agricultural establishments across the land use and agriculture study area varies across the different LGAs and statistical areas, and are:

- 8,100 hectares for Wentworth
- 16,200 hectares for Wentworth-Balranald
- 11,200 hectares for Hay
- 2,400 hectares for Murray River

- 2,000 hectares for Edward River
- 1,500 hectares for Federation
- 860 hectares for Lockhart
- 840 hectares for Wagga Wagga.

A section of the land use and agriculture study area is within the Yanga State Conservation Area, established in 2007. This section follows an existing transmission route across the conservation area. An easement for the study area would also traverse the Cullivel State Forest and Brookong State Forest.

12.3.4. Travelling stock reserves and livestock highways

The grazing industry often uses a network of Crown reserves called TSRs. These are commonly managed by LLS under the *Local Land Services Act 2013* and generally permit the moving or grazing of stock on foot around NSW. The land use and agriculture study area intersects several TSRs between the Balranald and Wagga Wagga substations. TSRs can either be linear and associated with major roads or Crown land lots. All of the Crown land TSRs that are crossed by the proposal are managed by LLS (either Western, Murray and Riverina LLS depending on the location of the TSR).

Linear TSRs associated with major roads intersected by the land use and agriculture study area (LLS, 2021):

- Balranald-Kyalite Road
- Moulamein-Balranald Road
- Hay Road (Maude Road)
- Cobb Highway
- Carrathool Road, and
- McLennons Bore Road.

TSR lots intersected by the land use and agriculture study area (LLS, 2021):

- Four Corners (Carrathool Road – 325 hectares)
- Fernbank (Fernbank Road – 139 hectares)
- Thurrowa (Newell Highway – 266 hectares)
- Bundure (Colombo Road – 255 hectares)
- Coonong (Coonong Road – 135 hectares)
- The Gums (Federation Way (Urana-Morundah Road) – 146 hectares)
- Cullivel (Boree Creek Road – 22 hectares)
- Brookong (Urana-Lockhart Road – 409 hectares).

A livestock highway, although not a TSR under the *Crown Lands Management Act 2016*, is a public road used for the movement of travelling stock. Livestock highways provide a network of livestock routes connecting key agricultural regions. The livestock highways intersected by the proposal are:

- Maude Road
- Cobb Highway
- Carrathool Road
- Urana-Lockhart Road
- Lockhart-The Rock Road
- Olympic Highway
- Holbrook Road.

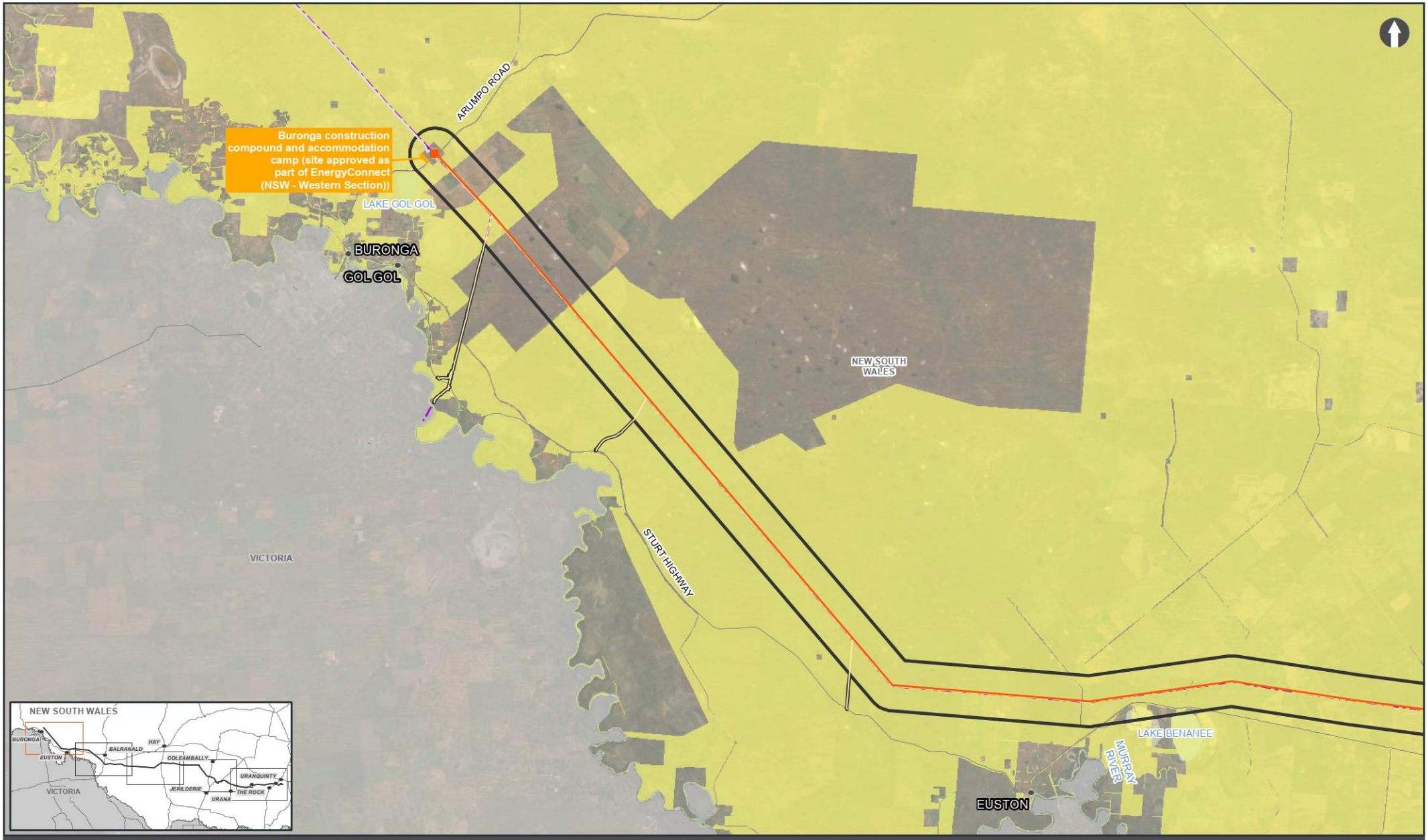

Figure 12-2

Crown land within and surrounding the proposal study area

Sheet 1 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

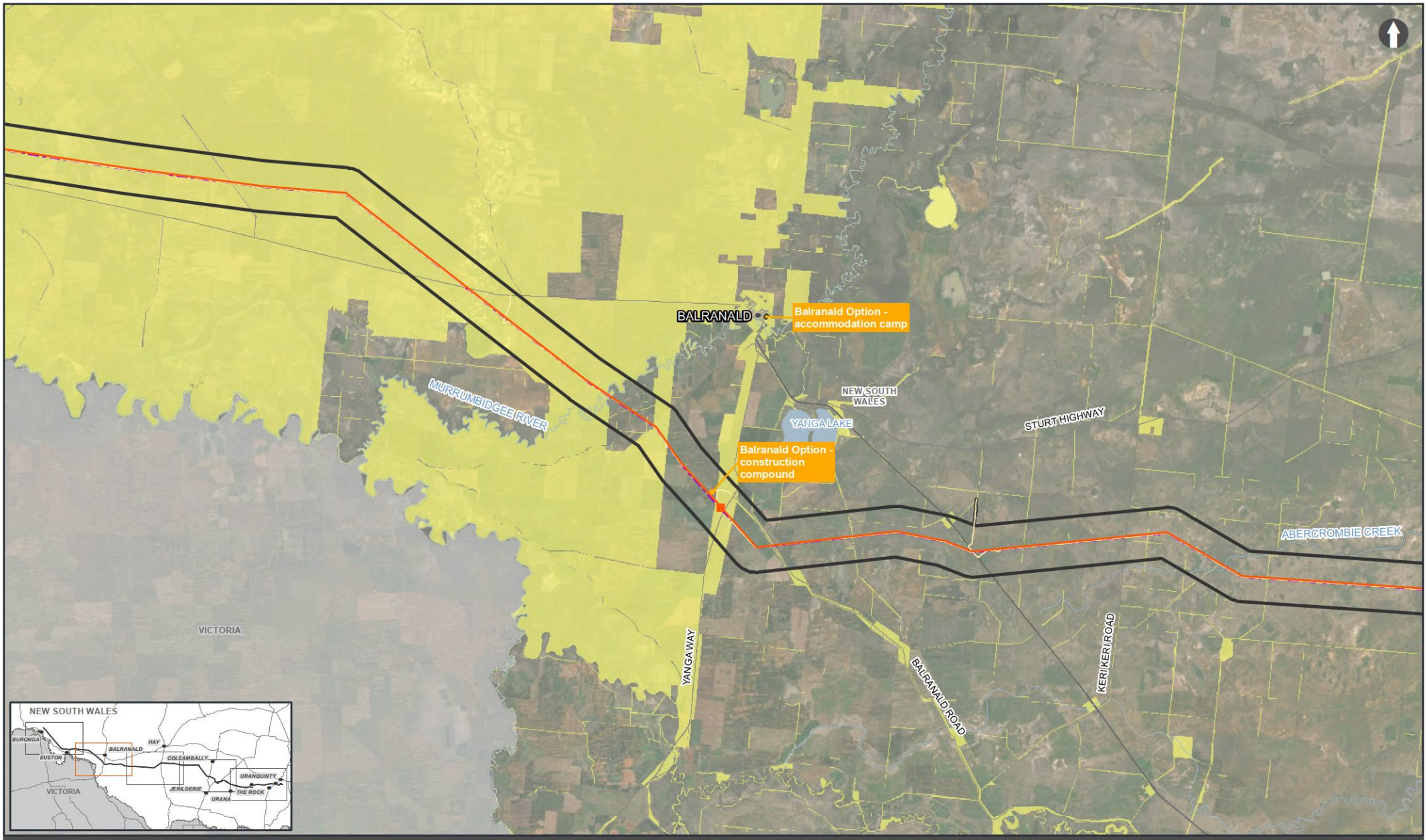

Figure 12-2

Crown land within and surrounding the proposal study area

Sheet 2 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

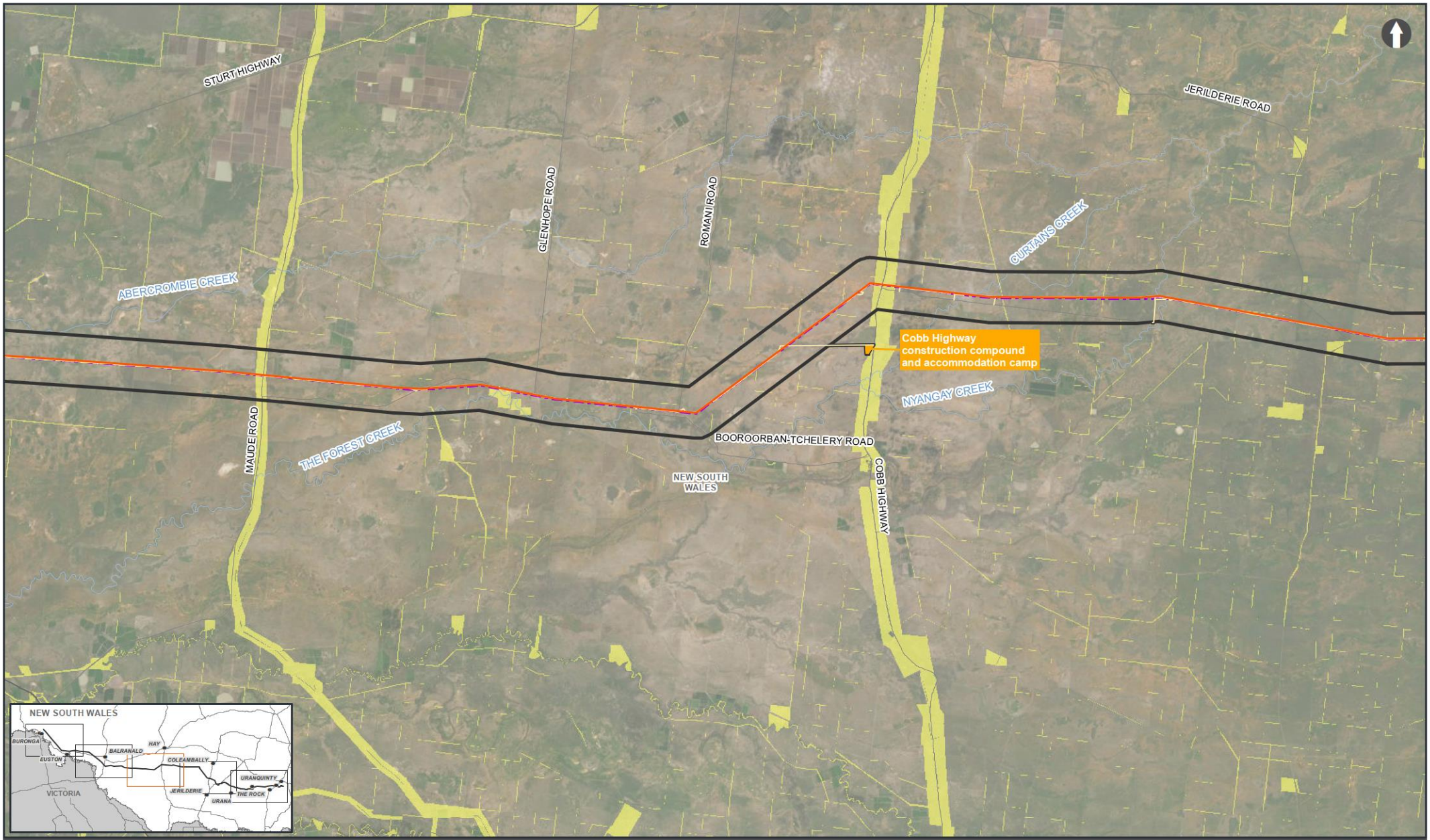

Figure 12-2

Crown land within and surrounding the proposal study area

Sheet 3 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

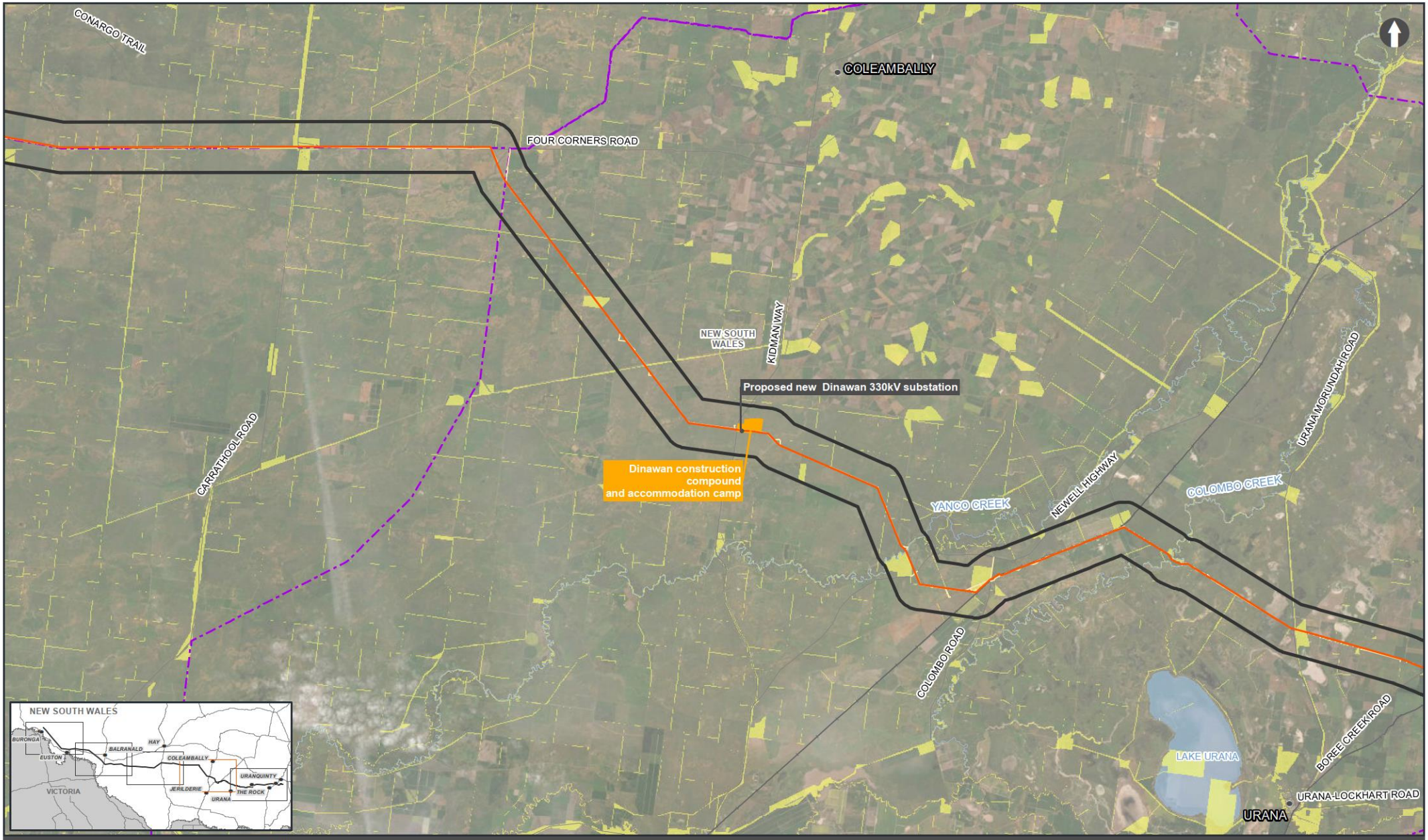

Figure 12-2

Crown land within and surrounding the proposal study area

Sheet 4 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

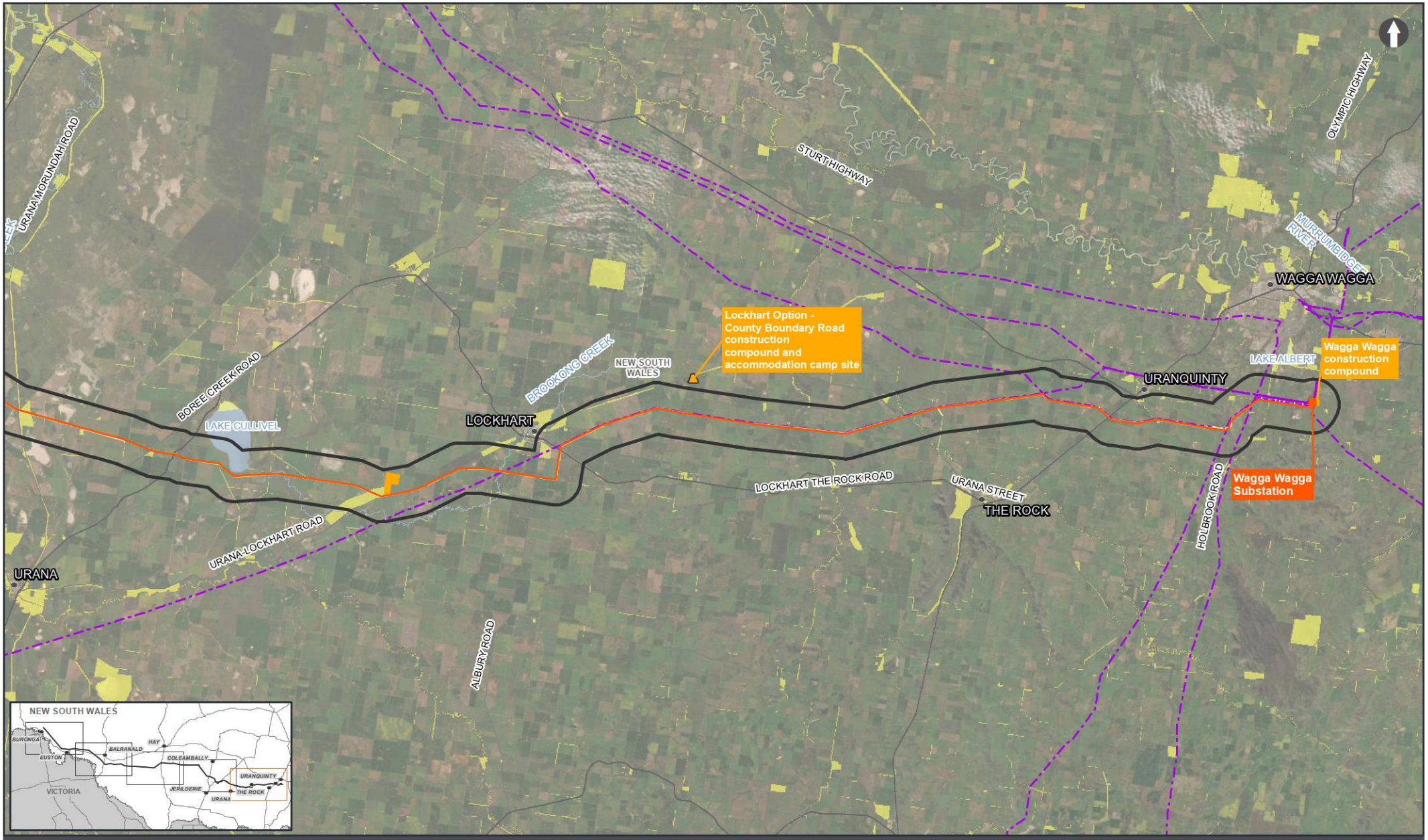

Figure 12-2

Crown land within and surrounding the proposal study area

Sheet 5 of 5

- EnergyConnect (NSW - Eastern Section)
- EnergyConnect (NSW - Western Section)
- Main Construction Compounds and Accommodation Sites
- Land Use Study Area
- Existing Substation
- Roads
- Existing Railway
- Existing transmission line infrastructure
- Waterbody
- Crown Land

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Source: NSWSS, ESRI, Transgrid, WSP

12.3.5. Geographical factors influencing land use

12.3.5.1. Topography

The land use and agriculture study area is mostly comprised of relatively flat dune fields and sand plains at an elevation between approximately 50 and 120 metres above Australian Height Datum (mAHD), with a wide expanse of the alluvial Riverine Plains to the east and undulating land of low relief around Wagga Wagga.

12.3.5.2. Climate

The land use and agriculture study area typically experiences between 285 to 571 millimetres of rain each year, with rain generally increasing west to east and generally less rain in summer and early autumn. Historical data shows that the average maximum monthly temperature within the study area reaches a high of 33°C in January and a low of 13°C in July. The study area experiences on average 19.6 days per year in Mildura and 50 days per year in Wagga Wagga with a minimum temperature under 2°C, which is generally regarded as the temperature at which frost will occur and is most likely to occur between May and September. Due to the typically high temperatures, high evaporation and low rainfall within the study area, the growing season is variable but short in duration.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) (2016b) climate projections for the Murray Basin regions indicate that by 2030, the annually averaged warming is projected to be around 0.6°C to 1.3°C above the climate of 1986–2005. By 2090, the warming is 2.7°C to 4.5°C for a high emission scenario and 1.3°C to 2.4°C under an intermediate scenario.

These factors are likely to lead to higher evapotranspiration, shorter growing seasons and a greater potential for heat and moisture stress on crops, pasture and animals within the study area in the future.

12.3.5.3. Soil, water and vegetation

The soils within the land use and agriculture study area are generally classified as having low to moderate inherent fertility, with low to moderately low inherent fertility and low water holding capacity to the west and moderately low to moderate inherent fertility to the east. Figure 12-3 shows the inherent soil fertility across the study area.

Water used for agriculture is mainly sourced from the Murrumbidgee River, Box Creek, Yanco Creek and Colombo Creek or earthen farm dams that capture and store local runoff. The water is mainly for stock and domestic use with some small areas of irrigation. Surface water is reticulated on some grazing properties using a system of pumps, pipes, tanks and livestock troughs. Groundwater in the area generally has high salinity levels making the water suitable only for stock use.

As discussed in Chapter 9 (Biodiversity), the study area is dominated by native vegetation and large areas are used for grazing.

Sections 9.3, 15.3 and 21.3 provide more information on the types of vegetation, water sources and soil characteristics within the study area, respectively.

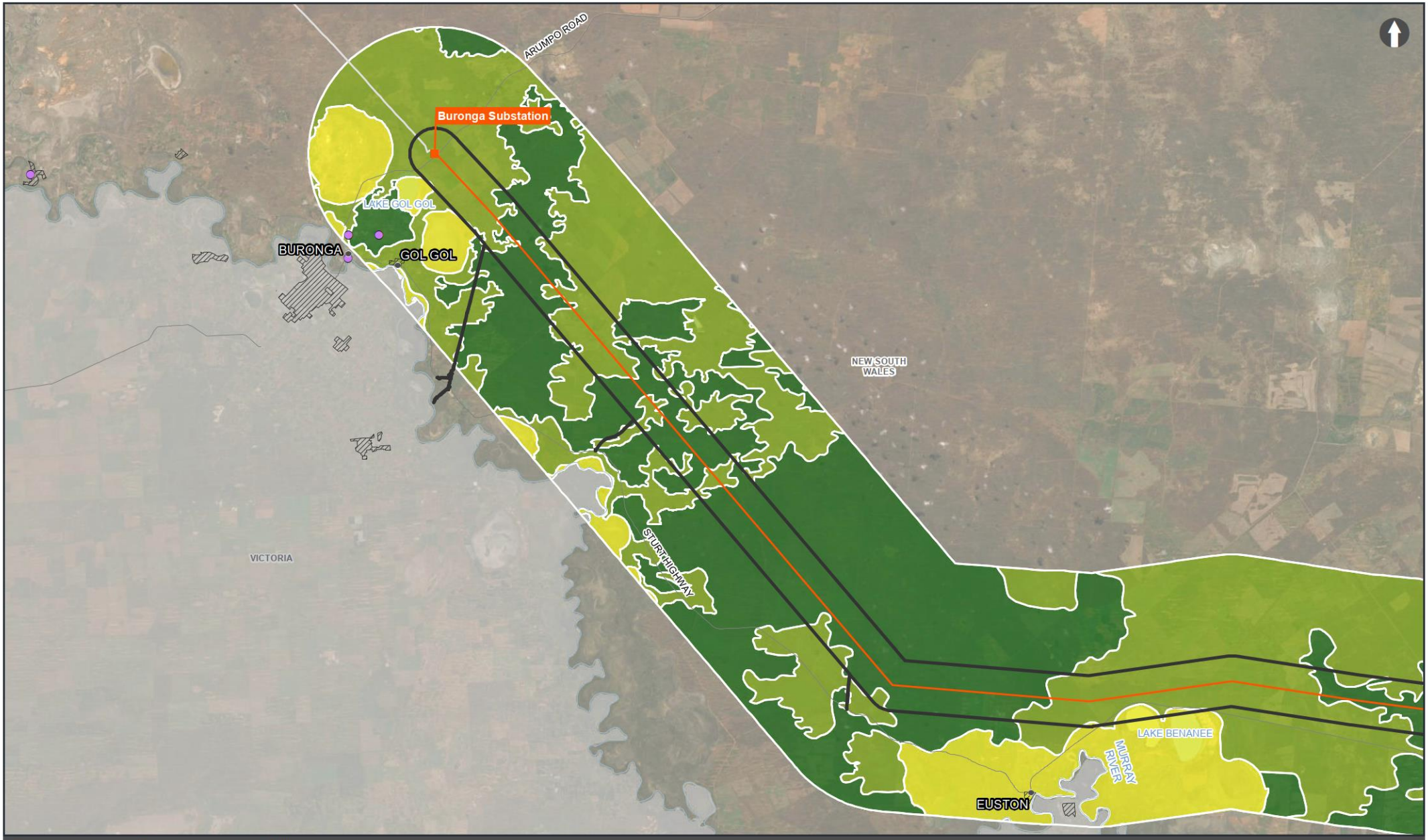

Figure 12-3

Soil fertility within and surrounding the proposal study area

Sheet 1 of 5

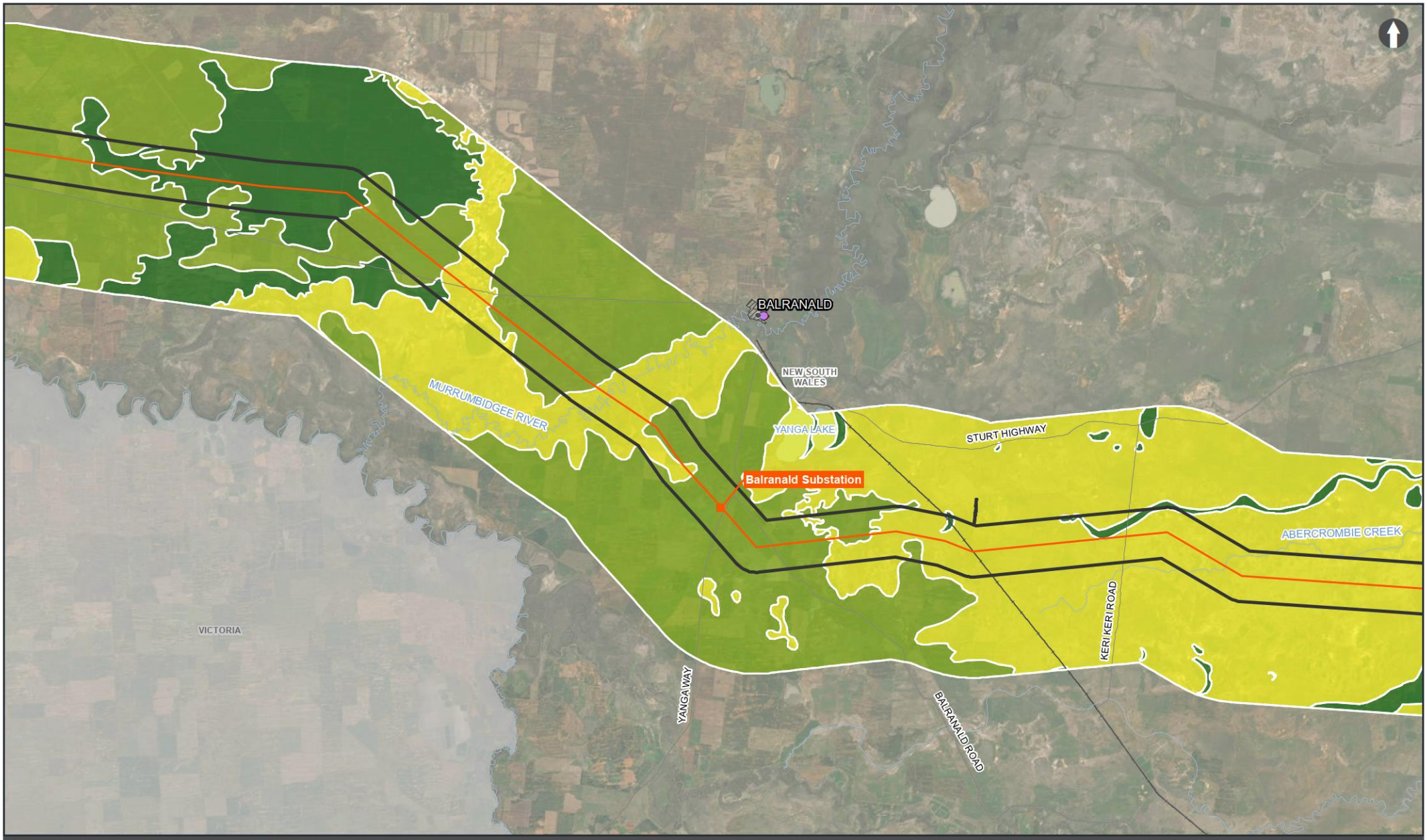

Figure 12-3

Soil fertility within and surrounding the proposal study area

Sheet 2 of 5

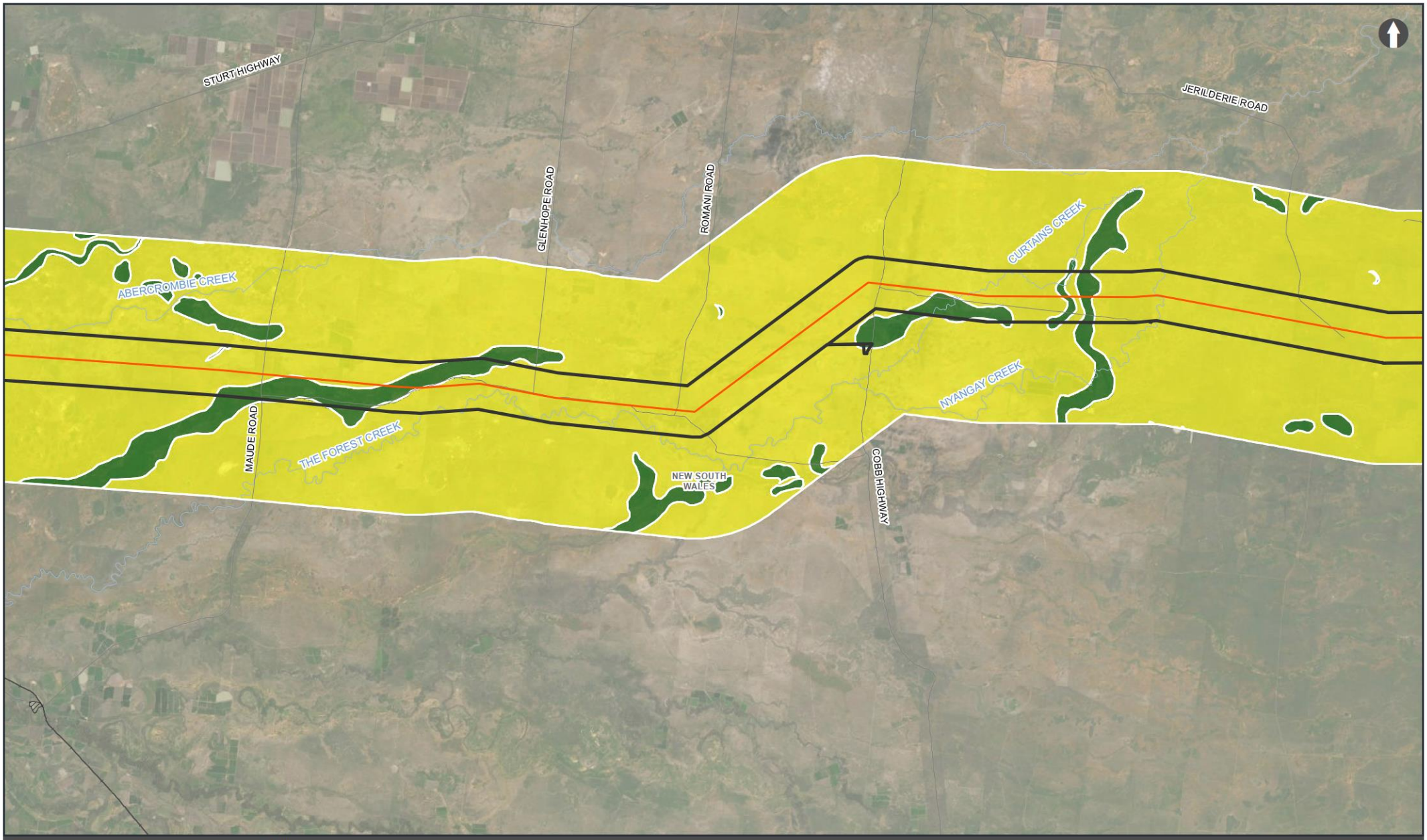

Figure 12-3

Soil fertility within and surrounding the proposal study area

Sheet 3 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

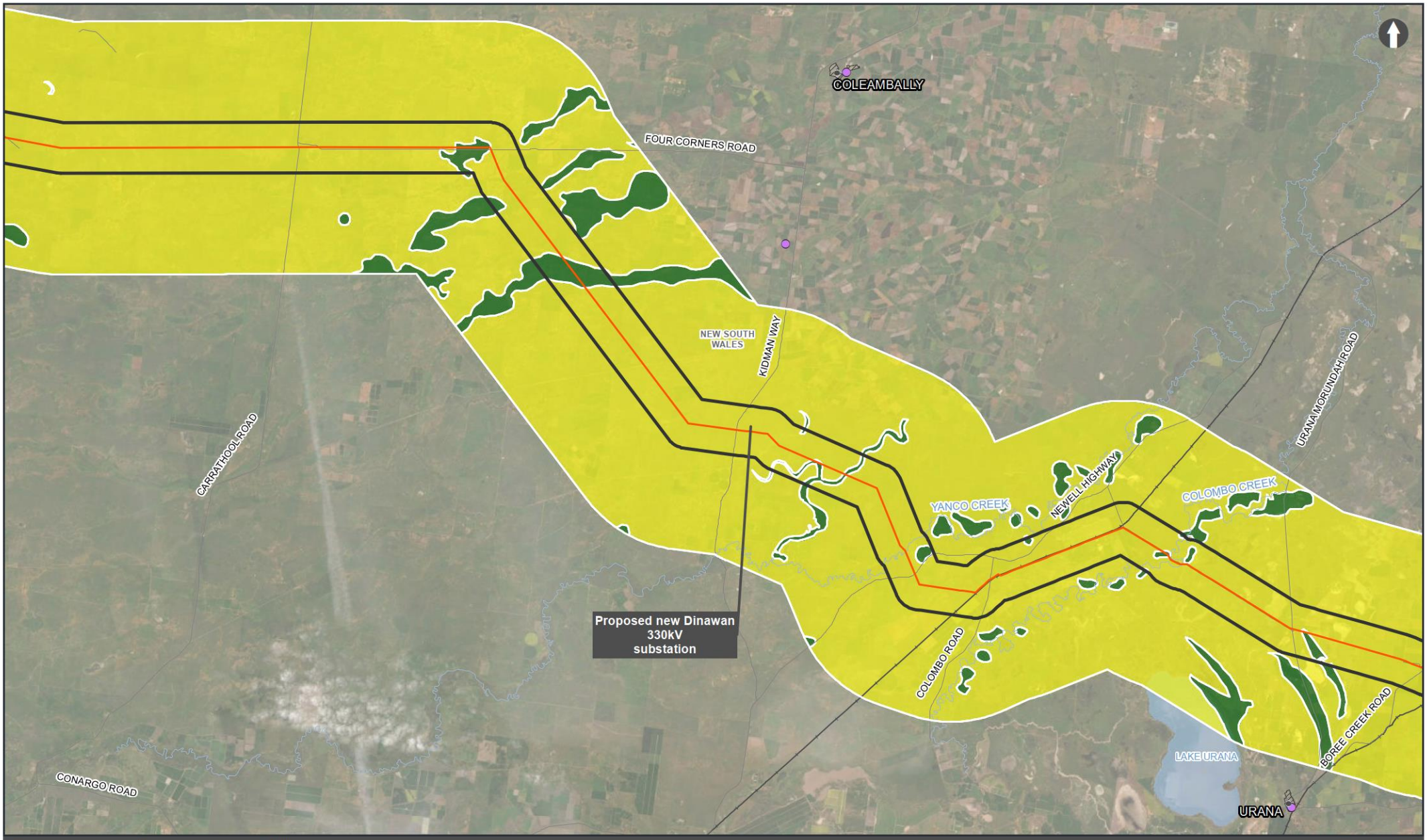

Figure 12-3

Soil fertility within and surrounding the proposal study area

Sheet 4 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

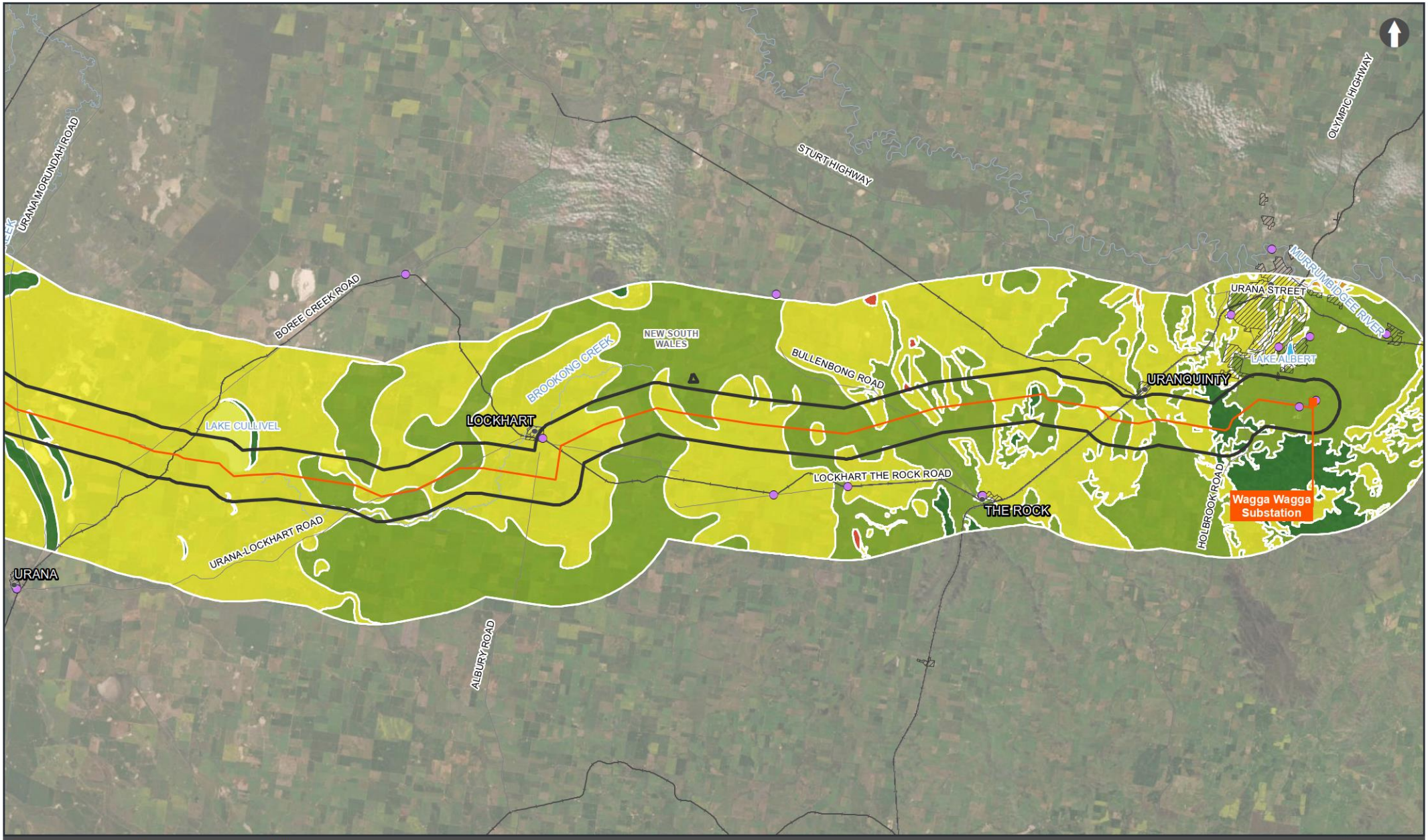

Figure 12-3

Soil fertility within and surrounding the proposal study area

Sheet 5 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

12.3.6. Land and soil capability

Land and Soil Capability is based on an assessment of the biophysical characteristics of the land, the extent to which this will limit a particular type of land use and the current technology that is available for the management of the land. Land and Soil Capability Class 1 represents land capable of sustaining most intensive land uses including those that are often associated with regular soil cultivation, whereas Class 8 represents land that can only sustain very low intensity land uses to minimise land and environmental degradation.

The dominant capability land within the study area is Class 4 and Class 5 capability land (moderate and moderate-low capability land), which is associated with the alluvial soils that can support cropping and horticultural land uses. The highest capability land within the study area is Class 3 capability land (highly capability land) located within the Urana district at the east end of the Cobb Highway.

Land located west of the Cobb Highway comprises Class 5 and Class 7 capability land (moderate-low and very low capability land) with small areas of Class 4 and larger areas of Class 6 capability land (low capability land) around Balranald.

Biophysical strategic agricultural land (BSAL) is land with high quality soil and water resources capable of sustaining high levels of productivity. NSW DPIE mapping indicates that there is BSAL along the Murrumbidgee flood plain, but there is no BSAL within or close to the study area.

Refer to Sections 4.3 and 4.4 of Technical paper 3 for more information.

12.3.7. Biosecurity risk

In contrast to much of NSW, most western parts of the study area have the potential to effectively manage biosecurity risks due to its separation from major populations and intensive agricultural industries as well as its semi-arid climate, which is challenging for exotic animals and plants to survive (DPE, 2017b). However, substantial biosecurity risks exist in the east of the study area where more intensive agriculture occurs.

There are several species of weeds that are likely to be located in the vicinity of the study area including (refer to Section 4.1.9 of Technical paper 3 for further detail):

- thirty-five species of weeds recorded during property inspections under the *Biosecurity Act 2015* (DPI, 2020)
- 27 species are identified as regional priority weeds under the Western Regional Strategic Weed Management Plan 2017 – 2022 (Western LLS, 2017), Murray Regional Strategic Weed Management Plan 2017-2022 (Murray LLS, 2018a) and Riverina Strategic Weed Management Plan 2017-2022 (Riverina LLS, 2018a)
- one state priority weed – Bitou bush (*Chrysanthemoides monilifer*a) identified in the Western LLS region (Western LLS, 2017)
- fourteen state priority weeds identified in the Murray and Riverina LLS regions (Murray LLS, 2018a and Riverina LLS, 2018a)
- twelve weeds that were specifically mentioned as problematic weeds by landholders: Khaki weed, devil's claw, spiny burr grass, African boxthorn, galvanised burr, Paterson's curse, green cestrum, St John's wort, caltrops, herbicide resistant ryegrass, needle grasses and horehound
- Khaki weed, Noogoora burr and Bathurst burr, which can be a problem in irrigation fields and contaminate wool.

Foxes, feral pigs, wild rabbits and kangaroos are the most significant vertebrate pests to agriculture across the Western, Murray and Riverina LLS regions (Western LLS 2018, Murray LLS 2018a and Riverina LLS 2018a). These pest animals can cause damage to primary production, natural environments and cultural assets. Plague locusts and mice can also cause problems in favourable seasons.

Some species (such as goats and pigs) pose significant biosecurity, economic and social threats to agricultural land uses in the study area as they can harbour and transmit both endemic and exotic diseases (Western LLS, 2017). The prevalence of sheep footrot and bovine Johnes disease within and surrounding the study area is considered to be low in recent years and unlikely to readily spread (DPI, 2016). In the Murray and Riverina LLS regions, 15 flocks were quarantined in December 2015 representing approximately 0.3 per cent of the flocks across the region at that time.

Horticultural enterprises within and surrounding the study area are particularly susceptible to plant diseases and pests. Parts (if not all) of the study area are located in quarantine zones including the:

- Greater Sunraysia Pest Free Area, which is aimed at preventing the entry of the Queensland fruit fly by banning certain fruit and vegetables from entering the area (covering the study area from Buronga to around 40 kilometres east of Euston)
- Phylloxera Exclusion Zone, which bans taking grapevines, cuttings or budwood into this zone (whole of the study area)
- Rice Biosecurity Zone, which bans the entry of rice plants or grain such as paddy rice or brown rice (covering the study area from around Euston to near Lake Cullivel (comprising the Balranald, Edward River, Federation Hay, Murray River and Murrumbidgee LGAs), a distance of around 375 kilometres of the proposal alignment)
- Potato Biosecurity Zone, which bans the movement of plants from the Solanaceae family in NSW (entire state of NSW).

12.4. Potential impacts – construction

12.4.1. Property impacts

The proposal would require the acquisition and/or temporary leasing of land within the land use and agriculture study area (refer to Section 5.5). This may require Transgrid to secure:

- temporary leases of freehold land for temporary access, main construction compounds, accommodation camps and the construction impact area
- temporary leases for affected sections of Crown Land in accordance with the *Crown Lands Management Act 2016* for access and construction
- an easement for the transmission line. Easements permit construction of the transmission line, as well as restricting certain activities on the land, and permitting ongoing maintenance and operation of the electricity network, including any permanent access tracks. Easements would be acquired either by agreement with landholders, (including options) or by compulsory process in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*
- an easement for the transmission line through Yanga (Murrumbidgee) State Conservation Area in accordance with the NP&W Act, where the Minister administering the NP&W Act may grant approval for an easement for the purpose of electricity transmission infrastructure through this park

- easements for the transmission line through both the Cullivel State Forest and Brookong State Forest in accordance with the Forestry Act, where the Minister administering the Forestry Act may grant approval for an easement for the purpose of electricity transmission infrastructure through these forests
- freehold land acquisition for the Dinawan 330kV substation.

As previously described in Section 6.4, the proposal would require a construction impact area along the length of the proposal to accommodate the construction of the proposed transmission line and towers. This would directly impact properties along the length of the proposal alignment to accommodate the following:

- construction of all proposal infrastructure elements (including the proposed transmission line alignment, transmission line easement, substation site works (at both the proposed Dinawan 330kV and upgraded and expanded Wagga Wagga substations), optical repeater infrastructure, and other ancillary works)
- locations for construction elements such as construction compounds and accommodation camps, access tracks (excluding public roads proposed to be used for access routes), site access points, water supply points, laydown and staging areas, concrete batching plants, brake/winch sites and site offices.

The transmission line and main construction and accommodation compounds have been located, through discussions with landholders, to minimise impacts to property, ensuring that land uses remain viable and access is retained. The guiding principle to minimise the potential for property impacts located along the transmission line was to locate the final transmission line easement parallel with existing transmission lines or road corridors or along property boundaries, where possible.

The expected transmission line easement represents approximately 0.005 per cent of the total area of agricultural holdings in the nine impacted LGAs. Therefore, the impacts of the proposal on existing agricultural enterprises would be minimal. The proposal would not cause significant fragmentation or severance of agricultural land or result in significant disruption to agricultural operations.

All acquisitions of easements over both Crown and privately owned land would be carried out in consultation with the landholders in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the supporting NSW Government Land Acquisition Reform 2016, where possible by agreement, or if agreement is not reached, by compulsory acquisition (including payment of compensation in accordance with the statutory provisions).

As discussed in Section 12.3.1, the land use and agriculture study area would cross rail corridors at five locations, two of which are operational. The proposal would require track possessions for stringing operations which would impact the two operational lines. Rail corridor possessions are typically for a 72-hour period, four times a year, where works are often carried out on a 24-hour basis. The timing and duration of the possessions would be agreed with the relevant rail authorities, track stakeholders and relevant government departments to minimise impact to train paths. Track possessions for stringing operations during construction on the remaining three rail corridors would not result in any impacts as the rail corridors are non-operational.

Refer to Section 20.4 for discussion on potential construction impacts on gas mains, including the Uranquinty gas main.

Areas within the construction footprint that are not required for operation of the proposal, including any temporary access tracks or construction compounds, would be rehabilitated at the completion of construction to a similar condition as the existing land. Easements would be created throughout the construction period, with all easements being in place prior to completion of construction.

12.4.2. Land use changes

12.4.2.1. Land use and productivity loss and restrictions

Construction activities may result in temporary land use changes (refer to Section 6.7). Temporary land use changes are most likely to impact existing agricultural enterprises within the land use and agriculture study area.

These land use changes are likely to disrupt agricultural activities through:

- temporary access restrictions, which may require landholders to access sections of their properties via alternative routes
- noise created by the construction activities, which may be an issue during calving and lambing as livestock may be sensitive to the additional noise generated by construction
- damage to existing fences or stock water pipelines, or gates accidentally left open leading to loss of livestock during construction
- potential indirect impacts to water sources such as farm dams (discussed further in Section 15.4).

Land use changes due to construction of the proposal are more likely to negatively impact areas used for cropping and horticulture within the land use and agriculture study area (refer to Figure 12-1) due to their higher intensity land use. However, the restrictions during construction of the proposal would generally be of a short duration due to the progressive nature of construction, in a limited location and would be minimised through appropriate mitigation measures (refer to Section 12.6.2). These mitigation measures would include establishment of alternate access routes in consultation with landholders, such as temporary access tracks where required.

The land use and agriculture study area would cover a small fraction (about 0.04 per cent) of the agricultural land in the nine LGAs, and therefore the impacts of the proposal on the overall agricultural productivity as discussed in Section 12.3.1 would be minimal. Additionally, given the relatively small size of the disturbance area compared to the large average size of the agricultural properties, construction activities are not likely to cause significant loss, fragmentation or severance of agricultural land or significant disruptions to agricultural operations.

Direct impacts to private airstrips have been avoided where possible through the selection of the transmission line corridor. The location of the transmission line in the proximity of existing airstrips employed for aerial agriculture may restrict the use of these airstrips in some cases as nearby powerlines can compromise safety during take-off and landing and the use of the airstrips may not be possible in certain conditions, or relocation of the airstrips may be required.

Upon completion of construction, the construction facilities and temporary access tracks would be removed and any land that is not required for operation within the construction footprint would be rehabilitated and returned to the relevant landholder to minimise loss in land use or viability. Further discussion regarding the ongoing use of the easement for farming (and other) operations during operation of the proposal is provided in Section 12.5.

12.4.2.2. Mining operations

The periphery of the five mining exploration operations intersect the proposal. For areas subject to exploration licences, consultation with these operators have advised that the proposal is unlikely to impact their activities.

12.4.2.3. Biosecurity risks

There are risks that animal diseases, plant diseases, feral pests and (especially) weeds could be introduced or spread during the construction of the proposal through vehicle, machinery or construction personnel movements. Biosecurity matter (as defined in the *Biosecurity Act 2015* as generally being any living thing, part of a living thing or product of a living thing (other than a human), or a disease or contaminant) could also be spread by soil erosion and water runoff associated with construction works.

Risk of weed spread

The risk of weed spread is generally highest during the earthworks phase of construction, due to the high frequency of vehicle movements and disturbance of ground cover and soil, which could lead to weed growth. Some species of weeds are readily spread by vehicles, machinery and human activity, including cacti, spiny burrgrass, khaki weed, Noogoora burr and Bathurst burr.

Spreading of weeds has the potential to impact surrounding agricultural enterprises due to the costs of monitoring pests, weeds or diseases and implementing control measures as well as the reduced income caused by loss of livestock, crop or pasture production and lower produce quality.

There are numerous other weeds which could potentially have a significant impact on the agricultural enterprises, however the risk is moderated by:

- most weeds not being readily spread by activities associated with the proposal; and
- limited adaptability of some weeds to the environmental conditions of the region, especially in the drier climate found in western parts of the land use and agriculture study area.

To minimise the risk of biosecurity incidents occurring due to construction, mitigation measures would be implemented to avoid the spread of weeds. In addition, the land use and agriculture study area lies within the biosecurity zone for phylloxera, which means that the local control authority would need to be notified of a new infestation of the weeds as well as action undertaken (or proposed to be undertaken) to eradicate, destroy or suppress the weeds. Additionally, the rice biosecurity zone extends from Euston to near Lake Cullivel along the land use and agriculture study area and the entire state of NSW is a potato biosecurity zone.

Risk of livestock disease

There is the potential for livestock diseases to be spread during construction of the proposal (through similar methods to weed spread as outlined above including transfer of earthwork materials between properties on machinery). The potential livestock diseases that may be subject to spread would include:

- ovine footrot, which is an important risk despite its low current prevalence due to the relative ease of its spread and economic consequences due to impacts to stock health, productivity and value, as well as disease control costs
- ovine Johne's disease, which can result in significant economic losses due to sheep deaths, lost meat production, fewer lambs and less wool
- sheep lice, which can cause significant losses in sheep enterprises due to treatment costs, reduced wool growth and lower meat production.

Under the *Biosecurity Act 2015*, ovine footrot and ovine Johne's disease are notifiable diseases.

However, considering the low density livestock and low prevalence of disease in the area, the overall risk of spreading these livestock diseases during construction is low.

Risk of other pest or disease spread

The most significant livestock pests in the vicinity of the land use and agriculture study area are pigs, foxes, rabbits and kangaroos, which may result in economic impacts on livestock and crop enterprises due to lamb predation, fence damage or consumption of pasture and crops. However, construction activities are unlikely to significantly change the number or movement patterns of these pests.

Horticultural enterprises may be impacted if construction activities were to result in inappropriate plant material or soil being brought into the land use and agriculture study area via vehicle, construction personnel or water movements. For example, the avocado orchards near the study area may be susceptible to phytophthora root rot. The closest orchards are approximately six to 10 kilometres from the study area (University of New England 2021). Phytophthora root rot could be spread to and within the construction impact area by soil attached to footwear or vehicle tyres, and by water movements. This risk for horticultural enterprises would be minimised through implementation of mitigation measures to prevent the spread of pests or disease within the construction impact area. It is noted that these plant diseases or pests are not considered to be an issue for grazing enterprises in the region.

12.4.2.4. Travelling stock reserves and livestock highways

It is possible that some movement of livestock along TSRs or public roads would be affected temporarily by restricted access to construction areas. However, these restrictions would be of a short duration and the proposal is not expected to significantly prevent or hinder livestock movements.

12.5. Potential impacts – operation

12.5.1. Property impacts

12.5.1.1. Freehold land acquisition

As previously identified in Section 5.5.1, five parcels of land have been acquired for the proposed Dinawan 330kV substation (inclusive of APZs). The need for acquisition of any further land as part of the proposal would be determined during finalisation of the proposal in consultation with relevant landholders (as required).

No residential dwellings would be subject to acquisition, however there may be direct or indirect impacts to other infrastructure (such as agricultural sheds, fencing and gates) where these occur in or close to the proposed easement.

12.5.1.2. Easements

The transmission line between the Buronga substation and Wagga Wagga substation would be located within an easement up to 80 metres wide. This easement would provide a right of access to construct, maintain and operate the transmission line and other operational assets associated with the line (such as the transmission line towers and conductors). The easement would also ensure safe electrical clearances during the operation of the lines. The transmission line easement would also be required to accommodate other permanent infrastructure including the optical repeater station communication huts at Booroorban and along Urana-Lockhart Road.

A total area of property impact from the proposal would be around 4,707 hectares to accommodate the required easements. Of this, around 419 hectares would be physically as a result of the proposed infrastructure consisting of the transmission line tower bases, the new Dinawan 330kV substation and ancillary infrastructure such as the optical repeater sites. These impacts would be relatively small, representing approximately 0.005 per cent of the total area of agricultural holdings across the land use and agriculture study area. The creation of the easement for the transmission line would also require around 4,288 hectares of land.

The establishment of easements would restrict some agricultural and other activities within the easement and provide rights for Transgrid to access, operate and maintain the transmission line infrastructure. Permitted activities within easements would depend on the nature or scale of the activity, as well as proximity to the transmission line and structures. Land access would preferentially rely on use of existing access gates, driveways, access tracks or as otherwise agreed (e.g. driving over paddocks when agricultural cropping is not a constraint).

As discussed in Section 12.3.1, the proposal would cross rail corridors at five locations, two of which are operational. Key areas of interest for rail authorities where potential operational impacts could occur are:

- conductor clearances over track lines
- conductor clearances over other rail assets
- offset of tower locations from the rail corridor.

Rail authorities would continue to be consulted during finalisation of the proposals design to minimise the potential of any operational impacts of the proposal.

The final extent of freehold property acquisition, lease requirements, and creation of easements, and associated mechanisms, would be refined and confirmed during design refinement in consultation with landholders.

12.5.2. Land use changes

12.5.2.1. Land use and productivity loss and restrictions

Operation of the proposal would result in a permanent change in land use from agricultural to electrical infrastructure where permanent infrastructure is located along the transmission line (e.g. tower structures and permanent access tracks) and at the location of the proposed Dinawan 330kV substation as discussed in Section 12.3.1.

The land within an easement, and immediately next to the proposal could continue to be used for grazing. However, the proposal has the potential to reduce the land available within the land use and agriculture study area for cropping and horticultural land uses. These land uses comprise a small portion of the proposal area and the area of land affected would be minimised where possible through design refinement.

There would be several movement and activity restrictions for surrounding agricultural activities as:

- the method and/or area for certain cropping and horticultural activities (including cultivation, crop establishment, spraying travel patterns and use of wide farming equipment) may need to be adjusted to avoid the transmission line structures and easement, which may reduce efficiency
- equipment within the transmission line easements would be restricted to a height of 4.3 metres to minimise the risk of collision or close approach with the transmission lines, which would prevent use of certain equipment within the easement such as large grain harvesters and grain augurs, which can typically extend up to five metres
- aerial activities, such as aerial spreading/spraying of fertilisers and use of drones for mustering or monitoring crops, would not be allowed within 30 metres of the transmission lines to minimise risk of collisions
- sheep and cattle may be disturbed by noise generated during operation or maintenance activities
- the transmission lines and high voltage equipment could potentially cause interference with radiocommunication equipment used in the immediate vicinity. Potential impacts would depend on the specific radiocommunication equipment in use
- sections of existing fences and gates may need to be realigned.

The overall impact on existing agricultural activities is expected to be relatively minor, with the exception of aerial agriculture east of the Urana area, as:

- a small percentage of high capability land would be taken out of production by the proposal
- a small percentage of the study area would be impacted by transmission line structures, hardstand areas and permanent tracks that could affect soil characteristics resulting in the land no longer being productive cropping or pasture areas
- any affected fences or gates would be realigned and/or reinstated in accordance with agreement with landholder, relevant guidelines and standards
- operation of the proposal would not impact any TSRs.

12.5.2.2. Impacts on aerial agriculture operations

Significant impacts on aerial agriculture operations (such as aerial spreading of fertilisers and aerial spraying) and drones could potentially arise from the presence of transmission lines in cropping or horticultural areas.

The efficiency and effectiveness of aerial agriculture operations would have the potential to decline as a result of the proposal as current application procedures would need to be amended to compensate for the presence of new transmission towers and transmission. Transmission lines and towers would create a potential hazard for low level aviation activities and would need to be considered in planning a safe aerial application programs for certain land parcels within and close to the transmission line easement. The direction of flight, release heights and run lengths may also have to be adjusted to maintain safe operations. This could lead to parts of cropping paddocks near proposal towers being less effectively sprayed due to increased release heights, or some areas may not be able to be sprayed safely at all. As a result, the efficiency of the aerial agricultural operations may decrease and become more time consuming.

Aerial agriculture is extensively used in the mixed dryland farming areas east of the Urana area, and on irrigated cropping lands. Aerial agriculture is considered to be less common in the western part of the land use and agriculture study area.

Additionally, the use of drones for mustering and monitoring in rangeland areas is increasing. The use of drones for monitoring crops (including horticulture) is also increasing. Proximal sensing using drones is also becoming more competitive with remote sensing by satellites for crop monitoring purposes. Crop sensing by drones is cheaper, more targeted, more timely, less affected by cloud cover, and provides higher quality images, which would probably result in increased future use.

Transmission lines and towers would restrict drone flight and sensing in areas around these structures. Drones are subject to electric and magnetic interference from transmission lines, and it is recommended that they are not flown within approximately 30 metres of a power line (Drone U Flight School, 2021). Unmanned aerial vehicles (such as drones) also cannot be flown within 60 metres of any transmission line structure, guy wire or conductor (Transgrid 2021).

12.5.2.3. Biosecurity risks

Movement of vehicles and equipment associated with maintenance and operation of the proposal may introduce or spread animal diseases, plant diseases, feral pests and weeds within the study area.
The potential impacts of this would be similar in nature to the construction phase (refer to Section 12.4.2), however the risk would be lower due to less frequent vehicle and equipment movements and infrequent ground disturbance. Regardless, the proposal would require ongoing weed control around and underneath transmission line structures during operation as part of regular maintenance activities in accordance with landholder agreements.

12.6. Management of impacts

12.6.1. Environmental management

Environmental management for the proposal would be carried out in accordance with the approach detailed in Chapter 24 (Environmental management).

12.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to land use and property are listed in Table 12-3.

Table 12-3 Mitigation measures – land use and property

Reference	Mitigation measure	Timing	Applicable location(s)
LP1	Access tracks (temporary and permanent) would be confirmed in consultation with landholders to minimise impacts on agricultural activities to the greatest extent possible. Where permanent tracks are required, a single access track would be designed to serve both temporary and permanent purposes, where possible.	Pre-construction and construction	All locations
LP2	Transmission line structures (and associated permanent structures or construction compounds) would be located where possible to avoid or minimise impacts, or as agreed with the affected landholder, on: • cropping and irrigated horticultural land • areas used for set up and pack up of agricultural equipment, entry points and turning areas • drainage catchments for farm dams • locations of high biosecurity risk.	Pre-construction	All locations
LP3	To minimise disruption to agricultural activities: • landholders would be consulted regarding any required adjustments to property infrastructure (fences, access tracks, etc) and the proposed timing and location of construction works, especially where some restriction on vehicular or stock movements would be necessary. Appropriate arrangements would be negotiated with the affected parties and put in place prior to any such disruption. • property infrastructure (such as gates) would be managed in accordance with landholder requirements, (provided access is not limited or restricted) • any damage to property infrastructure caused by construction would be repaired promptly • use of existing roads, tracks and other existing disturbed areas would be prioritised. • where access is required across open spaces, care would be exercised to ensure that minimum damage is caused to the surface by confining vehicular or plant movement, as far as possible, to one route.	Pre-construction and construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
LP4	Consultation would be undertaken with relevant landowners who utilise aerial farming operations to identify appropriate mitigation arrangements (where feasible) such as the installation of aerial warning markers on the transmission lines.	Pre-construction and construction	Transmission line
LP5	Disturbed areas would be stabilised and appropriately rehabilitated (i.e. back to pre-impacted conditions) as soon as feasible and reasonable following the completion of construction at each location. This would be carried out in consultation with the relevant landowner.	Construction	All locations
LP6	Procedures would be implemented so that potential impacts or conflicts between livestock and construction activities are appropriately managed. Procedures would be developed in consultation with affected landholders and would include management of: • noise intensive activities during sensitive periods within the livestock production cycle (such as lambing and calving) • vehicle movements and other activities within the vicinity of livestock • movement of stock away from potential stressors created by construction activities.	Construction	Transmission line
LP7	Biosecurity controls would be implemented during construction to minimise the risk of off-site transport or spread of disease, pests or weeds. Controls would include (but not limited to): • inspections and cleaning of vehicles, machinery, and personnel equipment prior to movement on and off construction work areas or between properties • minimising movements across adjoining farmland including trip numbers and locations • additional measures where localised areas of high biosecurity risks have been identified. The specific controls applicable to a property would be identified in consultation with the affected landholder. The effectiveness of these controls would be monitored in a manner and time interval consistent with the level of risk on each property.	Construction	All locations
LP8	Where present, weeds would be managed in consultation with the relevant landholder. Consultation would also occur with the relevant authority (LLS, the relevant local council, or NSW DPI) in relation to notifiable weeds.	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
LP9	In the event of new infestations of notifiable weeds as a result of construction activities, the relevant control authority would be notified as per *Biosecurity Act 2015* and Biosecurity Regulation 2017.	Construction	All locations
LP10	Fencing and access arrangements, such as locked gates, would be determined in consultation with landholders (where required such as around the new substation and optical repeater sites). Management of access including opening and closing of gates would be done in accordance with landholder requirements. Any damage caused by maintenance activities would be repaired promptly.	Operation	Transmission line
LP11	If landholders indicate adverse effects on agricultural precision farming GPS signals due to operation of the project within 12 months from commencement of operation, the claims would be investigated. Any disruption due to operation of the project would be addressed in consultation with the affected landholder. Where it is identified there is a disruption, Transgrid would investigate and implement mitigation measures (such as signal boosting equipment) in consultation with the affected operator.	Operation	Transmission line
LP12	Biosecurity controls, confirmed in consultation with the affected landholders, would be implemented during operation to minimise the risk of off-site transport or spread of disease, pests or weeds during maintenance activities.	Operation	All locations
LP13	Where present within the operational transmission line easement and associated areas for permanent infrastructure, weeds would be managed in accordance with the *Biosecurity Act 2015*.	Operation	All locations

12.6.3. Managing residual impacts or uncertainties

The final transmission infrastructure locations and extent of property acquisition would be refined and confirmed during finalisation of the proposal design in consultation with landholders.

13. Landscape character and visual amenity

This chapter provides an assessment of potential landscape character and visual amenity impacts and mitigation measures to address these impacts. It summarises *Landscape and Visual Impact Assessment* (Iris, 2021) for the proposal (refer to Technical paper 5).

13.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to landscape character and visual amenity and where these requirements are addressed in this EIS are outlined in Table 13-1.

Table 13-1 Secretary's environmental assessment requirements – landscape character and visual amenity

Ref.	Secretary's environmental assessment requirements	Where addressed
Amenity		
Key issues	The EIS must address the following matters: • an assessment of the likely visual impacts of the project on surrounding residences, scenic or significant vistas, night lighting, air traffic and road corridors in the public domain.	Landscape and visual impacts during construction are detailed in Section 13.4. Landscape and visual impacts during operation are detailed in Section 13.5.

13.2. Assessment approach

13.2.1. Legislative and policy context

The assessment considers national, state and local government policies and plans relevant to landscape and visual amenity, including:

- *Far West Regional Plan 2036* (DPE, 2017b)
- *Riverina Murray Regional Plan 2036* (DPE, 2017c)
- relevant Local Strategic Planning Statements for the Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart and Wagga Wagga LGAs that outline how to maintain a high level of environmental amenity, liveability and landscape quality
- relevant LEPs for the Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart and Wagga Wagga LGAs which provide land zoning and local development controls for each LGA. However, as the proposal is subject to assessment under Division 5.2 of the EP&A Act, the proposal is not subject to environmental planning instruments such as LEPs or Development Control Plans (DCPs)
- other policies and guidelines that provide more specific guidance including:
  - *Guidance Note for Landscape and Visual Assessment* (Australian Institute of Landscape Architects Queensland, 2018)
  - *Guidance for Landscape and Visual Impact Assessment*, Third Edition (Landscape Institute and Institute of Environmental Management & Assessment, 2013)
  - *Control of the obtrusive effects of outdoor lighting - AS/NZS 4282:2019* (Standards Australia and Standards New Zealand, 2019).

13.2.2. Methodology

The visual and landscape character impact assessment has considered the proposal study area.

Landscape character and visual amenity were assessed to identify the likely impacts arising from the proposal, considering landscape character, day and night-time visual amenity. This generally involved:

- a review of the relevant legislative and policy framework
- identifying the existing environmental conditions, supported by site visits
- identifying landscape character areas
- assessing the impacts of the proposal during construction and operation on:
  - landscape character
  - visual impact during the daytime and night-time (the visual impacts assessed were from publicly accessible locations, typically existing road corridors along the alignment)
  - impacts on views from private properties
- assessing potential cumulative impacts due to other projects within neighbouring areas
- identifying mitigation measures.

The operational landscape and visual impact assessment adopted a proposed centreline for the transmission line alignment for the purposes of impact assessment. The potential landscape and visual impacts would be confirmed during the finalisation of the proposal design to take into account any alignment shifts along the alignment that may result in a shift of proposed tower locations towards, or away from, sensitive receivers.

The assessment methodology for the landscape and visual impact assessment is detailed in the following section.

13.2.2.1. Landscape impact assessment method

To assess the potential landscape character impacts, the assessment identifies the:

- the proposal study area has been divided area into landscape character areas that reflect the qualities of the built, natural and cultural environment
- sensitivity of the landscape reflects the frequency and volume of users, as well as reflecting on the valued landscape characteristics such as rarity, tranquillity, scenic amenity and its contribution to sense of place. Landscape sensitivity levels applied in this assessment are defined in Table 13-2
- magnitude of change to the landscape character due to the proposal. This considers adverse and beneficial impacts, as well as direct impacts (e.g. the removal of vegetation) and indirect impacts (e.g. changes to the function of an area of open space). The magnitude ranges from very high to negligible, and are defined in Table 13-3)
- impact to landscape character. This is determined through a risk-based matrix approach that considers the sensitivity of the specific landscapes paired with magnitude of change anticipated resulting from the proposal (refer to Table 13-4).

Table 13-2 Landscape sensitivity levels

Landscape sensitivity	Description
National	Landscape feature or place that is protected under national legislation or international policy (e.g. the Red Top Lookout at the World Heritage Listed Mungo National Park).
State	Landscape feature or place that is heavily used and/or is iconic to the state (e.g. Lake Victoria).
Regional	Landscape feature or place that is heavily used/iconic and valued by residents of a major portion of a city or a non-metropolitan region, and/or places with regionally important scenic value or to landscape features.
Local	Landscape feature that is valued and experienced by concentrations of residents and/or local recreational users, and/or places of local scenic value or local landscape features.
Neighbourhood	Places without any particular scenic value or local landscape features.

Table 13-3 Landscape magnitude of change

Magnitude of change	Description
Very High	The landscape is altered such that the proposal dominates and/or transforms its character, amenity and/or function.
High	The proposal substantially changes and/or is not compatible with the character, amenity, and function of the landscape.
Moderate	The proposal somewhat changes and/or is not compatible with the character, amenity, and function of the landscape.
Low	The proposal changes are minor and/or are compatible with the character, amenity, and function of the landscape.
Negligible	The proposal would not change the character, amenity and/ or function of the landscape.

Table 13-4 Landscape impact matrix

Magnitude of change	Sensitivity				
	National	**State**	**Regional**	**Local**	**Neighbourhood**
Very high	Very high	Very high	High	High-Moderate	Moderate
High	Very high	High	High-Moderate	Moderate	Moderate-Low
Moderate	High	High-Moderate	Moderate	Moderate-Low	Low
Low	High-Moderate	Moderate	Moderate-Low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

13.2.2.2. Daytime visual impact assessment method

The daytime visual impact assessment aims to identify the range of views to the proposal study area that may be impacted. To assess the potential visual impacts, the assessment identifies the impacts to visual amenity as experienced by people and aims to identify the range of views to the proposal study area that may be impacted.

To assess the potential visual impacts, the assessment identifies the:

- existing visual catchment through an assessment of existing visual amenity conditions, supported by a digital visibility analysis and site visits
- viewpoints that have been selected to represent the range of views within the visual catchment. This included views from locations which have been identified as having increased visual sensitivity and where people are likely to congregate, such as lookouts, road corridors and scenic routes, as well as locations in sensitive recreational and natural areas
- visual sensitivity of the viewpoints considering the nature and duration of views, and distance of view. This considers the sensitivity of the possible views, ranging from national to neighbourhood significance (refer to Table 13-5)
- magnitude of change on specific viewpoints from the proposal. The magnitude of levels ranges from very high to negligible, and are defined in Table 13-6)
- overall level of impact on visual amenity. This is determined through a risk-based matrix approach that considers the sensitivity of the specific visual amenity paired with magnitude of change anticipated resulting from the proposal (refer to Table 13-7).

Table 13-5 Visual sensitivity levels

Visual sensitivity	Description
National	Heavily experienced view to a national icon, views to areas with a scenic value of national importance or to landscape features of the state, and/or views from World Heritage Listed Places.
State	Heavily experienced view to a feature or landscape that is iconic to the State (e.g. views from the Blue Mountains or the view from Memorial lookout at Lake Victoria).
Regional	Heavily experienced view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or an important view from an area of regional open space (e.g. view to The Rock from Urana Street in the town of The Rock), or views to areas of regionally important scenic value or to landscape features of the region.
Local	High quality view experienced by concentrations of residents and/or local recreational users, local commercial areas and/or large numbers of road or rail users, or views to areas of local scenic value or to local landscape features.
Neighbourhood	Views where visual amenity is appreciated by a small number of residents, not particularly valued by the wider community.

Table 13-6 Visual magnitude of change

Magnitude of change	Description
Very high	The view is altered such that the proposal dominates and transforms the character of the view.
High	The proposal is visually prominent, and/or contrasts with the character of the view.
Moderate	The proposal is somewhat prominent and/or is not compatible with the character of the view.
Low	The proposal is not visually prominent and/or is visually compatible with the character of the view.
Negligible	The proposal is not visible, is not visually prominent in the view and/or is compatible with the character of the view.

Table 13-7 Visual impact matrix

Magnitude of change	Sensitivity				
	National	**State**	**Regional**	**Local**	**Neighbourhood**
Very high	Very high	Very high	High	High-Moderate	Moderate
High	Very high	High	High-Moderate	Moderate	Moderate-Low
Moderate	High	High-Moderate	Moderate	Moderate-Low	Low
Low	High-Moderate	Moderate	Moderate-Low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

13.2.2.3. Night-time visual impact assessment method

An assessment of the potential visual impacts of the proposal at night uses similar methodology to the daytime assessment. To assess the potential night-time visual impacts, the assessment identifies the night-time visual sensitivity by determining the environmental zone(s) (defined in *Control of the obtrusive effects of outdoor lighting - AS/NZS 4282:2019* (Standards Australia and Standards New Zealand, 2019) that best describes the existing night-time visual conditions.

These zones are typical night-time settings and reflect the predominant light level of each landscape character area. The impact to night-time visual amenity uses a risk-based matrix approach that considerers the sensitivity of the specific night-time visual impacts, paired with magnitude of change anticipated resulting from the proposal. Each environmental zone is assigned a level of sensitivity as described in Table 13-8.

Table 13-8 Environmental zone sensitivity – night-time

Sensitivity level	Description	Examples
Very high	A0: Intrinsically dark	UNESCO Starlight Reserve IDA Dark Sky Parks Major optical observatories No road lighting – unless specifically required by the road controlling authority
High	A1: Dark	Relatively uninhabited rural areas No road lighting – unless specifically required by the road controlling authority
Moderate	A2: Low district brightness	Sparsely inhabited rural and semi-rural areas
Low	A3: Medium district brightness	Suburban areas in towns and cities
Very low	A4: High district brightness areas	Town and city centres and other commercial areas Residential areas abutting commercial areas

Further detail regarding the methodology undertaken for the assessment of views from private properties is provided in Section 3.3.3 of Technical paper 5.

13.2.2.4. Assessment of views from private properties

There is no current standard guidance for the assessment of visual impact on views for private properties that applies to energy transmission projects in NSW. However, the assessment of visual impact on views from private residential properties is generally guided by the planning principles for 'view sharing' provided in the judgment of the NSW Land and Environment Court in the *Tenacity Consulting V Warringah Council* [2004], NSWLEC 140. The principles set out in the judgment can be applied to regional landscape settings in a more general way and with considerations of scenic preference appropriate for the range of landscapes available within the setting of the proposal.

For the purposes of this assessment:

- all receivers identified within the proposal study area have been assessed. Where there is a group of properties in this area, a house which represents the worst-case scenario has been selected and assessed as representative of views from this group
- to determine whether view sharing is reasonable the judgment identifies a four-step assessment process, considering the views affected (desktop only) and from what part of the property the views are obtained, the extent of the impact and the opportunity to respond through finalisation of the proposals design
- where an impact was identified as a result of the proposal, methods for reducing and managing these impacts were considered and specific mitigation approaches have been recommended.

Due to the scale of the project and number of potential sensitive receivers, the assessment from private viewpoints was undertaken as a desktop analysis, and therefore a conservative approach was taken with respect to the identified impact levels. It is intended that where properties have been identified as having high or very high potential visual impacts, this would warrant further investigation during subsequent stages of the finalisation of the proposal design including engagement with landowners to identify the actual impact level and potential for mitigation of these impacts.

The potential impact levels assigned for each private properties was based upon the potential impact levels described in Table 13-9. This table includes a range of factors that are typical indicators of each impact level, with a combination of these scenarios being present for each level of impact.

Table 13-9 Visual impact levels – private properties

Potential visual impact level	Description
Very high	Potential for a substantial/overwhelming change to views, may include one or a combination of the following: • towers or substation located in close proximity • towers of a large height and scale • transmission line extending across the view with multiple towers visible • transmission line changes direction and may include larger corner towers • towers prominently located on a ridgeline • limited screening by vegetation or landform • large areas of vegetation removed • prominent new access tracks and/or landform change visible.
High	Potential for a considerable change to views, may include one or a combination of the following: • towers or substation located in foreground of the view • towers of a large height and scale • transmission line extending across the view with multiple towers visible • transmission line changes direction and/or includes larger corner towers • towers prominently located on a ridgeline • limited screening by vegetation or landform • large areas of vegetation removed • some new access tracks and/or landform change visible.
Moderate	Potential for a noticeable change to views, may include one or a combination of the following: • towers or associated infrastructure located in the middle ground • towers of a moderate to large height and scale • several towers visible or partly seen • some screening by vegetation or landform • some vegetation removal, access tracks and/or landform change visible.
Low-Moderate	Potential for a noticeable change to views, may include one or a combination of the following: • towers or associated infrastructure located in the middle to background • towers of a moderate to large height and scale • several towers may be partly seen above or between vegetation • some screening by vegetation or landform • some vegetation removal, access tracks and/or landform change visible.

Potential visual impact level	Description
Low	Potential for a slight change to the views, may include: • towers glimpsed in the background • infrastructure visible but not prominent • other similar infrastructure visible • glimpses to vegetation removal, access tracks and/or landform change.
Negligible	No change visible or the infrastructure would not be discernible in the view.

Further detail regarding the methodology undertaken for the assessment of views from private properties is provided in Section 3.3.4 of Technical paper 5.

13.3. Existing environment

13.3.1. Overview

Landscape character areas for the existing environment have been characterised as areas with similar topography, vegetation type and land use. The five landscape character types for the proposal from west to east (depicted in Figure 13-1) are:

- Mallee shrubland and rural landscape
- Murrumbidgee River plain rural landscape
- Lockhart rural valley landscape
- Great Dividing Range foothills landscape
- Wagga Wagga rural fringe landscape.

The visual catchment of the proposal study area varies and is determined primarily by landform and vegetation cover. More significant structures, such as transmission line structures, would be visible from a broad visual catchment due to the broad open semi-arid and rural landscapes. The visual sensitivity of the proposal study area is influenced by a range of tourist routes, facilities and land uses located throughout the study area. The location of selected viewpoints is provided in Figure 13-1. In addition to these viewpoints, a view from the air is addressed for the whole proposal study area. A number of tourist routes and places are present within the proposal study area, including:

- Classic Australian Drive
- Mallee Cliffs National Park
- Lake Benanee rest area
- Kidman Way
- Murrumbidgee Valley National Park
- Yanga State Conservation Area
- Oolambeyan National Park
- The Rock Nature Reserve
- The Newell Highway, which is part of Route 39 Touring Route (Victoria to Queensland)
- Long Paddock – Cobb Highway Touring Route.

While the tourist routes and places exist within five landscape character types, no significant vistas or identified scenic views exist within the proposal study area. However, this assessment has considered views from scenic routes, views to landscapes with scenic value and views from road corridors. The relative scenic value of these views is considered in determining the sensitivity level of each view (as discussed in Section 13.4 and Section 13.5).

13.3.2. Existing road corridors

The existing road network across the proposal study area consists of a combination of national, state, regional and local roads. The key road corridors within the proposal study area include:

- Sturt Highway: A major east-west highway that connects Buronga to Wagga Wagga including towns such as Euston, Balranald and Hay
- Newell Highway: A major north-south highway that connects south-eastern Queensland and Victoria via central New South Wales
- Olympic Highway: A major north-south highway in the central western NSW which provides links to the Sturt Highway at Wagga Wagga
- Riverina Highway: An east-west highway that connects the Hume Highway to the Cobb Highway
- Cobb Highway: A north-south highway that provides a key connection across the proposal study area
- Kidman Way: A north-south highway that links the Newell Highway and the Sturt Highway
- Murray Valley Highway: A north-south highway in Victoria and NSW that connects to the Sturt Highway at Euston
- Yanga Way: A north-south state road that connects Mallee Highway to the Sturt Highway at Balranald.

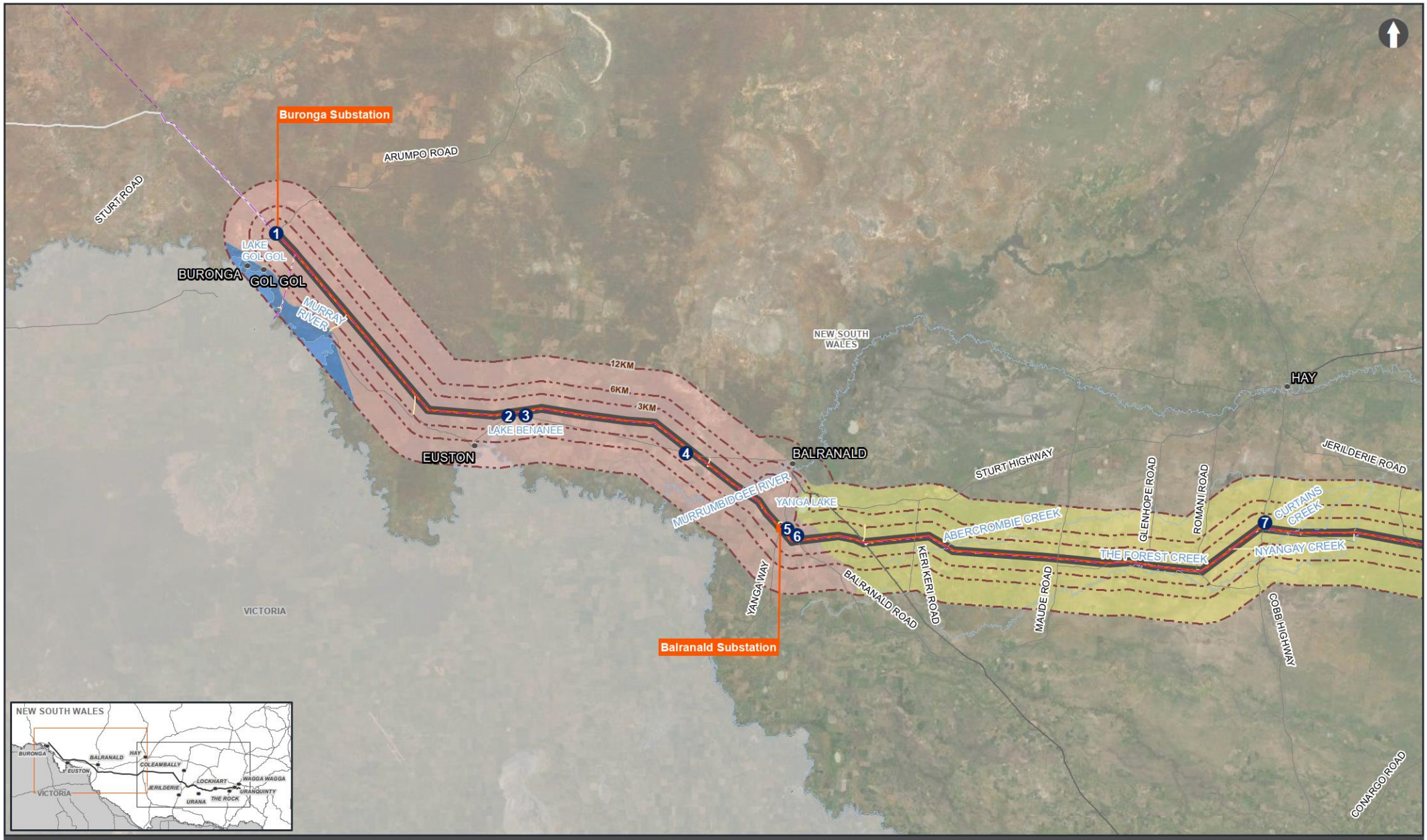

Figure 13-1

Landscape character areas and viewpoints

Sheet 1 of 2

- EnergyConnect (NSW - Eastern Section)
- EnergyConnect (NSW - Western Section)
- Roads
- Existing Railway
- Existing Substation
- Proposal Study Area (1km)
- Existing transmission line infrastructure
- Waterbody
- Distances from the proposal study area
- Viewpoint Location

Landscape Character Areas

- Coleambally irrigation area landscape
- Great Dividing Range foothills landscape
- Lockhart rural valley landscape
- Mallee shrubland and rural landscape
- Murray River plain rural landscape
- Murrumbidgee River plain rural landscape
- Wagga Wagga rural fringe landscape

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Source: NSWSS, ESRI, Transgrid, WSP

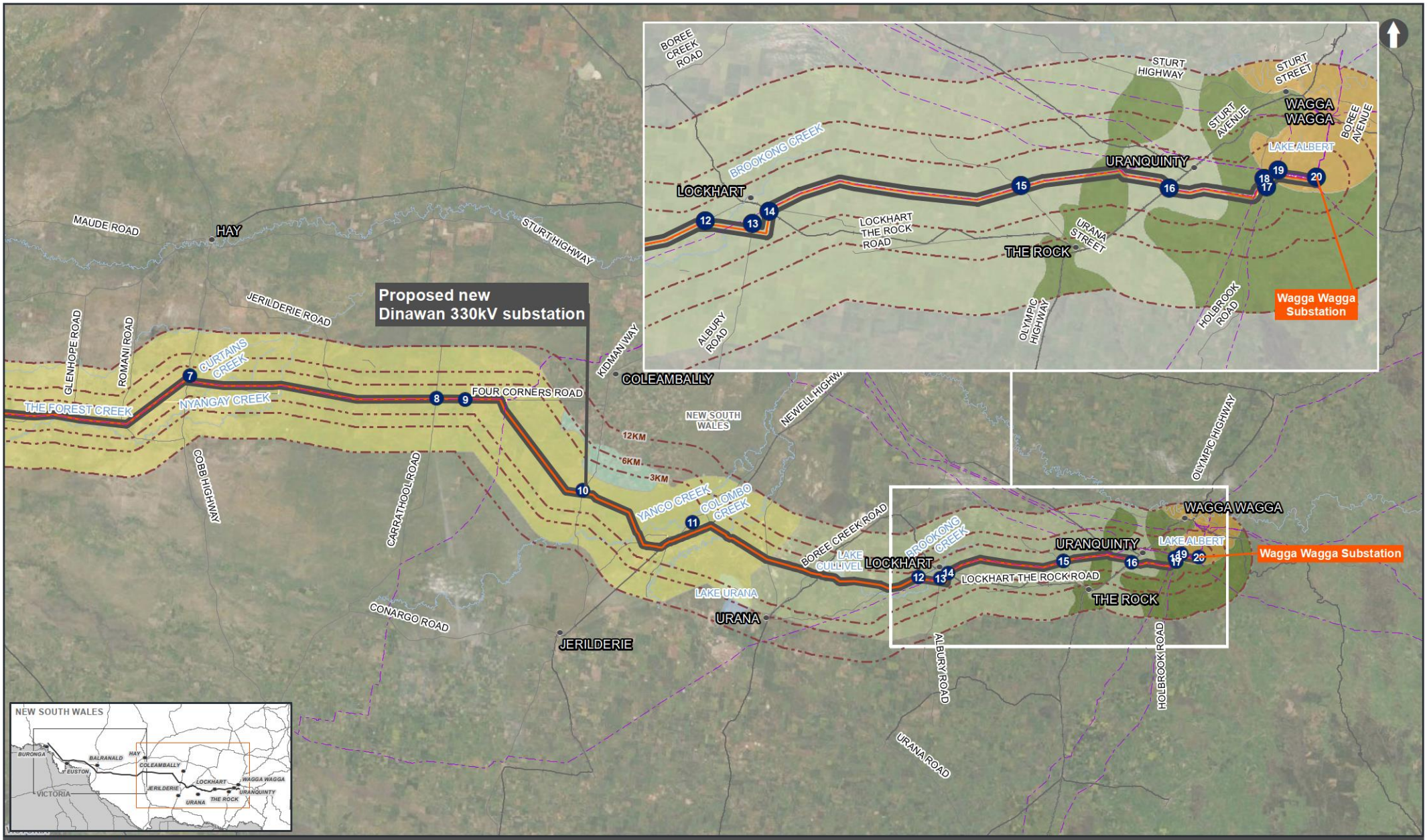

Figure 13-1

Landscape character areas and viewpoints

Sheet 2 of 2

- EnergyConnect (NSW - Eastern Section)
- EnergyConnect (NSW - Western Section)
- Roads
- Existing Railway
- Substation
- Proposal Study Area (1km)
- Existing transmission line infrastructure
- Waterbody
- Distances from the proposal study area
- Viewpoint Location

Landscape Character Areas

- Coleambally irrigation area landscape
- Great Dividing Range foothills landscape
- Lockhart rural valley landscape
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- Murray River plain rural landscape
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Source: NSWSS, ESRI, Transgrid, WSP

In addition, a number of regional roads local roads would be located within the study area. A number of the viewpoints assessed as part of the landscape and visual impact assessment were considered from these road corridors (refer to Section 13.4 and Section 13.5).

13.3.3. Mallee shrubland and rural landscape

13.3.3.1. Daytime landscape sensitivity

The landscape generally consists of open, undulating rural plains with areas of native eucalyptus forest (including mallee shrubland), between Buronga and Balranald.

In most areas, the proposal study area traverses areas of mallee scrub, characterised by low eucalyptus trees with an understorey of low native shrubs and grasses. Some small areas have been cleared for agricultural uses, near Buronga, Mallee, Euston and Balranald.

There are several seasonally dry relic lake beds, such as Lake Gol Gol and Gol Gol swamp, south of the proposal study area. While not visually prominent, these form local visual features and distinctive formations in the landscape.

Existing electricity infrastructure, including 220kV transmission lines and substations, and highways (Sturt Highway and Silver City Highway) are present within the proposal study area. Tourists to the area travel along the Wentworth to Mungo Loop tourist drive.

The Mallee shrubland and rural landscape character area is of local sensitivity. The visual sensitivity (daytime) of the identified viewpoints within this landscape character unit is summarised in Table 13-10.

Table 13-10 Mallee shrubland and rural landscape – viewpoints (daytime)

Viewpoint	Description	Visual sensitivity (daytime)
Viewpoint 1: View south from Arumpo Road to the Buronga substation	Arumpo Road provides local access to properties and the Buronga substation. It also forms part of the 'Wentworth to Mungo Loop' tourist drive.	Local
Viewpoint 2: View east from Sturt Highway, near Lake Benanee	The Sturt Highway is a two-lane road providing access between Buronga and Balranald and forms part of 'The Classic Australian Drive' tourist route. This view is experienced by high number of receivers, including tourists, residents and freight transporters. Existing power infrastructure can be seen, which reduces the sensitivity of this view.	Local
Viewpoint 3: View north west from Benanee Road to alignment	This road provides local access to properties. Views such as this are common within the areas to the north of Lake Benanee.	Neighbourhood
Viewpoint 4: View east from Sturt Highway to alignment crossing	The Sturt Highway is a two-lane road and forms part of 'The Classic Australian Drive' tourist route. This route also includes views south to Waldaira Lake. This view is experiences by a high number of receivers, including tourists. Existing power infrastructure can be seen, which reduces the sensitivity of this view.	Local

Viewpoint	Description	Visual sensitivity (daytime)
Viewpoint 5: View south from Yanga Way to alignment crossing	This road provides local access to properties and other localities such as Limondale and Sunraysia solar farms.	Neighbourhood
Viewpoint 6: View south from Balranald Road to alignment crossing	This unsealed road provides local access to properties. Views such as this are common within this area south of Balranald.	Neighbourhood

13.3.3.2. Night-time landscape sensitivity

At night, this landscape would have low light levels with scattered rural residences across the landscape. There would be some denser clusters of residences near townships and light from vehicles travelling along local roads and the Sturt Highway, contributing to the light levels. The sky glow from nearby settlements such as Buronga, Gol Gol, Euston and Balranald may also influence this character area. Overall, this landscape includes areas of Dark (A1) and is considered to have a high visual sensitivity at night-time.

13.3.4. Murrumbidgee River plain rural landscape

13.3.4.1. Daytime landscape sensitivity

The landscape generally consists of open, flat rural plains associated with the Murrumbidgee River and its tributaries. Known as the iconic Hay Plains, the landscape generally extends from Balranald to Urana.

This landscape includes the Murrumbidgee Valley Nature Reserve, comprised of Yanga National Park, Yanga Nature Reserve and the Yanga State Conservation Area. The proposal study area would traverse the southern part of Yanga State Conservation Area, where existing transmission infrastructure is located, with visitor facilities over five kilometres from the proposal study area.

Existing electricity infrastructure including the Balranald to Darlington Point 220kV transmission lines and Deniliquin to Coleambally 132kV transmission lines and several arterial roads (e.g. the Cobb Highway, Newell Highway and Kidman Way) are present within the proposal study area.

The Murrumbidgee River plain rural landscape character area is considered to be of local sensitivity. The visual (daytime) sensitivity of the identified viewpoints within this landscape character unit is summarised in Table 13-11.

Table 13-11 Murrumbidgee River plain rural landscape – viewpoints (daytime)

Viewpoint	Description	Visual sensitivity (daytime)
Viewpoint 7: View south from Cobb Highway	The Cobb Highway is a two-lane road and forms part of 'The Long Paddock – Cobb Highway Touring Route'. This view is experienced by a larger number of people, including tourists and locals. Existing power infrastructure can be seen, which reduces the sensitivity of this view.	Local
Viewpoint 8: View east at the intersection of Conargo and North Boundary Road	Local roads that provide local access to properties. Views such as this are common within the rural area west of Coleambally.	Neighbourhood
Viewpoint 9: View east along Four Corners Road	This unsealed road provides local access to properties. Views such as this are common within this rural area west of Coleambally.	Neighbourhood
Viewpoint 10: View south along Kidman Way to proposed Dinawan 330kV substation	Kidman Way is a two-lane road that forms part of a historic touring route between Albury and Bourke. Rural views such as this are experiences by a high number of receivers, including tourists, residents, and freight transporters.	Local
Viewpoint 11: View southeast along the Newell highway	The Newell Highway is a two-lane road that forms part of the 'Route 39' touring route between Victoria and Queensland. Rural views such as this are experienced by a high number of receivers, including tourists, residents and freight transporters.	Local

13.3.4.2. Night-time landscape sensitivity

At night, his rural landscape is predominantly dark with limited light sources at night, such as lighting associated with homesteads and agricultural buildings on rural properties, and vehicles on remote roads. Overall, this landscape includes areas of Dark (A1) which is considered to have a high visual sensitivity at night-time.

13.3.5. Lockhart rural valley landscape

13.3.5.1. Daytime landscape sensitivity

The landscape generally comprises flat, open plains of dryland arable fields, with grazing pastures on more undulating areas that are unsuitable for farming. The landscape is located in the heart of the Riverina Region.

This landscape includes rural areas of the central Riverina, which are identified as having amenity and scenic landscape values. This area also includes the township of Lockhart, a local conservation area, and The Rock Nature Reserve, a local landmark and vantage point to view the surrounding rural area. This landscape would be appreciated by small numbers of people travelling along the network of rural roads, including tourists and visitors to the region.

Existing electricity infrastructure including Finley to Uranquinty 132kV transmission lines and other infrastructure, predominantly rural structures to support the surrounding agricultural uses are present within the proposal study area.

The Lockhart rural valley landscape character area is considered to be of local sensitivity. The visual (daytime) sensitivity of the identified viewpoints within this landscape character unit is summarised in Table 13-12.

Table 13-12 Lockhart rural valley landscape – viewpoints (daytime)

Viewpoint	Description	Visual sensitivity (daytime)
Viewpoint 12: View north along Urana-Lockhart Road	Urana-Lockhart Road is a two-lane road used mainly by nearby residents and their visitors. This view includes the Brookong State Forest and is on the approach to the town of Lockhart.	Local
Viewpoint 13: View south west along Albury Lockhart Road	Albury–Lockhart Road is a two-lane road used mainly by nearby residents and their visitors. The view is common within the Brookong Creek valley, south of Lockhart.	Neighbourhood
Viewpoint 14: View east along Lockhart-The Rock Road	Lockhart–The Rock Road is a narrow two-lane road used mainly by a moderate number of tourists and residents. The view is common within this rural area east of Lockhart.	Local
Viewpoint 15: View south along Bullenbong Road	Bullenbong Road is a two-lane road used mainly by nearby residents. The Rock is an important local visual landmark, and this view is improved by the backdrop of this feature and ridgeline.	Local
Viewpoint 14: View northeast from the Olympic Highway	The Olympic Highway is a two-lane road passing through the Riverina region. The view is experienced by a high number of receivers, including tourists, residents and workers travelling on the road and rail corridor.	Local

13.3.5.2. Night-time landscape sensitivity

At night, this landscape would have low light levels with scattered rural residences across the landscape. There would be some denser clusters of residences in the vicinity of the township of Lockhart where there would also be more vehicles travelling along local roads, contributing to the light levels. There would be a general sky glow above the settlements which would also influence this character of this area. Overall, this landscape is an area of Low district brightness (A2) and is considered to have a moderate visual sensitivity at night-time.

13.3.6. Great Dividing Range foothills landscape

13.3.6.1. Daytime landscape sensitivity

The landscape generally separates the rural valley landscape east of Lockhart, and the rural plains along the Murrumbidgee River, near Wagga Wagga, and generally comprises hilly upland areas and escarpments rising above the surrounding rural plains.

Part of the western slopes of The Great Dividing Range, the landscape includes visually prominent ridgelines and hills which are valued as local and regional landscape features. These slopes are visually important to the visual setting of Wagga Wagga, and The Rock Nature Reserve is a visual marker within the region and vantage point to view the surrounding rural area.

There are existing transmission line easements and roads crossing the lower ridgelines.

The Great Dividing Range foothills landscape character area is considered to be of regional sensitivity. The visual (daytime) sensitivity of the identified viewpoints within this landscape character unit is summarised in Table 13-13.

Table 13-13 Great Dividing Range foothills landscape – viewpoints (daytime)

Viewpoint	Description	Visual sensitivity (daytime)
Viewpoint 17: View north west from Holbrook Road	A two-lane road that provides access to properties and visitors to the area. This view is experienced by small numbers of motorists travelling along the rural road network, including tourists. The view is common within this rural area south of Wagga Wagga. This is an incidental view to the ridgeline, typical of views in this valley.	Neighbourhood

13.3.6.2. Night-time landscape sensitivity

At night, this landscape would have low light levels with scattered rural residences across the landscape and a greater density of trees on the steeper, hilly landscape. This landform and vegetation cover would provide some screening of light sources within this area. There are also less roads crossing the hilly terrain, and therefore fewer vehicle headlights seen in this area. There are no densely settled areas within this landscape character area, however, the towns and highway in the surrounding landscape would influence the light levels in this area. Overall, this landscape is an area of Low district brightness (A2) and is considered to have a moderate visual sensitivity at night-time.

13.3.7. Wagga Wagga rural fringe landscape

13.3.7.1. Daytime landscape sensitivity

Forming a transitional character, the landscape extends between the Murrumbidgee River and the elevated lands of the Great Dividing Range, and generally comprises generally flat and low-lying land.

The semi-rural landscape fringes the urban area of Wagga Wagga. The area is comprised of small farms and acreage properties, residential development and light industrial activities such as waste and recycling facilities.

The landscape is traversed by a complex network of electricity infrastructure including the Wagga Wagga substation, a large variety of transmission tower types and sizes, the Uranquinty and Wagga 132kV, Yanco and Australian Newsprint Mills to Wagga Wagga 132kV transmission lines, and three further sets of larger 330kV transmission lines.

The Wagga Wagga rural fringe landscape character area is considered to be of neighbourhood sensitivity. The visual (daytime) sensitivity of the identified viewpoints within this landscape character unit is summarised in Table 13-14.

Table 13-14 Wagga Wagga rural fringe landscape – viewpoints (daytime)

Viewpoint	Description	Visual sensitivity (daytime)
Viewpoint 18: View east from Holbrook Road	A two-lane road that provides access to properties and visitors to the area. Rural views such as this are common within this rural area south of Wagga Wagga.	Neighbourhood
Viewpoint 19: View west from Boiling Down Road	This unsealed road provides access to properties. Although the Gelston Park and Gregadoo Hills area a local feature, rural views such as this are common within this area south of Wagga Wagga.	Neighbourhood
Viewpoint 20: View southwest from Butterbush Road	This road provides access to properties. Although the Gelston Park and Gregadoo Hills are a local visual feature, rural views such as this are common within this area south of Wagga Wagga.	Neighbourhood

13.3.7.2. Night-time landscape sensitivity

At night, this landscape would have medium light levels with scattered rural residences across the landscape and a greater density of residences to the north on the outskirts of Wagga Wagga. While the vegetation cover would provide some screening of light sources within this area, there would be a bright skyglow associated with the city of Wagga Wagga. This would include the lights from vehicles travelling along roads within this area. Overall, this landscape is an area of medium district brightness (A3) and is considered to have a low visual sensitivity at night-time.

13.3.8. Other viewpoints

The proposal study area is also viewed from the air. These views are seen from scenic flights from Lockhart Airport, with routes extending to Lake Cullivel and Lake Urana with views of the attractive patchwork of surrounding agricultural fields. As these scenic flights are for tourist and recreational purposes, the views from these flights would be of regional visual sensitivity.

13.4. Potential impacts – construction

13.4.1. Landscape character impacts

The level of impact on landscape character during construction is dependent on the sensitivity of the landscape and the magnitude of change that would occur as a result of the proposal.

Across all landscape character areas, construction activities would involve the temporary mobilisation of plant throughout the proposal landscape to construct the proposal and to provide ancillary infrastructure (e.g. construction compounds and access tracks). Construction activity would be most prominent around transmission line structure footings, and at the Dinawan 330kV substation and Wagga Wagga substation upgrade and expansion sites. Vegetation removal would be required, and landform modification would be small and localised.

Of specific note:

- within the Mallee shrubland and rural landscape, the alignment of the transmission line easement would largely avoid areas of native bushland, and the dry relic lakes, to the south of the Sturt Highway, which are important local landscape features. However, there would be areas where native trees would be removed within farmland and at creek and river crossings, including at the Murrumbidgee River crossing south west of Balranald. While the works would be small at each individual tower site and the proposed Dinawan 330kV substation as individual elements, combined these works would extend across a large area, and would therefore have a moderate magnitude of change to the landscape

- within the Murrumbidgee River plain rural landscape, the presence of existing energy power infrastructure in the vicinity of the alignment, limited vegetation removal and flat landform reduces the magnitude of change from construction works (considered to be a low magnitude), with no direct impacts on any important landscape features expected

- within the Lockhart rural valley landscape, there would be areas of localised landform modifications to the existing undulating landscape for the proposal. There would also be areas of localised landform modifications to accommodate the transmission line towers and also at the construction compound and accommodation camp site. There would also be vegetation within sections of the Cullivel State Forest and Brookong State Forest removed to accommodate the transmission line easement. Overall, this is therefore considered to result in a moderate magnitude of change to the existing landscape during construction

- within the Great Dividing Range foothills landscape, there is greater vegetation coverage and more challenging terrain that would result in greater vegetation clearing and landform modification (moderate landscape character change) compared to the three more western landscape character areas

- within the Wagga Wagga rural fringe landscape, there would be only small and localised modifications to the predominately flat terrain. However, the combined modifications would comprise a larger area with the expansion of the Wagga Wagga substation in addition to the transmission line infrastructure.

Table 13-15 summarises the construction impact assessment results for landscape character.

Table 13-15 Summary of landscape impact during construction – daytime

Landscape character area	Daytime landscape sensitivity	Magnitude of change	Landscape impact
Mallee shrubland and rural landscape	Local	Moderate	Moderate-low
Murrumbidgee River plain rural landscape	Local	Low	Low
Lockhart rural valley landscape	Local	Moderate	Moderate-low
Great Dividing Range foothills landscape	Regional	Moderate	Moderate
Wagga Wagga rural fringe landscape	Neighbourhood	Moderate	Low

13.4.2. Daytime visual amenity impacts

Construction activities that would impact visual amenity are associated with vegetation removal, excavation and levelling works, the construction of the proposal infrastructure, and the presence of plant and equipment that would temporarily pass through the assessed viewpoints (refer to Figure 13-1 for viewpoint locations). This includes excavators, cranes, ground pulled draw wire or stringing drones as required to erect the transmission line structures and string wires and conductors.

Table 13-16 summarises the construction impact assessment results for daytime visual amenity. Views chosen were from all highways and from a range of intersecting roads intermittently along the alignment. Of all the viewpoints assessed the greatest magnitudes of changes were identified to be for Viewpoint 10 and Viewpoint 12.

At Viewpoint 10, the substation site would extend across a large part of the middle and background of this view. Construction of the transmission line towers would be seen to either side of the substation, including foundation works, erection of the towers and stringing of the wires and conductors. The corridor would be perpendicular to and cross the highway about 600 metres away. A construction compound and accommodation camp site would be established beside the substation construction site, including a large laydown area to the north east of the substation site (around 20 to 25 hectares), for storage of equipment and stockpiling, including use of mobile screening plant. Combined, the proposed works in this viewpoint would result in a high magnitude of change.

At Viewpoint 12, construction of the proposed transmission line would be located directly adjacent to the existing road reserve. The work would include the removal of existing bushland within the Brookong State Forest and adjacent to the road for each tower site and any vegetation within the transmission line easement which exceed vegetation clearance requirements (with some vegetation within the road verge not within the transmission line easement being retained). The works would include the installation of the new transmission line towers and stringing of the wires and conductors, rising above the height of the adjacent treeline. Overall, the construction of the proposal within this view would result in a very high magnitude of change due to the large area of vegetation removal required for construction, including within Brookong State Forest. The scale of the construction activity would reduce the amenity of this view.

For the remaining viewpoints:

- where works are visible at the assessed viewpoints, construction works would contrast with the surrounding landscape resulting in a low to moderate magnitude of change
- as distances to construction works increase or where intervening vegetation or existing power infrastructure are present, the magnitude of the change due to construction would decrease
- when viewed from the air, construction work would be visible but would be seen in a complex landscape resulting in a moderate to negligible magnitude of change.

Table 13-16 Summary of day time visual impacts during construction

Location		Visual sensitivity	Magnitude of change	Visual impact
Mallee shrubland and rural landscape				
1	Viewpoint 1: View south from Arumpo Road to the Buronga substation	Local	Moderate	Moderate-Low
2	Viewpoint 2: View east from Sturt Highway, near Lake Benanee	Local	Low	Low
3	Viewpoint 3: View north west from Benanee Road to alignment	Neighbourhood	Low	Negligible
4	Viewpoint 4: View east from Sturt Highway to alignment crossing	Local	Moderate	Moderate-Low
5	Viewpoint 5: View south from Yanga Way to alignment crossing	Neighbourhood	Moderate	Low
6	Viewpoint 6: View south from Balranald Road to alignment crossing	Neighbourhood	Moderate	Low
Murrumbidgee River Plains rural landscape				
7	Viewpoint 7: View south from Cobb Highway	Local	Moderate	Moderate-Low
8	Viewpoint 8: View east at the intersection of Conargo and North Boundary Road	Neighbourhood	Moderate	Low
9	Viewpoint 9: View east along four Corners Road	Neighbourhood	Moderate	Low
10	Viewpoint 10: View south along Kidman Way to the proposed Dinawan 330kV substation	Local	High	Moderate
11	Viewpoint 11: View south east along Newell Highway	Local	Low	Low
Lockhart rural valley landscape				
12	Viewpoint 12: View north along Urana-Lockhart Road	Local	Very high	High-Moderate
13	Viewpoint 13: View south west along Albury Lockhart Road	Neighbourhood	Low	Negligible
14	Viewpoint 14: View east along Lockhart-The Rock Road	Local	Moderate	Moderate-Low
15	Viewpoint 15: View south along Bullenbong Road	Local	Moderate	Moderate-Low
16	Viewpoint 16: View northeast from the Olympic Highway	Local	Moderate	Moderate-Low

Location		Visual sensitivity	Magnitude of change	Visual impact
Great Dividing Range foothills landscape				
17	Viewpoint 17: View north west from Holbrook Road	Neighbourhood	Moderate	Low
Wagga Wagga rural fringe landscape				
18	Viewpoint 18: View east from Holbrook Road	Neighbourhood	Moderate	Low
19	Viewpoint 19: View west from Boiling Down Road	Neighbourhood	Moderate	Low
20	Viewpoint 20: View southwest from Butterbush Road	Neighbourhood	Moderate	Low
Views from the air				
1.	Scenic flights from Lockhart (Lake Cullivel)	Regional	Moderate	Moderate
2.	Scenic flights from Lockhart (areas surrounding Lockhart)	Regional	Low	Moderate-Low
3.	Lake Urana	Regional	No impact	No impact

13.4.3. Night-time impacts

Construction work would occur between 7 am to 7 pm, seven days a week, and camp accommodation would be proposed to operate 24 hours, seven days a week. Other works may be required during the night-time period, in limited circumstances.

There would be a moderate magnitude of change in the Mallee shrubland and rural landscape and Murrumbidgee River plains rural landscape due to the lighting required at the construction compounds and accommodation camps which would contrast with the predominantly dark landscape. While there are no construction compounds or accommodation camps proposed within the Lockhart rural valley landscape, there would be some out of hours works in remote locations where lighting would be required at the minor staging, storage and laydown ancillary areas as well as headlights from staff and construction vehicles accessing and moving along the construction impact area.

Given the hours of construction, the remaining landscape character areas would experience a low magnitude of change as:

- only early evening works are proposed during the short winter period in the Great Dividing Range foothills landscape.
- the Wagga Wagga rural fringe landscape has an existing medium district brightness, which reduces the sensitivity of the landscape and would absorb the construction lighting of the proposal.

Table 13-17 summarises the construction impact assessment results for night-time visual amenity.

Table 13-17 Summary of night-time visual impacts during construction

Landscape character area	Landscape sensitivity	Magnitude of change	Landscape impact
Mallee shrubland and rural landscape	High (Dark (A1))	Moderate	High-Moderate
Murrumbidgee River plains rural landscape	High (Dark (A1))	Moderate	High-Moderate
Lockhart rural valley landscape	Moderate (A2: Low district brightness)	Moderate	Moderate
Great Dividing Range foothills landscape	Moderate (A2: Low district brightness)	Low	Moderate-Low
Wagga Wagga rural fringe landscape	Low (A3: Medium district brightness)	Low	Low

13.5. Potential impacts – operation

13.5.1. Landscape character impacts

The impacts to landscape character during operation would result from the transmission lines, the new Dinawan 330kV substation, the upgraded and expanded Wagga Wagga substation and the ancillary infrastructure (such as access tracks). Areas directly impacted by construction would be rehabilitated, including revegetation as appropriate. Dispersed rural activities would continue under the transmission lines. However, there would be relatively small areas of direct impact, minimal landform changes and important landscape features would be avoided.

Of specific note:

- within the Mallee shrubland and rural landscape, there would be a low magnitude of change due to the presence of existing power infrastructure within the landscape
- within the Murrumbidgee River plain rural landscape, there would be a moderate magnitude of change due to the limited change to vegetation cover and landform within the landscape area. The vast landscape is capable of absorbing large scale energy infrastructure
- within the Lockhart rural valley landscape, there would be a moderate magnitude of change due to the substantial vegetation cover and an undulating landform that increases the capability of the landscape to absorb the proposal.
- within the Great Dividing Range foothills landscape, there would be a moderate magnitude of change due to the increased presence of transmission line infrastructure on visually prominent ridgelines and the extent of vegetation removal
- within the Wagga Wagga rural fringe landscape, there would be a moderate magnitude of change due to the presence of existing power infrastructure that lessens the magnitude of change in the rural landscape.

Table 13-18 summarises the operational impact assessment results for landscape character.

Table 13-18 Summary of landscape character impact during operation

Landscape character area	Landscape sensitivity	Magnitude of change	Landscape impact
Mallee shrubland and rural landscape	Local	Low	Low
Murrumbidgee River plain rural landscape	Local	Moderate	Moderate-Low
Lockhart rural valley landscape	Local	Moderate	Moderate-Low
Great Dividing Range foothills landscape	Regional	Moderate	Moderate
Wagga Wagga rural fringe landscape	Neighbourhood	Moderate	Low

13.5.2. Daytime visual amenity impacts

The operation of the proposal would result in changes in visual amenity, due to the introduction of transmission lines, the new Dinawan 330kV substation and associated structures into the landscape, or changes in the scale of infrastructure as a result of the upgrade and expansion of the Wagga Wagga substation.

The magnitude of change ranges from negligible to high-moderate, noting:

- there would be low and moderate-low visual impacts on views from roads within the Mallee shrubland and rural landscape, between Buronga and Balranald, during construction and operation. This is due to the relatively low sensitivity of these routes and the absorption capacity of the landscape with taller vegetation, an undulating terrain and precedent of existing power infrastructure

- there would be low and low-moderate visual impacts on views from roads within the Murrumbidgee River plain rural landscape, between Balranald and Urana, during construction and operation. This includes views from road corridors inlcu9idng the Cobb Highway and Newell Highway, Four Corners Road and other similar roads which cross the proposal in this area. This is due to the relatively low sensitivity of these routes, precedent of existing transmission line infrastructure and lack of other visual features in these views, which increases the visual absorption capacity

- in the vicinity of the proposed Dinawan 330kV substation, these impacts would increase to moderate adverse during construction and operation in views from Kidman Way (Viewpoint 10), due to the large scale and extent of the construction works and presence large scale infrastructure

- there would be moderate-low and moderate visual impacts in views from roads throughout the Lockhart rural valley landscapes during construction and operation of the proposal. This includes views from Lockhart-The Rock Road, Bullenbong Road and the Olympic Highway, which cross the proposal alignment in this area. This is due to the relatively low sensitivity of these routes and the absorption capacity of the landscape with taller vegetation, an undulating terrain and precedent of existing power infrastructure. These impacts would increase to a high-moderate adverse along Urana-Lockhart Road (Viewpoint 12) during construction and operation, due to the removal of a large area of vegetation and proximity of the easement to viewers using the road. Along Albury Lockhart Road, the visual impact would be negligible, due to the greater distance from the proposal, screening effect of intervening existing trees and low sensitivity of this route

- as the proposal alignment nears Wagga Wagga, there would be moderate-low and low visual impact during construction and operation of the proposal, including views from Holbrook, Boiling Down and Butterbush roads. This is due to the presence of an existing substation and convergence of transmission lines in this location

- when viewed from the air, the proposal would create a strong linear corridor across the landscape and would be more prominent on scenic flights from Lockhart (Lake Cullivel). This infrastructure would be seen near Lake Cullivel which is a local visual feature and visually interesting from the air. In other areas surrounding Lockhart, the new transmission line easement would be seen with a complex landscape where other transmission and related infrastructure are seen and would be largely absorbed into the view.

Table 13-19 summarises the construction impact assessment results for daytime visual amenity.

The photomontages in Figure 13-2 to Figure 13-12 illustrate the likely magnitude of change at select viewpoints within the proposal. The depiction of the proposal within the photomontages has been based on the current design for the proposal. As discussed in Chapter 5, the final height, spacing and structure type would be determined during finalisation of the proposal design.

Table 13-19 Summary of daytime visual impacts during operation

Location		Visual sensitivity	Magnitude of change	Visual impact
Mallee shrubland and rural landscape				
1	Viewpoint 1: View south from Arumpo Road to the Buronga substation	Local	Low	Low
2	Viewpoint 2: View east from Sturt Highway, near Lake Benanee	Local	Low	Low
3	Viewpoint 3: View north west from Benanee Road to alignment	Neighbourhood	Low	Negligible
4	Viewpoint 4: View east from Sturt Highway to alignment crossing	Local	Moderate	Moderate-Low
5	Viewpoint 5: View south from Yanga Way to alignment crossing	Neighbourhood	Low	Negligible
6	Viewpoint 6: View south from Balranald Road to alignment crossing	Neighbourhood	Low	Negligible

Location		Visual sensitivity	Magnitude of change	Visual impact
Murrumbidgee River Plains rural landscape				
7	Viewpoint 7: View south from Cobb Highway	Local	Low	Low
8	Viewpoint 8: View east at the intersection of Conargo and North Boundary Road	Neighbourhood	Low	Negligible
9	Viewpoint 9: View east along four Corners Road	Neighbourhood	Low	Negligible
10	Viewpoint 10: View south along Kidman Way to proposed Dinawan 330kV substation	Local	Moderate	Moderate-Low
11	Viewpoint 11: View south east along Newell Highway	Local	Low	Low
Lockhart rural valley landscape				
12	Viewpoint 12: View north along Urana-Lockhart Road	Local	Very high	High-Moderate
13	Viewpoint 13: View south west along Albury Lockhart Road	Neighbourhood	Low	Negligible
14	Viewpoint 14: View east along Lockhart-The Rock Road	Local	High	Moderate
15	Viewpoint 15: View south along Bullenbong Road	Local	High	Moderate
16	Viewpoint 16: View northeast from the Olympic Highway	Local	High	Moderate
Great Dividing Range foothills landscape				
17	Viewpoint 17: View north west from Holbrook Road	Neighbourhood	High	Moderate-Low
Wagga Wagga rural fringe landscape				
18	Viewpoint 18: View east from Holbrook Road	Neighbourhood	Moderate	Low
19	Viewpoint 19: View west from Boiling Down Road	Neighbourhood	High	Moderate-Low
20	Viewpoint 20: View southwest from Butterbush Road	Neighbourhood	Moderate	Low
Views from the air				
1.	Scenic flights from Lockhart (Lake Cullivel)	Regional	Low	Moderate-Low
2.	Scenic flights from Lockhart (areas surrounding Lockhart)	Regional	Negligible	Negligible
3.	Lake Urana	Regional	No impact	No impact

Note: Original view top image, photomontage bottom image

Figure 13-2 View east from Sturt Highway, near Lake Benanee (Viewpoint 2)

Note: Original view top image, photomontage bottom image

Figure 13-3 View east from Sturt Highway to alignment crossing (Viewpoint 4)

Note: Original view top image, photomontage bottom image

Figure 13-4 View south from Cobb Highway (Viewpoint 7)

Note: Original view top image, photomontage bottom image

Figure 13-5 View south along Kidman Way to proposed Dinawan 330kV substation (Viewpoint 10)

Note: Original view top image, photomontage bottom image

Figure 13-6 View south east along the Newell Highway (Viewpoint 11)

Note: Original view top image, photomontage bottom image

Figure 13-7 View south from Urana-Lockhart Road (Viewpoint 12)

Note: Original view top image, photomontage bottom image

Figure 13-8 View south west along Albury-Lockhart Road (Viewpoint 13)

Note: Original view top image, photomontage bottom image

Figure 13-9 View east along Lockhart-The Rock Road (Viewpoint 14)

Note: Original view top image, photomontage bottom image

Figure 13-10 View south along Bullenbong Road (Viewpoint 15)

Note: Original view top image, photomontage bottom image

Figure 13-11 View northeast from Olympic Highway (Viewpoint 16)

Note: Original view top image, photomontage bottom image

Figure 13-12 View west from Boiling Down Road (Viewpoint 19)

13.5.3. Night-time visual amenity impacts

Night-time visual amenity impacts associated with the operation of the proposal would result from the security lighting around the Dinawan 330kV substation. This would result in a low magnitude of change. As a result of the upgrade and expansion of the Wagga Wagga substation, there may be additional lighting at the substation. However, this lighting would be screened by the surrounding vegetation in most views and absorbed into the surrounding medium district brightness and hence present a negligible magnitude of change. No lighting of transmission lines and structures is proposed.

Table 13-20 summarises the operation impact assessment results for night-time visual amenity.

Table 13-20 Summary of night-time visual impacts during operation

Landscape character area	Landscape sensitivity	Magnitude of change	Landscape impact
Mallee shrubland and rural landscape	High	Negligible	Negligible
Murrumbidgee River plains rural landscape	High	Low	Moderate
Lockhart rural valley landscape	Moderate	Negligible	Negligible
Great Dividing Range foothills landscape	Moderate	Negligible	Negligible
Wagga Wagga rural fringe landscape	Low	Negligible	Negligible

As noted in Table 13-20, only the Murrumbidgee River plains rural landscape is expected to result in a greater than negligible landscape impact during operation. This impact is anticipated as a result of the minor security lighting proposed to be utilised at the proposed Dinawan 330kV substation. While this lighting would be somewhat contained by the vegetation within the surrounding fields and along Kidman Way, and not be appreciably greater than other surrounding homesteads. Overall this would result in a low magnitude of change to a landscape of high visual sensitivity, leading to the potentially moderate visual impact at night.

13.5.4. Impacts on views from private properties

Up to 582 private residences were identified within five kilometres of the proposal, in addition to the broader residential areas within the town and regional city of Wagga Wagga. Of these, 240 residences were considered (some individually and some forming groups of residences) in relation to potential visual impacts from these private residences.

The potential for a visual impact at each of these private residences has been addressed and arranged by landscape character area. These impacts are described in the following sections for each landscape character area.

13.5.4.1. Mallee shrubland and rural landscape character area

In this landscape character area private residences are scattered across the rural landscape so that there are typically large distances between these dwellings and the transmission line easement. This proposal would follow the existing power line easement through this area and the presence of the existing transmission lines and towers would increase the visual absorption capacity of these views due to the visual compatibility of this proposal with the existing transmission infrastructure.

Overall, there are around sixteen rural dwellings in this landscape character area there which would have the potential for low visual impact during operations. There is one dwelling that would have a slightly higher, low-moderate, potential for a visual impact due to there being less intervening existing vegetation. Overall, considering the length of this proposal there relatively few receptors and low visual impacts in this section of the corridor.

13.5.4.2. Murrumbidgee River Plain rural landscape character area

In this landscape character area private residences are scattered across the rural landscape so that there are typically large distances between these dwellings and the transmission line easement. This proposal would follow the existing power line easement through this area and the presence of the existing transmission lines and towers would increase the visual absorption capacity of these views due to the visual compatibility of this proposal with the existing transmission infrastructure.

In this landscape character area, there about 16 rural dwellings which would have the potential for low visual impact, five would have a low-moderate visual impact and one would have a moderate potential visual impact. There would also be six private residences that have the potential for a high visual impact. The high visual impacts would be from dwellings located within relatively close proximity to the transmission line easement. This landscape has low levels of vegetation cover and at these closer distances, the transmission line towers would be seen rising above any intervening vegetation (as showing in example cross-sections in Figure 13-13 and Figure 13-14). The vegetation shown in the elevations is indicative and based on aerial photos of the relevant area.

Overall, considering the scale and length of this proposal there are a relatively low number of receptors that have the potential for high visual impacts in the Murrumbidgee River Plain rural landscape character area section of the corridor.

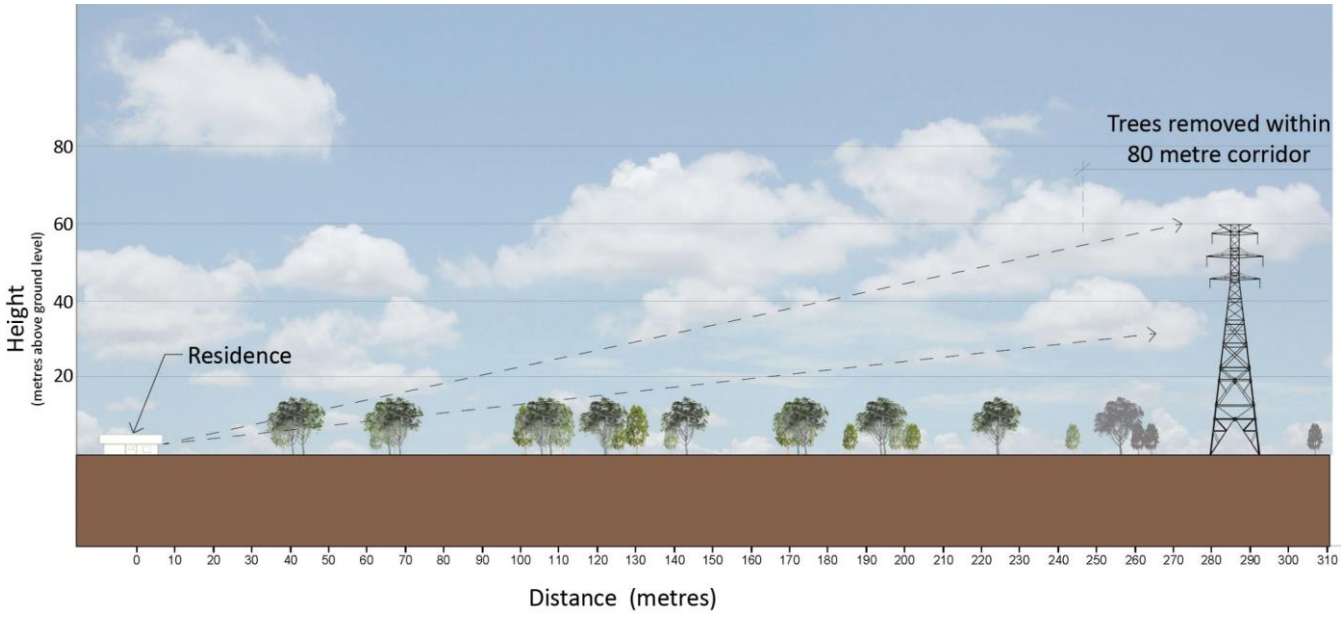


Figure 13-13 Example cross section of a high potential visual impact (823 Fernbank Road, Argoon (R422))

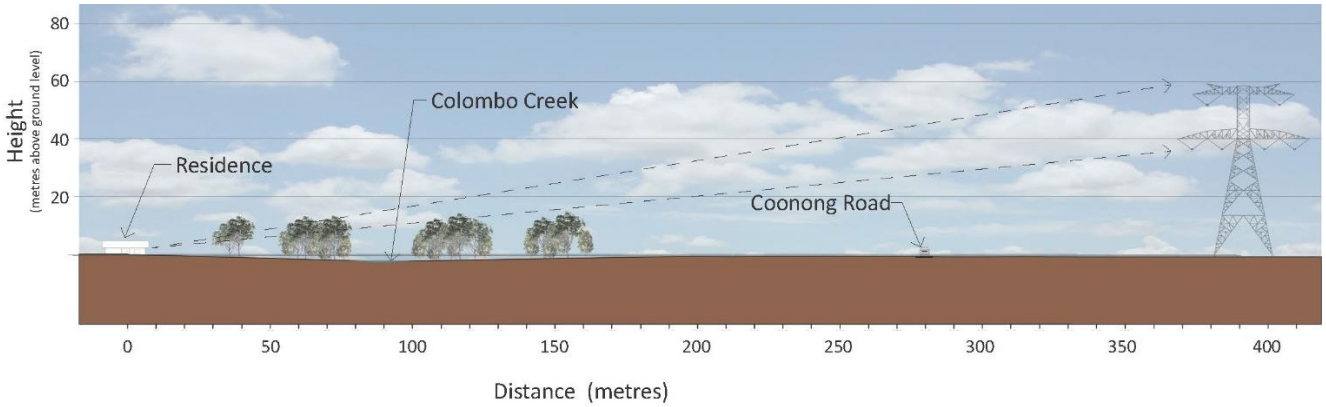


Figure 13-14 Example cross section of a high potential visual impact (877 Coonong Road, Morundah (R20522))

13.5.4.3. Lockhart rural valley landscape character area

In this landscape character area there is an increased density of private residences scattered across the rural landscape and concentrated around the town of Lockhart so that there would be less distance between properties and between these dwellings and the proposed transmission line easement. This proposal would follow the existing power line easement through some parts of this alignment, but mostly it is a new easement. Some dwellings may have views to the vegetation within the Brookong nature reserve, some of which would be removed, increasing the level of potential visual impact.

The transmission line easement would cross an elevated area to the east of Lockhart, the introduction of additional transmission towers onto this elevated land and vegetation removal would be prominent from the surrounding area and increase the potential visual impact. In this area there is also several existing transmission lines that converge, increasing the potential for a visual impact due to the introduction of towers of a different size and shape and potentially converging with others in a way that increases its prominence.

In this landscape character area around 21 dwellings that would have a potential low-moderate visual impact and 18 have the potential for a moderate visual impact. Fifteen dwellings have the potential for a high visual impact and one would potentially have a very high visual impact.

The potential high and very high visual impacts would be from dwellings located within relatively close proximity to the transmission line easement, where there is limited natural screening by landform or vegetation, and the transmission line towers and potential vegetation removal would be prominent (see example in Figure 13-15).

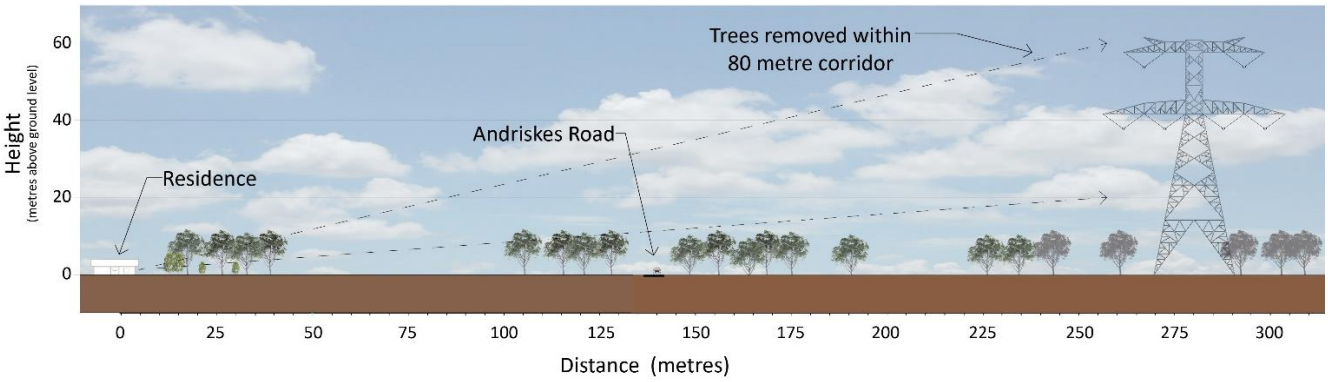


Figure 13-15 Example cross section of a very high potential visual impact (Andriskes Lane, Cullivel (R385))

13.5.4.4. Great Dividing Range foothills landscape character area

In this landscape character area there is an increased density of private residences on elevated land. There would be less distance between properties and between these dwellings and the proposed transmission line easement, and the elevated vantage point allows for longer range views and reduces the potential effectiveness of screening vegetation in some locations.

The proposal would follow the existing power line easement through this area and the presence of the existing transmission lines and towers would increase the visual absorption capacity of these views due to the visual compatibility of this proposal with the existing transmission infrastructure where this occurs. The transmission line easement would cross the ridgeline at Rowan. The introduction of further transmission towers onto this elevated land and vegetation removal would be prominent from the surrounding area and increase the potential visual impact levels. In this area there is also several existing transmission lines that converge, increasing the potential for a visual impact due to the introduction of towers of a different size and shape and potentially converging with others in angled alignments that attract the eye.

In this landscape character area there around seven dwellings that would have a potential low-moderate visual impact, 41 have the potential for a moderate visual impact and 12 have the potential for a high visual impact.

The dwellings where there is the potential for a high visual impact are located within close proximity to the transmission line easement, where there is limited natural screening by landform or vegetation, there would be vegetation removal and the towers would be in more elevated locations so that they would be more prominent. While in some locations the new transmission line towers would be seen in the context of other power infrastructure, the towers would be of a larger scale and/or not located parallel to nor be aligned with the existing tower spacings (see example in Figure 13-16).

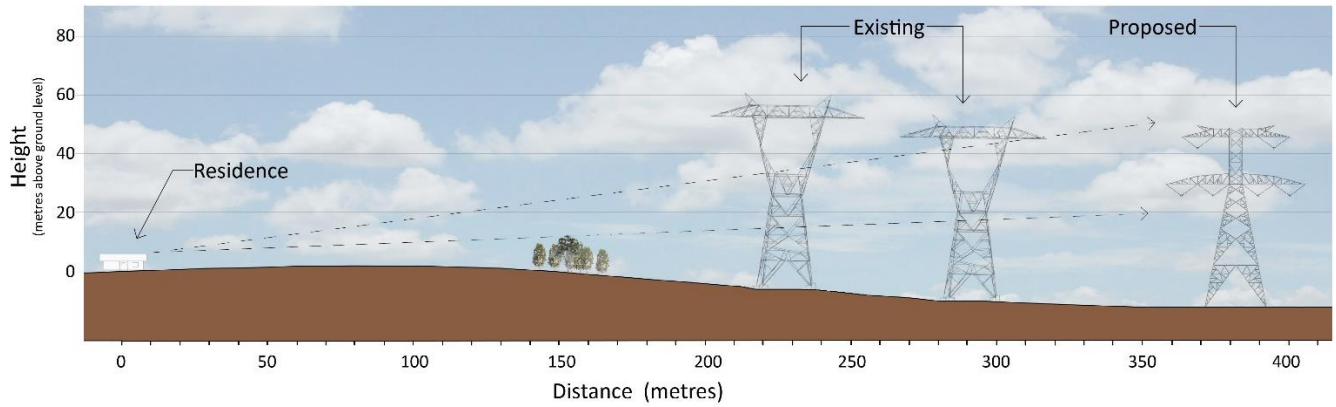


Figure 13-16 Example cross section of a high potential visual impact (6823 Holbrook Road, Rowan (R504))

13.5.4.5. Wagga Wagga rural fringe landscape character area

In this landscape character area there is an increased density of private residences on the plains, and on the outskirts of Wagga Wagga. There are also several other transmission line easements in this area, the existing Wagga Wagga substation and industrial scale uses such as the Gregadoo Recycling and Waste Management Centre. Due to this increased density, and the existing transmission lines, there would be less distance between residential dwellings and the proposed transmission line easement. This landscape has some vegetation cover that reduces long range views within the area.

This proposal would follow the existing power line easement through this area and the presence of the existing transmission lines and towers would increase the visual absorption capacity of these views due to the visual compatibility of this proposal with the existing transmission infrastructure where this occurs. The transmission line easement would cross the ridgeline at Rowan and be viewed from some locations. The additional transmission line towers on the elevated land and vegetation removal would be more prominent and increase the potential visual impact levels.

In this landscape character area there around 11 dwellings that would have a potential low-moderate visual impact, 20 have the potential for a moderate visual impact and two have the potential for a high visual impact.

The dwellings where there is the potential for a high visual impact would be located within relatively close proximity to the transmission line easement, where a greater area of vegetation removal is likely to be seen, and in locations where there would be both transmission line infrastructure and the Wagga Wagga substation expansion seen. Overall, there would be a relatively low number of private properties with the potential for a high impact in this area.

13.5.4.6. Summary of visual impact from private residences

Potential impacts on private properties during operation are summarised in Table 13-21.

Table 13-21 Summary of potential impacts on private properties

Landscape character area	Number of properties	Potential level of impact and number of properties
Mallee shrubland and rural landscape	16	Low
	1	Moderate-Low
Murrumbidgee River plain rural landscape	15	Low
	5	Moderate-Low
	1	Moderate
	6	High
Lockhart rural valley landscape	15	Low
	21	Moderate-Low
	18	Moderate
	15	High
	1	Very High
Great Dividing Rage foothills landscape	25	Low
	7	Moderate-Low
	40	Moderate
	13	High
Wagga Wagga rural fringe landscape	9	Low
	11	Moderate-Low
	20	Moderate
	2	High

Further details regarding the potential impacts of the proposal on private properties is provided in Technical paper 5 including:

- Appendix E which includes the location of these private residences
- Appendix F which includes a detailed analysis of potential visual impact for each receptor group
- Appendix G which includes further analysis of those receptors identified as having the potential for a very high or high visual impact
- Appendix H which includes a supporting visual analysis of private residences with potential for high and very high visual impact including the potential for effectiveness of mitigations pending landholder consultation and agreement on measures to be implemented.

13.6. Management of impacts

Approaches to avoid and minimise landscape and visual impacts were considered in the selection of the proposal study area. This includes:

- minimising the number of intersections with other infrastructure, which would require the use of taller towers
- maximising distances to dwellings and inhabited areas where possible
- minimising intersections with existing farm infrastructure, areas of vegetation within conservation areas and cultural heritage places
- following the alignment of existing transmission line easements where possible
- using the existing Buronga and Wagga Wagga substation sites for the additional substation infrastructure.

13.6.1. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to landscape character and visual amenity are listed in Table 13-22.

Table 13-22 Mitigation measures – landscape character and visual amenity

Reference	Mitigation measure	Timing	Applicable location(s)
LV1	Opportunities for the retention and protection of existing trees within the disturbance area would be identified during detailed construction planning. Identified trees of high conservation significance would be retained and protected where practicable.	Pre-construction	Whole of proposal
LV2	Temporary and permanent access would be designed to minimise vegetation removal, changes to landform, and visual impacts where practicable.	Pre-construction	Whole of proposal
LV3	Lighting at construction compounds and accommodation camps would be designed and operated in accordance with AS4282-2019 Control of the obtrusive effects of outdoor lighting	Pre-construction and construction	Construction compound and accommodation camps
LV4	The Tree Protection Zone of retained trees within or immediately adjacent to the disturbance area would be managed in accordance with AS4970-2009 Protection of Trees on Development Sites where practicable to minimise the impact of the works on the long-term health of these trees.	Pre-construction	Whole of proposal
LV5	For residences where the project is predicted to have a high or very high visual impact, opportunities for screening vegetation would be investigated. Appropriate visual screening or other options would be confirmed in consultation with the affected landholder and implemented during construction. Vegetative screening would be maintained by the landholder.	Construction	Transmission line

Reference	Mitigation measure	Timing	Applicable location(s)
LV6	Lighting at the substations would be designed and operated in accordance with AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.	Operation	Dinawan 330kV substation and Wagga Wagga substation upgrade/ expansion

13.6.2. Managing residual impacts or uncertainties

Mitigation measures as outlined in Section 13.6.1 have been identified which would assist in further reducing these impacts, however, it is expected that some residual impacts would remain given the scale of some components of the proposal. It is intended that where properties have been identified as having high or very high potential visual impacts, this would warrant further investigation during subsequent stages of the finalisation of the proposal design including engagement with landowners to identify the actual impact level and potential for mitigation of these impacts.

Based on the assessment presented in Appendix H of Technical paper 5, and pending consultation with affected landholders, there is the potential that the impact level for the 36 properties currently identified with high impacts would be able to be reduced to moderate impacts and the single property currently identified with a very high impact rating would be able to be reduced to a high impact.

14. Social

This chapter provides an assessment of potential social impacts of the proposal and identifies mitigation measures to address these impacts. It summarises the Social impact assessment (WSP, 2021b) (refer to Technical paper 6).

14.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to social impacts and where these requirements are addressed in this EIS are outlined in Table 14-1.

Table 14-1 Secretary's environmental assessment requirements – social and economic

Ref.	Secretary's environmental assessment requirements	Where addressed
Amenity		
Key issues	The EIS must address the following matters: • including an assessment of the social and economic impacts and benefits of the project (including the workers accommodation facility) for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services.	Sections 14.4 and 14.5 of this EIS address the social impact and benefits of the proposal, supported by Technical paper 6. Sections 15.4 and 15.5 of this EIS address the economic impacts and benefits of the proposal, supported by Technical paper 7.

14.2. Assessment approach

14.2.1. Legislative and policy context

The Social Impact Assessment (SIA) was guided by the following international, Commonwealth and State Guidelines:

- the *Environment and Biodiversity Conservation Act 1999* (EPBC Act) protects and manages prescribed Matters of National Environmental Significance (MNES)
- the *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for assessing all types of development in New South Wales. In particular, the objects of the EP&A Act include the need to promote the social and economic welfare of the community and to include social considerations in decision-making about environmental planning and assessment
- the *Social Impact Assessment Guideline – for State Significant Projects* (the SIA Guideline) (DPIE, 2021) provides guidelines for the social impact assessment to identify, predict and evaluate the likely social impacts that could arise from the proposal and the response to each of the impacts
- the *Far West Regional Plan 2036* and *Riverina Murray Regional Plan 2036* presents the NSW Government's vision for both regions to create a diverse economy, supported by the right infrastructure, protect an exceptional natural environment and create resilient communities
- Regional Economic Development Strategies (REDS) 2018-22 in the Far West and Riverina regions including *Western Murray REDS, Eastern Riverina REDS, Murray REDS, Western Riverina REDS* and *Albury – Wodonga REDS*

- relevant Community Strategic Plans (CSP) for the Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart Shire and Wagga Wagga LGAs which outline strategic planning directions to create thriving, innovative, connected and inclusive communities in each LGA.

14.2.2. Methodology

The impact assessment approach used for this SIA was guided by both national, state and local-level social impact assessment principles and methods as described in the DPIE guidelines described in Section 14.2.1.

The assessment of social impacts for the proposal occurred through the following key steps.

14.2.2.1. Area of influence

Social impacts relate to people, their livelihoods and their wellbeing. To define the extent of these impacts, an area of influence that extends beyond the proposal's direct infrastructure footprint requires defining. The area of social influence takes into account the way people organise themselves, connect with each other and move around the broader geographic area, and hence has been organised into two distinct components:

- the local study area comprises the Australian Bureau of Statistics (ABS) Statistical Area 1 (SA1) units that intersect the proposal study area. The local study area covers 62,747 square kilometres of the nine local government areas (LGAs) of Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart and Wagga Wagga
- the regional study area covering the full extent of the nine LGAs of the Far West and Riverina Murray regions of NSW, that encompass the main transportation corridors and infrastructure and services' hubs to and from the proposal.

14.2.2.2. Existing conditions

Technical paper 6 details the existing conditions of the local and regional study areas through review of data, legislation and targeted consultation for the proposal. The existing conditions assessment identifies community groups and individuals that have the potential to be subject to positive or negative social impacts.

14.2.2.3. Defining impact pathways

The SIA then defines potential social impacts through the adaptation of the DPIE guidelines and assigning impacts into the nine distinct categories (see Table 14-2).

Table 14-2 Impact categories

Category	Description
Way of life	How people live, how they get around, how they work, how they play, and how they interact on a daily basis.
Community	Composition, character, cohesion, function, and sense of place.
Access	How people access and use infrastructure, services and facilities, whether provided by local, state, or federal governments, or by for-profit or not-for-profit organisations or groups.

Category	Description
Culture	Both Aboriginal and non-Aboriginal culture, including shared beliefs, customs, values, and stories, and connections to country, land, waterways, places, and buildings.
Health and wellbeing	Physical and mental health, especially for those who are highly vulnerable to social exclusion or substantial change, plus wellbeing of individuals and communities.
Surroundings	Access to, and use of, services that ecosystems provide, public safety and security, access to and use of the natural and built environment, and its aesthetic value and amenity.
Livelihoods	People's capacity to sustain themselves, whether they experience personal breach or disadvantage, and the distributive equity of impacts and benefits.
Decision-making systems	Whether people experience procedural fairness; can make informed decisions; have power to influence decisions; and can access complaint, remedy and grievance mechanisms.

14.2.2.4. Evaluation of significance

The dimensions of each social impact were investigated by:

- understanding the key components and activities of the proposal that contributed to the impact
- contextualising the proposal in its strategic and regulatory setting
- considering the characteristics of communities in the social locality likely to be affected
- identifying links to outcomes of various other technical studies prepared for the EIS
- understanding the outcomes of stakeholder and community engagement.

Impact characteristics and consequences are assessed within the social risk matrix framework (as defined in the *Technical Supplement – Social Impact Assessment Guidelines For State Significant Projects* (DPIE, 2021)) to determine risk of level for the relevant construction and operation phases of the proposal. To determine the magnitude of any potential social impact, five dimensions were considered including the extent of people affected, duration, severity or scale of impacts, intensity or importance and level of concern/interest. The consequence and likelihood definitions and social risk matrix framework is outlined in Table 14-3 to Table 14-5.

Table 14-3 Definitions of magnitude (consequence) levels (DPIE, 2021)

Consequence level	Definition
Minimal	• little noticeable change experienced by people in the locality
Minor	• mild deterioration/improvement, for a reasonably short time, for a small number of people who are generally adaptable and not vulnerable
Moderate	• noticeable deterioration/improvement to something that people value highly, either lasting for an extensive time, or affecting a group of people
Major	• substantial deterioration/improvement to something that people value highly, either lasting for an indefinite time, or affecting many people in a widespread area
Transformational	• substantial change experienced in community wellbeing, livelihood, infrastructure, services, health, and/or heritage values; permanent displacement or addition of at least 20% of a community

Table 14-4 Definitions of likelihood levels (DPIE, 2021)

Likelihood level	Definition
Almost certain	Definite or almost definitely expected – is expected to occur under most circumstances
Likely	High probability – will probably occur in most circumstances
Possible	Medium probability – would occur and has occurred in comparable circumstances
Unlikely	Low probability – could occur but is not expected
Very unlikely	Improbable or remote probability – could occur under only exceptional circumstances

Table 14-5 Social impact significance matrix (DPIE, 2021)

Likelihood		Consequence				
		1	2	3	4	5
		Minimal	Minor	Moderate	Major	Transformational
A	Almost certain	Low	Medium	High	Very high	Very high
B	Likely	Low	Medium	High	High	Very high
C	Possible	Low	Medium	Medium	High	High
D	Unlikely	Low	Low	Medium	Medium	High
E	Very unlikely	Low	Low	Low	Medium	Medium
Social risk rating						
Low		Medium		High	Very high	

14.3. Existing environment

The existing environment is defined both geographically and by the existing social conditions present within the area of social influence. This section defines the existing towns and regions assessed and their demographic, employment and economic compositions in order to understand how the proposal would potentially impact the area of influence in a positive and negative sense.

14.3.1. Local context

The local study area is sparsely populated with the area predominantly used for agricultural activities, interspersed with local and regional administrative centres. It had a population of 5,354 people, living in 1,986 occupied dwellings at the 2016 Census (ABS, 2016). The population density of 0.08 people per square kilometre sits well be below NSW (9.8) and Australia (3.2), demonstrating a heavily dispersed rural population.

Fourteen towns sit within 50 kilometres of the proposal in this local area: Wentworth, Buronga – Gol Gol, Euston, Balranald, Hay, Jerilderie, Coleambally, Urana, Oaklands, Lockhart, The Rock, Wagga Wagga and Uranquinty. Of these, six were identified as service communities for the proposal and form the basis of this assessment (the area of influence).

In order from west to east, these include:

- Balranald – Located on the Murrumbidgee River, at the Stuart Highway crossing, Balranald had a population of 1,159 people in 2016 and is the administrative centre of the Balranald LGA. Balranald is a regional transportation hub and service centre for interstate and regional freight and vehicle movements and the location of a workforce accommodation camp for the proposal.

- Hay – Positioned on the banks of the Murrumbidgee River, Hay had a population of 2,316 people in 2016 and is the administrative centre of the Hay LGA. Located approximately midway between Sydney and Adelaide at the junction of the Sturt, Cobb and Mid-Western Highways, Hay is an important regional and national transport node. Hay is located approximately 40 kilometres north of the Cobb Highway workforce accommodation camp for proposal.

- Jerilderie – The town is located on the Newell Highway in the south of the Murrumbidgee LGA. Jerilderie had a population of 881 people in 2016 and is a rural service centre and highway town, located approximately 35 kilometres from the proposed Dinawan construction compound and accommodation camp.

- Coleambally – Located off Kidman Way in the Murrumbidgee LGA, Coleambally was established in 1968 to service the Coleambally Irrigation Area. Coleambally had a population of 660 people in 2016 and features a range of community facilities and services to support surrounding populations and a range of agricultural support services. Coleambally is located approximately 30 kilometres from the Dinawan construction compound and accommodation camp.

- Lockhart – An historical agricultural town in the Lockhart LGA, Lockhart had a population of 818 people at the 2016 Census. Lockhart offers local-level community services and retail, however due to its relative proximity to Wagga Wagga, residents travel to Wagga Wagga for higher-level needs.

- Wagga Wagga – This is NSW's largest inland city. Positioned on the banks of the Murrumbidgee River, Wagga Wagga is the administrative centre of the Wagga Wagga LGA with a population of 48,263 in 2016. Wagga Wagga would host some of the proposal workforce in existing accommodation options.

14.3.2. Regional context

The regional study area comprises the full extent of the nine LGAs spanning the Far West and Riverina Murray regions in southern NSW.

14.3.2.1. Far West Region

The Far West region encompasses the two LGAs of Wentworth and Balranald, both of which the proposal would traverse. Both the townships of Wentworth and Balranald act as local centres for each LGA for business, retail, some health care and recreation for the surrounding smaller settlement and villages (DPIE, 2019).

The southern area of the Far West region has strong cross-border connections with Victoria, and people from the area can access higher-order health, education, retail, commercial and transport services in Mildura. In addition to this, the southern far west provides a critical inland transport connection between Sydney, Melbourne, and Adelaide, supporting transport and freight links via the Silver City and Sturt highways.

It is estimated that by 2036, the population profile of people aged over 65 years will increase by more than a third to approximately 11,950 people (or 34 per cent). The general health of the region's population is anticipated to decline due to chronic illness. The *Far West Regional Plan 2036* (DPIE, 2017) highlights the need to improve health care access, aged care and senior housing to meet future demands.

14.3.2.2. Riverina Murray Region

The Riverina Murray region encompasses the seven LGAs of Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart and Wagga Wagga, all of which the proposal would traverse. The Murrumbidgee and Murray Rivers traverse the region and provide a range of ecosystem, biodiversity and agricultural support services. The two rivers support productive agricultural lands, resulting in the region being one of Australia's main food-producing regions.

The Riverina Murray region is well connected to national and international markets via both the highway and heavy rail network. The development of Inland Rail, from Melbourne to Brisbane, will further enhance regional connectivity for freight and logistics, particularly to the Port of Melbourne, enhancing access to international markets for regional producers.

Around 27 per cent of the region's population is expected to be aged 65 years and over by 2036. The change in population age profiles will put pressure on housing, jobs, and service and support needs of the region, particularly the demand for aged-related services and supporting health infrastructure and public transport needs (NSW Government, 2020).

14.3.3. Social context

The following describes the key existing environment findings to form the social baseline of each of the social impact categories identified in Table 14-2. The social baseline offers an understanding of critical social trends at each level of the social locality to assess the community's strengths and vulnerabilities.

14.3.3.1. Way of life (Existing)

Way of life looks to understand the values of how people live, work, recreate and interact with each other on a daily basis within the community.

Household composition across the local study area is relatively consistent with household types within the regional study area. However, the local study area exhibits a higher proportion of 'Other household types' and a lower proportion of 'Lone Person households' compared to the regional study area (while the regional study area presents a higher proportion of 'Lone Person households' compared to NSW). Also, the Wagga Wagga LGA has a higher proportion of 'Group Households' compared to the regional study area.

The local study area is serviced by an extensive network of state, regional and local roads that support the movement of people and freight. Requisite of rural areas, residents would rely on the road network to access essential services in towns across the region. Primary producers would also be highly reliant on the road network for access to markets and operational supplies.

Coach services are available for the towns near the proposal, including the service communities of Buronga, Balranald, Hay, Jerilderie and Lockhart. Rail services are available to Wagga Wagga and the larger regional centre of Narrandera to the north of the regional study area.

The largest and closest regional airport in the regional study area is Wagga Wagga Airport, which is one of the busiest regional airports in NSW.

Journey to work patterns align with the heavily agricultural land use and dispersed development patterns across the local study area. Overall, the data shows a heavy reliance on motor vehicles across the regional study area to access employment.

14.3.3.2. Community (Existing)

Community looks to understand the aspects of population composition, cohesion, character, function and sense of place within the community.

There are no significant variations in gender across the social locality, including the service communities. The local study area has a slightly higher proportion of males compared to NSW that can likely be attributed to the agricultural workforce, which is more commonly male dominated.

Population change across the regional study is anticipated to be experienced differently by each LGA. All LGAs, except for Balranald, Murray River and Wagga Wagga, are anticipated to decrease in population through a mixture of natural change and migration. Median ages differ between the local and regional study areas, being 42 and 44 respectively, both higher than the NSW median age of 38. All the LGAs traversed by the proposal, except for Wagga Wagga LGA, are experiencing an aging population.

Communities in the study area are well established and stable, with household mobility rates across the local and regional study area significantly lower than NSW. Likewise, communities within the study area have a high proportion of residents participating in voluntary work, reflecting a commitment to the local community, an important factor in building community cohesion.

14.3.3.3. Accessibility (Existing)

Accessibility looks to understand the community's access to and use of infrastructure, services and facilities provided by local, state and federal governments, as well as by for-profit and not-for-profit organisations.

Given the highly dispersed nature of development across the region, most social infrastructure, such as healthcare, emergency services, short-term accommodation, mobile phone coverage and other community infrastructure are in larger towns and villages that act as hubs for rural residents.

Generally, local and regional study area residents living outside of larger towns would have to travel long distances to access health care. Key items of the social infrastructure assessment include:

- three Aboriginal Health Clinics located across the regional study area in Dareton, Balranald and Hay
- Edward River LGA has the Deniliquin Specialist Community Mental Health Drug and Alcohol Service
- Hay LGA has only one GP service, but this reflects a smaller population of under 3,000 people
- the Oaklands Medical Centre is an upcoming project for General Practitioner services between Urana and Oaklands
- the Wagga Wagga city is considered a health hub that services regional study area communities. There are approximately 47 specialists' centres and 17 GP services in the area. Wagga Wagga also has one private hospital and private day surgery which services the area and surrounds.

There is adequate provision of emergency services within proximity to the proposal, capable of responding to issues within typically half an hour. No emergency services have been identified within 50 kilometres of the proposal in the Murray River and Edward River LGAs, but this section of the proposal would be within 50 kilometres of emergency services in the neighbouring LGAs of Balranald and Hay.

A broad range of short-term accommodation options are available across the region (servicing business travel and tourism). Across the regional study area, Wagga Wagga has the most short-term accommodation options available followed by both the Murray River and Hay LGAs. Wagga Wagga is currently experiencing a constrained rental market, with a rental vacancy rate of 0.5 per cent with the property market experiencing a significant increase in demand over the last 12 months. As a result, rental prices have increased 17.7 per cent for houses and 16.5 per cent for units. The Wentworth and Murray River LGAs have access to a broad range of cross border accommodation options in Victorian border towns and cities.

Mobile phone coverage is fragmented across the regional study area, with large coverage gaps along much of the proposal.

14.3.3.4. Culture (Existing)

Culture looks to understand a community's or peoples' shared beliefs, customs, values, stories and language or dialect.

The regional study area exhibits high levels of cultural homogeneity, with all LGAs having over 80 per cent of the population born in Australia. Aboriginal people represent the most significant minority cultural and linguistic group in each area, except for Federation LGA. The regional study area is home to a number of Aboriginal language groups as previously discussed in Section 10.3.

Within the local study area, 2.7 per cent of residents identify as Aboriginal, which is lower than the NSW average of 2.9 per cent. However, within the regional study area, 5.5 per cent of residents identify as Aboriginal, which is nearly double that of NSW.

Aboriginal settlement differs greatly across regional study area LGAs, with Wentworth, Balranald and Murrumbidgee LGAs having larger Aboriginal populations. The population of Aboriginal people residing in service communities is significant – with all service communities exhibiting Aboriginal populations higher than the regional study area average and NSW average.

There is an active and vibrant network of LALCs operating across the regional study area, supporting various private and public sector projects to improve Aboriginal outcomes and working towards improving cultural understating. No active native title claims affect the proposal. However, the Barkandji Traditional Owners have an approved native title claim over large sections of western New South Wales, including land and waterbodies around Buronga-Gol Gol. There are also two discrete Aboriginal communities close to the proposal site, New Mirnee near Buronga-Gol Gol and Balranald Reserve near Balranald.

14.3.3.5. Health and wellbeing (Existing)

The social study area spans two Local Health Districts. These comprise of:

- Far West Local Health District (FWLHD), which includes Wentworth and Balranald LGAs
- Murrumbidgee Local Health District (MLHD) which includes Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart and Wagga Wagga LGAs.

Several mental health and general wellbeing indicators for the two relevant Local Health Districts reflect health risks associated with suicide, alcoholism, and lifestyle-related illness or disease. Together these indicators contribute to lower life expectancy and lower quality of life for many residents across the regional study area.

There were differences in community safety across the regional study area, with Wentworth, Edward River and Wagga Wagga LGAs having significantly higher rates of assault than Balranald and Hay LGAs. This suggests that within the regional study area, community cohesion and safety vary.

14.3.3.6. Surroundings (Existing)

The Riverina Murray and Far West regions are significant agricultural assets for NSW and Australia, generating significant revenue and agricultural products for domestic and international markets. The regional study area is drought-prone, particularly to the west, where water allocations and access to water are critical issues for landholders, councils and communities alike. The suitability of the region for large scale renewable energy developments is becoming increasingly apparent and sought after, which risks the region losing highly productive agricultural land.

There are several major national and state highways and regional roads that provide vital connections for the movement of people and freight. These roads often transect isolated and sparsely populated areas, with long journeys to access essential services standard for many residents and account for 65 per cent of deaths and 40 per cent of hospitalised injuries from road trauma. The Lockhart, Hay and Federation LGAs all experienced the highest proportion of accidents resulting in deaths and serious injuries over the years 2015-2019.

14.3.3.7. Livelihoods (Existing)

Livelihoods looks to understand the community's and individual's access to economic resources, including income, assets, employment, and industry within a community. The primary source of economic capital on an individual level is income sourced from employment. Agricultural activities dominate the regional study area employment profile, with six of the regional study area LGAs having various agricultural industries as the top industry of employment, including Wentworth, Balranald, Hay, Murrumbidgee, Federation and Lockhart.

All LGAs have lower median household incomes than NSW, with Wentworth LGA being the lowest and Wagga Wagga LGA being the highest. In contrast, the regional study area exhibited an unemployment rate of 4.8 per cent, lower than both the national and NSW unemployment rates.

Youth (15-24 years old) unemployment data is provided at the Statistical Area 4 (SA4) level and does not align with LGA boundaries:

- the Murray SA4, which incorporates parts of Wentworth, Hay, Edward River, Murray River, Murrumbidgee and Federation LGAs had a youth unemployment rate of 16.5 per cent
- the Riverina SA4, which incorporates the northern half of Murrumbidgee LGA, and the Lockhart, Wagga Wagga, Griffin and Narrandera LGAs had a youth unemployment rate of 8.4 per cent.

Aboriginal unemployment data is not up to date at a LGA or regional level. However, the 2018–19 National Aboriginal and Torres Strait Islander Health Survey found that the unemployment rate for Aboriginal and Torres Strait Islanders was 3.8 times the rate for non-Aboriginal Australians.

The Hay LGA has the lowest socio-economic disadvantage score, indicating high levels of relative disadvantage and is also the 30th most disadvantaged LGA within NSW. The Wagga Wagga and Murray River LGAs have similar scores to each other, which indicates a relative lack of disadvantage and closely aligns with the national average.

14.4. Potential impacts – construction

Social impacts have been assessed against the impact categories defined in Table 14-2. The potential positive and negative social impacts prior to mitigation are described in the following sections. Measures to mitigate negative impacts or to enhance positive impacts are discussed in Section 14.6.

14.4.1. Way of life

Way of life is a broad category of social impact, defined as how people live, work, recreate and interact with each other on a daily basis. With respect to the proposal:

- construction related amenity impacts for residential properties affect the way residents use and enjoy private space; these impacts would be most likely to occur:
  - surrounding the Wagga Wagga substation upgrade and expansion site and the main construction compound
  - for residential properties located proximal to the transmission alignment and Lockhart main construction compound and accommodation camp options
- regional road users and residents in service communities may experience slightly longer journeys and minor annoyance due to increased construction traffic movements through towns and temporary road management measures during line stringing activities over roads.

Table 14-6 Way of life – construction (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Construction related amenity impacts for residential properties surrounding the Wagga Wagga substation upgrade and expansion site and the main construction compound affect the way residents use and enjoy private space.	Moderate	Almost certain	High
Construction related amenity impacts for residential properties located proximal to the transmission alignment and Lockhart main construction compound and accommodation camp options affect the way residents use and enjoy private space.	Minor	Almost certain	Medium
Within towns, increased construction traffic movements may contribute to temporarily reduced road capacities at some locations. This may cause temporary delays during the construction peak on highways or state roads, resulting in slightly longer journeys, decreased perceptions of safety and minor annoyance for residents and road users.	Minor	Possible	Medium
Regional road users experience temporary delays and longer journey times due to reduced speeds and traffic management measures during line stringing activities over roads.	Minor	Possible	Medium

14.4.2. Community

Community impacts refer to aspects of population composition, cohesion, character, function and sense of place. It is recognised that this category of impact involves a level of uncertainty because social environments and the processes that affect them are constantly changing and can vary from place to place and over time. With respect to the proposal:

- access to employment and training opportunities could increase residents' capacity and willingness to engage at a community level and improve overall community cohesion and wellbeing
- some residents may develop an 'us versus them' mentality and anti-proposal sentiment if they are passed over for employment opportunities affecting community cohesion and workforce integration and wellbeing
- perceived unfair distribution of impact and benefit have the potential to result in community division affecting residents' social networks, sense of community and wellbeing.

Table 14-7 Community – construction (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
The presence of up to 180 proposal workers in Balranald town materially alters community composition and affects residents' perceptions of safety and sense of place	Minor	Unlikely	Low
Access to employment and training opportunities could increase residents' capacity and willingness to engage at a community level and improve overall community cohesion and wellbeing.	Moderate	Possible	High (positive)
The increased presence of male workers in service communities affects local perceptions of safety and wellbeing, particularly for female residents.	Minor	Unlikely	Low
Some residents may develop an 'us versus them' mentality and anti-proposal sentiment due to being passed over for employment opportunities affecting community cohesion and workforce integration and wellbeing.	Minor	Possible	Medium
The perceived unfair distribution of impact and benefit results in community division affecting residents' social networks, sense of community and wellbeing.	Moderate	Unlikely	Medium

14.4.3. Accessibility

Access to and use of infrastructure covers a broad array of infrastructure, services and facilities provided by local, state and federal governments, as well as by for-profit and not-for-profit organisations. With respect to the proposal:

- proposal related demands for social infrastructure has the potential to reduce access for residents, primarily:
  - the provision of emergency services and health care
  - some leisure and recreation facilities, primarily the Balranald Pool, should workers be accommodated within the town and use this facility in larger numbers
  - telecommunications services in regional and remote areas
- proposal related demands for longer term private rental properties in Wagga Wagga has the potential to further constrain market supply and increases prices limiting access for residents, particularly those who may face economic disadvantage
- proposal related demands for short term accommodation in the Wagga Wagga region may limit access for broader community needs.

Table 14-8 Access to and use of infrastructure, services and facilities – construction (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Proposal related demands for healthcare constrain local services limiting access for residents.	Moderate	Unlikely	Medium
Proposal related demands for emergency services constrain local services limiting access for residents.	Major	Unlikely	Medium
Proposal related demands for leisure and recreation facilities constrains local services limiting access for residents.	Minor	Unlikely	Low
Increased utilisation of the Balranald Pool by proposal workers results in council potentially having to employ a new lifeguard resulting in increased operational cost if the Balranald Camp option in Balranald town is selected for use.	Minor	Possible	Medium
Proposal related demands for telecommunications constrain local services limiting access for residents.	Moderate	Unlikely	Medium
Proposal related demands for private rental properties in Wagga Wagga further constrains market supply and increases prices limiting access for residents, particularly those who may face economic disadvantage.	Moderate	Possible	Medium
Proposal related demands for short term accommodation limit access for broader community needs.	Moderate	Possible	Medium

14.4.4. Culture

Culture refers to a community's or peoples' shared beliefs, customs, values, stories and language or dialect. Potential social impacts on culture for the proposal relate to:

- the proposals cultural heritage management practices are sufficient for Traditional Owner and Aboriginal Groups to have trust and confidence in Transgrid
- proposal related activities have the potential to result in changes to the environment and sites of cultural heritage significance that are not acceptable to Aboriginal people, affecting sense of place and cultural connection to Country.

Table 14-9 Culture – construction (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
The proposal's cultural heritage management practices are sufficient for Traditional Owner and Aboriginal Groups to have trust and confidence in Transgrid.	Moderate	Likely	High (positive)
Proposal related activities result in changes to the environment and sites of cultural heritage significance that are not acceptable to Aboriginal people, affecting sense of place and cultural connection to Country.	Moderate	Unlikely	Medium

14.4.5. Health and wellbeing

Health is defined as a state of complete physical, mental and social wellbeing. Social impact has the potential to result in poor health outcomes if it causes affected individuals or groups significant stress and anxiety. The proposal has the potential to affect levels of stress for some individuals and groups. The following social groups are considered to potentially experience impacts to their health and wellbeing:

- some landowners could experience decreased health (physical and mental) outcomes if there is a negative culmination of the acquisition process, adverse changes to their properties and the way they use and manage their land
- some proposal workers could be at risk of mental health impacts associated with feelings of isolation, long work hours and unhealthy lifestyles
- at risk members of vulnerable communities may experience decreased perceptions of safety in service communities associated with an influx of construction workers.

Table 14-10 Health and wellbeing construction (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Landowners could experience decreased physical and mental health outcomes due to the culmination of the acquisition process, changes to their properties and way they use and manage their land.	Minor	Possible	Medium
Proposal workers suffer from mental health impacts associated with feelings of isolation, long work hours and unhealthy lifestyles.	Minor	Possible	Medium

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Vulnerable members of the community in the Murrumbidgee LGA, where certain health issues are more prevalent may experience decreased perceptions of safety in service communities associated with an influx of construction workers (based on consultation undertaken as part of the preparation of the proposal).	Moderate	Possible	High
The perceived risk of bushfires associated with electricity infrastructure poses a safety risk and results in increased stress and anxiety for regional communities.	Moderate	Possible	Medium

14.4.6. Surroundings

Surroundings refers to access to and use of ecosystem services, public safety, access to and use of nature and the built environment, and aesthetic value and/or amenity. With respect to the proposal:

- construction activities result in visual disturbances and impact valued landscapes affecting some residents' sense of place
- construction activity near roads has the potential to increase the risk of driver distraction, with potential safety implications
- construction water would be supplied from existing regulated sources and purchased through the existing regulated water market, which would minimise potential impacts to landholders and other water users.

Table 14-11 Surroundings – construction (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Construction activities result in visual disturbances and impact valued landscapes affecting residents' sense of place	Minor	Possible	Medium
Construction activity near roads may distract drivers, affecting road safety	Moderate	Unlikely	Medium
Proposal related use of water limits the supply of and access for agricultural and community users	Minor	Unlikely	Low

14.4.7. Livelihoods

Livelihoods are directly linked to a person's access to economic resources, including income, assets, employment, and industry within a community. With respect to the proposal:

- affected landholders would receive economic benefit from easement compensation while still being able to utilise land, improving their economic standing and financial resilience to agricultural shocks such as drought
- regional employment opportunities would improve the livelihoods of those employed, improving mental health and wellbeing, the way they interact with their communities their ability to access goods and services
- targeted employment and training initiatives aimed at young people and local Aboriginal communities has the potential to improve the way of life, mental health and general sense of wellbeing for cohorts that generally experience higher levels of unemployment and barriers to employment
- proposal related procurement activities has the potential to improve regional economic outcomes and result in flow on employment for regional residents
- recreation and leisure spending by workers could improve regional economic outcomes for tourism businesses
- the easement and associated transmission line may restrict or alter how landholders manage their property, decreasing productivity affecting livelihoods.

Table 14-12 Livelihoods – construction (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Construction activities result in impacts to agricultural landholdings, reducing productivity and landholders ability to sustain themselves.	Minor	Unlikely	Low
Landholders receive economic benefit from easement compensation while still being able to utilise land, improving their economic standing and financial resilience to agricultural shocks such as drought.	Moderate	Almost certain	High (positive)
Regional employment opportunities would improve the livelihoods of those employed, improve mental wellbeing, the way they interact with their communities their ability to access goods and services.	Moderate	Almost certain	High (positive)
Targeted employment and training initiatives aimed at young people and local Aboriginal communities improves the way of life, mental health and general sense of wellbeing for groups of people that generally experience higher levels of unemployment and barriers to employment.	Moderate	Likely	High (positive)
Proposal related procurement activities improve regional economic outcomes and result in flow on employment for regional residents.	Moderate	Almost certain	High (positive)
Recreation and leisure spending by workers improve regional economic outcomes for tourism businesses.	Minor	Likely	Medium (positive)

14.4.8. Decision making systems

Decision making systems refers to the extent to which people believe they can have their say in decisions that affect their lives, and are aware of and have access to complaint, remedy and grievance mechanisms.

The Barkandji Traditional Owners have an approved native title claim over large sections of western NSW, including land and waterbodies around Buronga and Gol Gol. While the proposal does not directly intersect or affect the determined land, this determination carries substantial socio-political value for Traditional Owners. There may be perceptions of reduced decision-making ability and perceived (or real) ability to control activities, such as any permanent infrastructure constructed on the land. The level of establishment of strong working relationships with Traditional Owners and their representative bodies may assist in understanding any such concerns as well as enabling different parties to cooperate in forming shared priorities for the proposal's construction activities.

With respect to land acquisition and/or leasing arrangements, landholders have expressed a range of sentiments towards potential property impacts. This includes a level of dissatisfaction with the acquisition process for some landholders. At present, Transgrid has commenced property negotiations with all easement-affected landholders and is continuing to work closely with others to manage perceived and actual issues, and deliver sound outcomes for both parties.

Table 14-13 Decision making system – construction (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Traditional Owners and other Aboriginal Groups feel engaged, supportive of the proposal, and capable of interacting with the proposal and Transgrid to maximise the benefit for regional Aboriginal communities.	Moderate	Likely	High (positive)
Landholders may perceive negative impacts in relation to their property rights and individual livelihoods, regardless of the standards of procedural fairness being met and just compensation terms being in place.	Moderate	Possible	Medium

14.5. Potential impacts – operation

14.5.1. Way of life

The proposal has the potential to impact in the following manner:

- Some residents located proximal to the transmission line may experience operation related amenity impacts that affect the way they use and enjoy private space.

Table 14-14 Way of life – operation (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Operation related amenity impacts for residential properties located proximal to the transmission alignment and associated infrastructure affect the way residents use and enjoy private space.	Minor	Likely	Medium

14.5.2. Accessibility

The proposal has the potential to impact in the following manner:

- The Community Partnership Program aspect of the proposal has the potential to improve the financial viability of local community services and facilities, improving access to services and overall community wellbeing. While in place already, the program would be an ongoing program for communities to utilise once the proposal is operational.

Table 14-15 Accessibility – operation (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
The CPP improves the financial viability of local community services and facilities, improving community outcomes.	Minor	Likely	Medium (positive)

14.5.3. Culture

The impacts to decision making systems during operation are the same for the construction phase which are considered in Section 14.4.4.

14.5.4. Health and wellbeing

The proposal has the potential to impact in the following manner:

- Perceived health impacts associated with electric and magnetic fields may lead to stress and anxiety for some landholders and community members, affecting mental and physical health and wellbeing.
- The perceived risk of bushfires associated with electricity infrastructure posing a safety risk could result in increased stress and anxiety for some regional communities.

Table 14-16 Health and wellbeing – operation (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Perceived health impacts associated with electric and magnetic fields creates stress and anxiety affecting landholders and community members mental and physical health and wellbeing.	Minor	Possible	Medium
The perceived risk of bushfires associated with electricity infrastructure poses a safety risk and results in increased stress and anxiety for regional communities.	Moderate	Possible	Medium

14.5.5. Surroundings

The proposal has the potential to impact in the following manner:

- The presence of new transmission infrastructure has the potential for visual impacts ranging from low to very high on residences prior to the implementation of visual mitigation measures. High and very high visual impacts would occur at 36 and one residences respectively, most of which are located across the Lockhart rural valley and the Great Dividing Range foothills landscape units (refer to Section 13.5.4). Potential high and very high visual impacts would occur at residences that are located in close proximity to the transmission line easement, where there is limited natural screening by landforms or vegetation, and where towers or vegetation removal would be prominent. High levels of concern about visual and amenity impacts on the Lockhart LGA were raised by stakeholders during consultation for the proposal. As outlined in Section 3.3.3.1, the corridor in the vicinity of Lockhart was refined in response to stakeholder feedback.

- Residents that experience high or very high visual impacts may experience a sense of loss of valued rural landscapes, which may affect sense of place and the enjoyment of their property. Mitigation measures would reduce the level of impact.

Table 14-17 Surroundings – operation (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
The presence of new transmission infrastructure in the Lockhart region results in substantial visual impacts for some residential properties, affecting residents' sense of place and the way they enjoy private space.	Moderate	Likely	High
The presence of new transmission lines and associated infrastructure across the local study area results in visual impacts for some residents affecting valued rural landscapes and people's sense of place.	Minor	Unlikely	Low

14.5.6. Livelihoods

The proposal has the potential to impact in the following manner:

- The easement and associated transmission line may restrict or alter how some landholders manage their property, potentially decreasing productivity on portions of land which could have an effect on livelihoods.
- The proposal would result in increased development occurring across the region and associated employment opportunities for local communities across the regional study area LGAs.

Table 14-18 Personal and property rights – operation (prior to mitigation)

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
The easement and associated transmission line may restrict or alter how some landholders manage their property, potentially decreasing productivity on some portions of land which could have an effect on livelihoods	Moderate	Possible	Medium
The proposal encourages investment in renewable projects and associated industries, and improves employment opportunities for local communities in the regional study area.	Major	Possible	High (positive)

14.5.7. Decision making system

The impacts to decision making systems during operation are the same for the construction phase which are considered in Section 14.4.8.

14.6. Management of impacts

14.6.1. Environmental management

Environmental management for the proposal would be carried out in accordance with the approach as detailed in Chapter 24 (Environmental management).

Environmental management to reduce the effect on socio-economic impacts would be implemented throughout the design finalisation, procurement, construction and operation stages. For the purpose of the EIS, the mitigations have been grouped into the construction and operation stages, as these are the stages whereby potential impacts would transpire.

14.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential social impacts are listed in Table 14-19.

Additional mitigation measures, as identified in other chapters of the EIS, would also be relevant to the management of potential impacts to biodiversity. This includes:

- Chapter 10 (Aboriginal heritage) with respect to the next stages of engagement with RAPs as well as requirements to mitigate and manage impacts on Aboriginal heritage
- Chapter 12 (Land use and property) with respect to mitigating and managing impacts to property and land use
- Chapter 13 (Landscape character and visual amenity) with respect to visual impacts, including views from private property
- Chapter 15 (Economic) with respect to economic impacts, including workforce and local businesses
- Chapter 20 (Hazards and risk) with respect to electric and magnetic fields, bushfire and biosecurity risks management.

Table 14-19 Mitigation measures – social and economic

Reference	Mitigation measure	Timing	Applicable location(s)
SE1	A Community and Stakeholder Management Plan (CSMP) would be implemented. This would include: • appropriate communication and engagement tools and approaches to engage with councils, landholders, community groups in service communities, emergency services and the broader community • complaint handling processes in line with the Transgrid Complaints Handling Policy.	Pre-construction and construction	All locations
SE2	Land and Property Access Officers would be appointed for affected landholders to provide direct avenues of enquiry for information and issues management.	Construction	Line affected landholders along the alignment
SE3	A Local Business and Employment Strategy would be implemented to guide local opportunities during construction, and where possible, align with existing plans and strategies of regional study area LGAs, and Transgrid's Reconciliation Action Plan. The strategy would be developed in consultation with regional study area councils and would take into account current unemployment trends across the region. The strategy would include initiatives for: • local supplier and labour procurement targets • Aboriginal workforce and business participation • training and upskilling programs for local labour force • transitioning the local workforce following the completion of construction.	Pre-construction and construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
SE4	A Workforce Management Plan would be developed for each accommodation camp in consultation with relevant councils, social infrastructure managers and community service providers in nearby service communities. The plan would identify potential constraints in local service provision and mechanisms to promote workforce health and wellbeing and integration into the affected service community without affecting access for residents. It would include: • a list of recreation facilities, sports teams and organisations that workers could utilise • social service providers, including medical and allied health providers • local initiatives that facilitate non-resident workforce and community interactions at local venues, events and community projects. The plan would be reviewed every six months in collaboration with councils to identify and manage any emergent issues.	Pre-construction	Service communities – likely Balranald, Hay, Jerilderie, Coleambally, Lockhart and Wagga Wagga
SE5	If proposal construction coincides with the construction of other projects around Wagga Wagga, a workforce accommodation strategy for the proposal would be implemented and would be informed by an additional review of existing housing and accommodation capacity relative to the proposal workforce needs.	Pre-construction	Wagga Wagga LGA
SE6	The long-term rental market in Wagga Wagga would not be used to satisfy short term (less than six months) accommodation needs for the construction workforce in Wagga Wagga.	Construction	Wagga Wagga LGA
SE7	Cultural Heritage and awareness training would be provided to all construction workers during the onboarding process.	Construction	Whole proposal

14.6.3. Managing residual impacts or uncertainties

Adoption of mitigation measures would result in residual social (negative) impacts being predominately low, and no greater than moderate (refer to Table 8.1 of Technical Paper 6). Where positive social impacts can be enhanced, there is potential for substantial benefit for individuals and communities. Key mitigations to reduce or enhance social impacts revolve around the procurement policies and considered engagement with communities to enable inclusion, upskilling and support throughout the proposal stages.

15. Economic

This chapter provides an assessment of potential economic impacts of the proposal and identifies mitigation measures to address these impacts. It summarises the *Economic impact assessment* (Gillespie Economics, 2021) (refer to Technical paper 7).

15.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to economic impacts and where these requirements are addressed in this EIS are outlined in Table 15-1.

Table 15-1 Secretary's environmental assessment requirements – economic

Ref.	Secretary's environmental assessment requirements	Where addressed
Amenity		
Key issues	The EIS must address the following matters: • including an assessment of the social and economic impacts and benefits of the project (including the workers accommodation facility) for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services.	Economic impacts and benefits from the proposal are presented in Sections 15.3 and 15.4 of this chapter and supported by Technical paper 7. Social impacts and benefits from the proposal are presented in Sections 14.4 and 14.5 of the EIS supported by Technical paper 6.

15.2. Assessment approach

15.2.1. Legislative and policy context

This economic impact assessment has been guided by the EP&A Act which establishes the framework for assessing all types of development in NSW. In particular, the objects of the EP&A Act include the need to promote the economic welfare of the community and to include considerations in decision-making about environmental planning and assessment.

15.2.2. Methodology

15.2.2.1. Economic study area

The economic study area comprises of nine LGAs in NSW. These LGA's have the potential to provide inputs to the proposal and derive benefits from the construction of the proposal. The nine LGAs that form the regional economy assessed for economic impacts are listed below:

- Wentworth
- Balranald
- Hay
- Murray River
- Edward River
- Murrumbidgee
- Federation
- Lockhart
- Wagga Wagga.

15.2.2.2. Assessment

The approach for this assessment included the following key steps:

- a desktop assessment of the existing regional economic environment based on ABS 2016 Census of Population and Housing
- an analysis of the existing economic activity in the region and the direct impact (or stimulus) of the proposal through the completion of an Input-Output (IO) analysis. The IO analysis was prepared using the Generation of Regional Input Output Tables (GRIT) procedure developed by the University of Queensland and provides an upper bound of the estimated direct impact of the proposal
- identifying measures to minimise and manage the potential impacts identified.

Further information regarding the assessment approach for the economic assessment, including the IO analysis and analysis assumptions, is provided in Chapter 3 of Technical paper 7.

15.3. Existing environment

The Wagga Wagga LGA comprises 55 per cent of the population of the economic study area and 58 per cent of the labour force. Outside of the Wagga Wagga LGA, the region is sparsely populated with the remaining 45 per cent of the population spread out over the remaining eight LGAs.

An indication of the health of an economy can be gained from population changes. Across Australia, non-coastal rural regions have seen a decline in population. Trends in regional economics as a result of globalisation and associated structural adjustment include:

- loss of significant industries such as abattoirs and timber mills from many rural areas
- increased mechanisation of agriculture and aggregation of properties, resulting in loss of employment opportunities in this industry
- growth of regional centres, at the expense of smaller towns
- preference of Australians for coastal living, particularly for retirement
- preference of many of today's fastest growing industries for locating in large cities.

Despite this pressure, it is evident that the population of the region has been growing, at a rate of 4.7 per cent since 2006, with this mainly reflecting growth in the Wagga Wagga and Murray River LGAs. The population of other LGAs has been relatively static or declining throughout this period.

The key employment sections for the region are health care and social assistance, agriculture, forestry and fishing and retail trade (refer to Figure 15-1). Agriculture, forestry and fishing is the main employment sector in the economic study area except in the Edward River and Wagga Wagga LGAs. Within these LGAs, health care and social assistance is the main employment sector.

The Gross Regional Product (GRP) of the regional economy was estimated at $6,150 million for 2018/19. The region is a net importer, with exports out of the region of $3,114 million and imports into the region of $5,940 million. Using the IO industry classifications, the largest exporting industries by output value in the economic study area are:

- sheep, grains, beef and dairy cattle ($661 million)
- meat and meat products manufacturing ($473 million)
- basic chemicals manufacturing ($172 million)
- basic non–ferrous metal manufacturing ($143 million)
- accommodation ($120 million)
- petroleum and coal product manufacturing ($97 million).

In addition, within the Wagga Wagga LGA, employment in defence services was also identified as the top industry sector of employment for usual residents of the LGA (typically associated with the RAAF base at Wagga Wagga and other defence services associated with this site within the LGA). The Australian Bureau of Statistics, 2016 Census of Population and Housing, Community Profile (ABS, 2017a) for the Wagga Wagga LGA identified that around 1,370 people were identified as being employed within the defence industry.

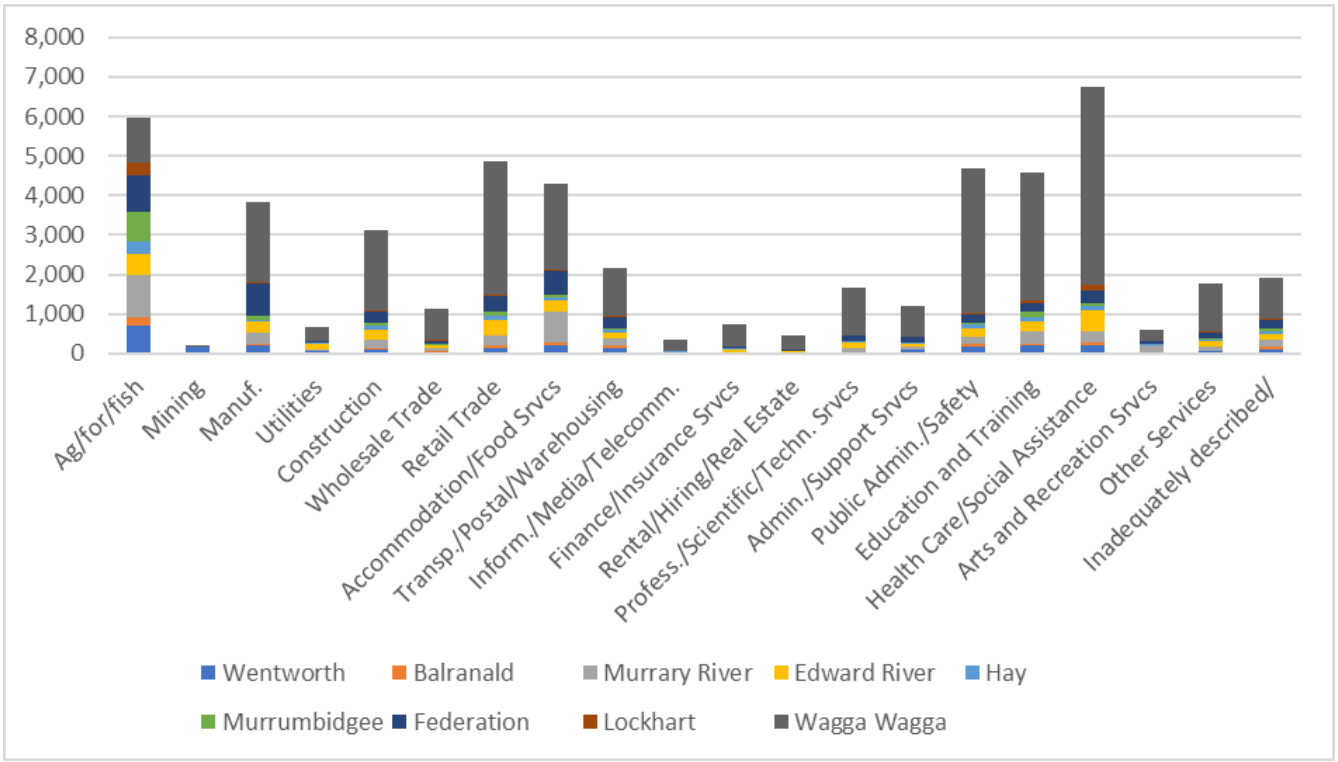


Figure 15-1 Place of work employment (No.) by industry (1 digit ANZSIC sectors)

Using the IO industry classifications, the assessment found that the top five employment industries (being defence; sheep, grains, beef and dairy cattle; health care and social assistance; retail trade; and public administration) had the highest value added – totalling around 27 per cent of the regional economy and 34 per cent of regional employment as shown in Table 15-2.

Table 15-2 Gross Value Added for the five largest industries in the regional economy (by sectors)

Industry	Gross Value Added ($m)	Proportion of regional economy (%)	Proportion of regional employment (%)
Defence	498	8%	4%
Sheep, grains, beef	454	7%	8%
Health care and social assistance	272	4%	8%
Retail trade	268	4%	10%
Public administration	260	4%	4%

15.4. Potential impacts – construction

15.4.1. Regional impacts

The proposal would provide economic activity to the region during construction. Expenditure from the proposal construction that can potentially be captured by the region arises from:

- non–labour inputs (goods and services)
- direct labour inputs.

15.4.1.1. Non-labour inputs

Non–labour inputs to the proposal would include the supply of plant and equipment, accommodation and other services (such as transport services, catering, construction material supply). Given the scale, complexity and nature of the proposed works, a range of the goods and services required for the construction of the proposal would likely be required outside of the region, including:

- specialised plant and equipment that would need to be imported into the region.
- requirements associated with the following restrictions typically required of by large construction companies:
  - centralised procurement arrangements, and/or
  - the prequalification requirements which small to medium sized regional businesses can find difficult and expensive to meet.

Notwithstanding, the contractor would adopt strategies to maximise local business input to production. This would include strategies to promote local workforce participation as well as programs to assist local and regional businesses gain qualifications to supply goods and services to the proposal in collaboration with other stakeholders (refer to Section 15.6).

A review of all the goods and services to be acquired for the proposal, and whether opportunities to supply the key goods and services are expected for Australia and the region, found that in the order of $159.4 million of goods and services over the 18-months of construction i.e. $106.2 million in year 1 (full year of construction) and $53.1M in year 2 (remaining six months of the estimated 18-month construction program), may be able to be provided by the region.

The main sectors directly potentially benefiting over the 18 months of construction are identified in Table 15-3. This is the basis of the modelling of non–labour inputs.

Table 15-3 Estimated direct expenditures in the regional community from the proposal ($M)

Sectors	Total non–labour expenditure ($M)	Year 1 construction non–labour expenditure ($M)	Year 2 construction non–labour expenditure ($M)
Heavy and civil engineering construction	48.0	32.0	16.0
Construction services	16.8	11.2	5.6
Rental and hiring services (except real estate)	15.6	10.4	5.2
Professional, scientific and technical services	15.1	10.1	5.0
Transport support services and storage	14.6	9.7	4.9
Cement, lime and ready-mixed concrete manufacturing	9.6	6.4	3.2
Accommodation	9.5	6.4	3.2
Agriculture, forestry and fishing support services	6.4	4.2	2.1
Road transport	4.3	2.8	1.4
Waste collection, treatment and disposal services	4.2	2.8	1.4
Building cleaning, pest control and other support services	3.7	2.5	1.2
Non-metallic mineral mining	3.6	2.4	1.2
Food and beverage services	2.1	1.4	0.7
Wholesale trade	2.1	1.4	0.7
Employment, travel agency and other admin services	1.8	1.2	0.6
Electricity transmission, distribution, on selling and electricity market operation	0.8	0.5	0.3
Petroleum and coal product manufacturing	0.8	0.5	0.3
Retail trade	0.3	0.2	0.1
Gas supply	0.1	0.0	0.0
TOTAL	**159.4**	**106.2**	**53.1**

*Inconsistencies in totals are due to rounding.

15.4.1.2. Direct labour inputs

The impact of the provision of direct labour (employment) in the region arises from:

- the additional wages spent in the region
- the ability of the regional economy to continue to produce and provide the goods and services demanded by households in the region.

The proposal is estimated to provide 500 full time equivalent construction jobs. Twenty per cent (or 100 jobs) would be sourced locally, with the remainder sourced from elsewhere in Australia or overseas (such as for specific specialist skills). The workforce would mainly reside in accommodation camps established across the study area, although local accommodation would also be utilised.

The level of additional wages spent in the region would depend on where the labour is sourced (locally or external to the region) and where the workforce resides while off-shift. Local direct employment opportunities can increase the level of expenditure in the region. While a commuting workforce would result in wage expenditure outside the region, the proposal would increase demand for regional goods and services (such as recreational services).

The level of the expenditure captured by the region would depend on the ability to provide the goods and services sought by the workforce, and where the goods are manufactured. Increased demand for goods and services can also create opportunities for businesses to expand and/or establish within the region.

15.4.1.3. Economic impact estimate

Overall, total economic impact of the non–labour expenditure ($106.2 million) in the regional economy during the first full year (12 months) of main construction works is estimated up to:

- $159 million in annual direct and indirect regional output (the gross value of business turnover)
- $70 million in annual direct and indirect value–added (the difference between the regional output and the costs of the inputs (such as materials brought into the region to produce the regional output, excluding wages)
- $36 million in annual direct and indirect income
- 571 direct and indirect jobs.

Year 2 of construction (comprising half a year of construction) is estimated to provide half the above level of regional economic activity during this period.

The flow-on economic impact of the direct labour wage spending in the region ($3.9 million) of the estimated 100 local people directly employed during the first full year of main construction works is estimated up to:

- $3 million in annual direct and indirect regional output
- $2 million in annual direct and indirect value–added
- $1 million in annual direct and indirect income
- 17 jobs from wage expenditures.

Total annual employment generated by the proposal during year 1 of construction for people that live permanently in the region is estimated at 698 i.e. 100 direct jobs, 17 jobs from wage expenditures and 571 jobs from direct and indirect non-labour expenditure. Further detail regarding the impact estimate of the proposal is provided in section 3.3.4 of Technical paper 7.

15.4.2. NSW impacts

The economic activity generated by the proposal for NSW would be greater than that reported for the region because:

- the NSW economy has a greater capacity to provide direct inputs to production and labour
- there is a greater level of linkages across NSW than there is in the regional economy, therefore the economic effects would be larger. For example, this impact takes into consideration factors such as the economic benefits of goods that are made outside the region that are then purchased within the region by workers as well as the broader economic benefits of worker salaries being spent outside the region.

15.5. Potential impacts – operation

The proposal would contribute to the NSW economy through the secure provision of reliable electricity in the near term, while facilitating the longer–term transition across the NEM to low–emission energy sources. The cost–benefit analysis prepared as part of the RIT–T process for the AER shows that EnergyConnect is expected to deliver net market benefits of around $900 million over 21 years (in present value terms). Part of these net benefits would accrue to NSW.

Additionally, Section 2.6 of the EIS outlined a range of broader economic benefits that are anticipated to occur as a result of the full EnergyConnect, including the proposal including:

- providing diverse low-cost renewable generation sources to help service NSW demand going forward, particularly as existing coal-fired generators retire
- avoiding substantial capital costs associated with enabling greater integration of renewables in the NEM
- generating sufficient benefits to recover the proposal capital costs within nine years of completion
- reducing annual residential bills and small business customer bills in SA and NSW
- delivering flow on economic benefits to the wider economy totalling over $6 billion across SA and NSW (in present value terms)
- generating around 1,500 jobs (including up to around 300 local/regional jobs) during construction
- improving the security, reliability and resilience of the power network in SA and NSW
- improving the ability of parties to obtain hedging contracts in SA and help relieve the tight liquidity in hedging markets currently.

15.6. Management of impacts

15.6.1. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise negative potential economic impacts and maximise economic benefits from the proposal are listed in Table 15-4.

Table 15-4 Mitigation measures – economic

Reference	Mitigation measure	Timing	Applicable location(s)
EC1	The positive local employment and business opportunities would be maximised via promotion of local workforce participation and the preparation and implementation of a Local Industry Participation Plan and Australian Industry Participation Plan.	Pre-construction and construction	All locations
EC2	The proposal team would collaborate with the local Councils and local chambers of commerce to: • inform local business of the goods and services required of the proposal, the service provision opportunities and compliance requirements of business to be able to secure contracts • encourage local business to meet the requirements of the proposal for supply contracts.	Pre-construction and construction	All locations

15.6.2. Managing residual impacts or uncertainties

Adoption of mitigation measures would result in positive economic benefits to the region. Non-labour and direct labour economic opportunities would be maximised through local procurement where possible and implementing strategies for local workforce participation.

16. Hydrology, flooding and water quality

This chapter provides an assessment of potential hydrology, flooding and water quality impacts of the proposal and identifies mitigation measures to address these impacts. It summarises the *Hydrology and flooding impact assessment* (WSP, 2021c) (refer to Technical paper 8).

16.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to hydrology, flooding and water quality and where these requirements are addressed in this EIS are outlined in Table 16-1.

Table 16-1 Secretary's environmental assessment requirements – Hydrology, flooding and water quality

Ref.	Secretary's environmental assessment requirements	Where addressed
Water		
Key issues	The EIS must address the following matters: • an assessment of the impacts of the project on the quantity and quality of the region's surface water resources, including the Murray River, Darling River, Murrumbidgee River, having regard to NSW Water Quality Objectives.	Assessment of the impacts of the project on the quantity and quality of the region's surface water resources is presented in Section 16.4 and Section 16.5 (noting the project does not cross the Darling River or any part of its catchment and therefore this river has not been considered).
	• details of water requirements, supply arrangements and wastewater disposal arrangements for construction and operation.	Details of water requirements, supply arrangements and wastewater disposal arrangements is presented in Section 16.4.4 and Section 16.5.4 for construction and operation respectively.
	• an assessment of the impacts of the project on groundwater aquifers and GDEs having regard to the *NSW Aquifer Interference Policy* (DPI, 2012c) and relevant *Water Sharing Plans*.	Assessment of the impacts of the project on groundwater aquifers and GDEs is provided in Chapter 21 and Technical paper 15.
	• an assessment of the potential flooding impacts and risks of the project.	Assessment of the potential flooding impacts and risks of the proposal is provided Section 16.4.1 and Section 16.5.1 for construction and operation respectively.

16.2. Assessment approach

16.2.1. Legislation and policy context

The assessment was completed with consideration of relevant Australian and state legislation which includes the:

- *Water Management Act 2000* (WM Act)
- POEO Act
- Water Sharing Plans including:
  - *NSW Murray and Lower Darling Regulated Rivers Water Sources plan 2016*
  - *Lower Murray-Darling Unregulated River Water Source 2011*
  - *Murrumbidgee Regulated River Water Source 2016*
  - *Murrumbidgee Unregulated River Water Source 2012.*

Policies and guidelines that are also relevant to the assessment include:

- *National Water Quality Management Strategy* (Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000)
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018)
- *NSW Water Quality and River Flow Objectives* (OEH, 2006)
- *Murray–Darling Basin Plan* (Murray-Darling Basin Authority, 2012) and the associated water resource plans (*NSW Murray and Lower Darling surface water resource plan and Murrumbidgee River surface water resource plan*)
- *Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia*, Handbook 7 (Australian Institute for Disaster Resilience, 2017)
- *Floodplain Risk Management Guide, Incorporating 2016 Australian Rainfall and Runoff in studies* (OEH, 2019)
- *NSW Floodplain Development Manual* (Department of Infrastructure, Planning and Natural Resources (DIPNR), 2005) and *Flood prone land policy* (DIPNR, 2017)
- Local flood plans prepared for the LGAs within the proposal study area
- *Guidelines for controlled activities on waterfront land* (DPI, 2012a)
- *Guidelines for developments adjoining land and water* (OEH, 2013b)
- *Managing Urban Stormwater – Soils and Construction*, 4th Edition (Landcom, 2004).

16.2.2. Methodology

The hydrology and flooding study area was defined as the catchment areas of the Murrumbidgee River and the Lower Murray River that the proposal is located within and includes all minor watercourses within these catchments.

The approach for this assessment included the following key tasks:

- a desktop review of publicly available resources and identification of sensitive receiving environments
- a qualitative assessment of flooding impacts (discussed further in this section) to identify risks to the proposal as well as potential impacts to flood behaviour and risk due to the proposal. This includes a review of a hydrological risk assessment prepared for EnergyConnect by Beca (2020)

- an assessment of potential impacts to water quality, including:
  - review of historical water quality assessments and baseline data to determine existing conditions relevant to water quality
  - comparison of the established baseline data to relevant water quality objectives
  - a qualitative assessment of the potential impacts to water quality from the proposal, including potential residual impacts post-mitigation and the likely performance against the water quality objectives
- an assessment of geomorphology, including review of the existing geomorphic condition of waterways, with reference to the NSW River Styles mapping (DPI, 2019), and qualitative assessment of potential changes in surface water flows and impacts to geomorphology from the proposal
- an assessment of potential impacts to water supply and water resources, including:
  - background review of existing relevant water sharing plans, and existing water supply, use and storage within the water quality and flooding study area
  - identification of existing environmental water requirements in the vicinity of the disturbance area
  - review of indicative demand for water from construction and operation of the proposal
  - qualitative assessment of potential impacts to water availability for the construction and operation of the proposal
- identification of relevant mitigation measures.

The assessment of hydrology, flooding and water quality has considered all water catchments that could be potentially impacted by the proposal. A catchment is defined as the area that drains directly to a stream or body of water and includes areas upstream and downstream of the proposal.

Detailed discussion of the methodology for the hydrology and flooding assessment is provided in Chapter 3 of Technical paper 8.

16.3. Existing environment

16.3.1. Climate, rainfall and topography

The proposal is located in a semi-arid climate with hot summers and cool winters in regional western NSW. The average temperature range is around 16°C to 33°C in summer and around 4°C to 15°C in winter. The average annual rainfall across the study area is variable, however generally average rainfall is higher at the eastern end of the study area and lower at the western end.

Rainfall is fairly evenly spread across the year, with higher peak rainfall values from November to April. Climate change predictions forecast increases in mean annual rainfall, but also predict high mean evaporation rates. This will result in changed intensity of flood events.

The topography varies across the study area. The western end of the study area generally sits around 40 metres above sea level, rising to about 200 metres above sea level in the eastern end of the study area. The terrain varies, however is predominantly flat to undulating plains.

16.3.2. Catchments and watercourses

The proposal crosses several sub catchments in the Murray-Darling Basin. These sub-catchments include from west to east the Lower Darling, the Murrumbidgee and the Mid-Murray catchments.

The Lower Darling catchment is around three per cent of the Murray-Darling Basin. The catchment in the study area covers the Wentworth LGA and the majority of the Balranald LGA. The major river systems, the Darling River and the Darling Anabranch, are located outside the study area. Box Creek, a non-perennial river within this catchment, is the key watercourse within the study area.

The majority of the study area is located in the Murrumbidgee catchment. This catchment is about 84,000 square kilometres, or about eight per cent of the Murray-Darling Basin. The Murrumbidgee River flows west through the study area and has its confluence with the Murray River near Balranald. The Yanco Creek system, located in the eastern end of the study area, is an anabranch complex which links the Murrumbidgee River to the Edward River through interconnected watercourses including Yanco Creek, Colombo Creek, Billabong Creek and The Forest Creek. Water from the Murrumbidgee River is diverted into Yanco Creek.

The upper reaches of the Mid-Murray catchment are located in the study area, located generally between Kidman Way and County Boundary Road. This catchment is around three per cent of the Murray-Darling Basin and includes the Murray and Edwards rivers.

Numerous natural watercourses and man-made waterways intersect the study area, including unnamed drainage lines, dry rivers, perennial rivers, canals and drains. Ten lakes are also located within the study area. Of particular significance is Lake Urana and Lake Albert. Lake Urana is a large shallow intermittent salt lake in a depression at the end of the drainage basin of Billabong, Coonong and Urangeline creeks. The lake fills every ten to 20 years and retains water for several years. Lake Albert is a 125-hectare artificial lake in the suburb of Lake Albert in Wagga Wagga. The lake is used for recreational purposes including water sports, boating and fishing.

Surface water features and catchments are displayed in Figure 16-1.

16.3.3. Flooding

There are large floodplains around Box Creek, the Murrumbidgee River, Condoulpe Creek, Yellow Clay Creek, Coonong Creek, Bullenbong Creek and dispersed flooding at the very eastern end of the study area around Sawpit Gully, Crooked Creek and Boiling Down Creek (Beca, 2020). Floodplains are also present around Talia Creek, The Forest Creek, Colombo Creek, Yanco Creek, Halliday's Cut, Brookong Creek and Sandy Creek. During one per cent AEP flood events, depths in the main river channels are estimated to be up to six metres and up to two metres across the floodplains in the proposal study area (Beca, 2020). The velocities within watercourses range from 0.5 metres per second to up to three metres per second.

The Murrumbidgee River near Wagga Wagga flooded most recently in 2012 reaching a peak of 10.56 metres. The severity of flooding from the river can be affected by man-made storage farms located in the upper Murrumbidgee valley which can reduce the peak flood discharge, resulting in lower peak flood heights but longer flood durations within the proposal study area (State Emergency Service (SES), 2006).

Based on photographs supplied by landholders, areas surrounding the Lake Cullivel have flooded in the past, including part of the proposed transmission line easement.

Existing flood affected receivers are largely located near existing waterways, including residential dwellings, industrial and community facilities near:

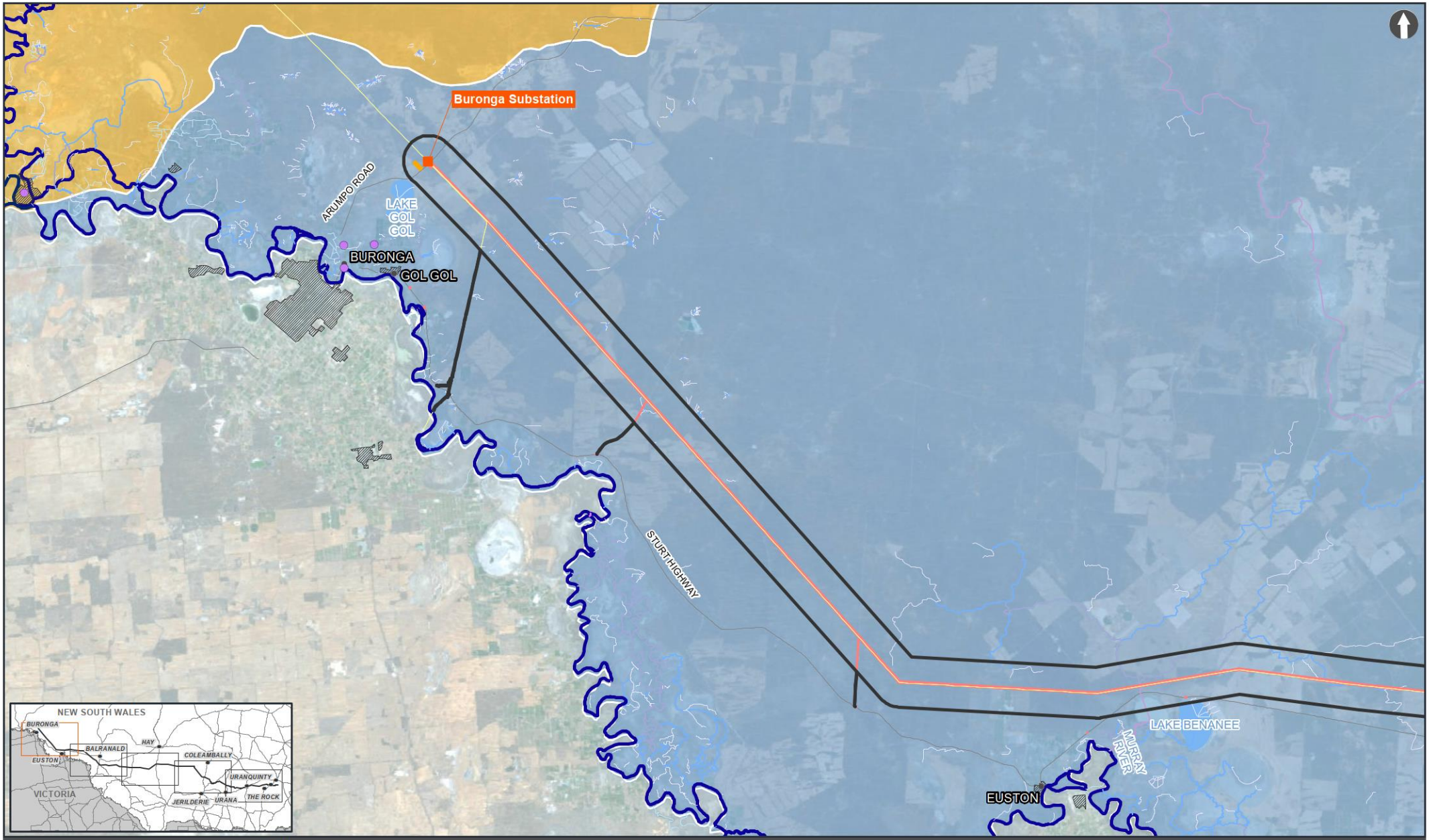
- Talia Creek
- Murrumbidgee River
- Condoulpe Creek
- the Forest Creek
- Yellow Clay Creek
- Colombo Creek, Yanco Creek
- Halliday's Cut
- Brookong Creek
- Bullenbong Creek
- Sandy Creek
- Sawpit Gully and
- Crooked Creek.

Floodplain areas between Colombo Creek and Halliday's Cut to the north of Lake Urana also include a number of flood affected receivers.

Roads in the study area are also predicted to be flood affected roads including:

- Sturt Highway near the Box Creek and Murrumbidgee River crossing
- Balranald Road near Condoulpe Creek
- Booroorban-Tchelery Road near the Forest Creek
- West Burrabogie Road near Curtains Creek
- Newell Highway near Yanco Creek
- Federation Highway and a number of unnamed access roads, near Coonong Creek and Lake Urana
- County County-Boundary Road
- Lockhart Road
- Bullenbong – The Rock Road
- Lockhart – The Rock Road, and
- Boyds Road near Bullenbong Creek and Burkes Creek.
- most roads east of Sandy Creek (near Wagga Wagga).

Flood related infrastructure (such as flood levees or flood control banks) are present within the floodplains of the Murrumbidgee River, and capture and store floodwaters for later use.



Project Components

- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Water Fill Point
- Existing Transmission Line Infrastructure
- Existing Substation
- Existing Railway
- Surface Water Study Area
- Built Up Areas
- Waterbody

Catchment Boundaries

- Darling River Basin
- Peacock Creek Basin

Strahler Stream Order

- Strahler Stream Order - 0
- Strahler Stream Order - 1
- Strahler Stream Order - 2
- Strahler Stream Order - 3
- Strahler Stream Order - 4
- Strahler Stream Order - 5
- Strahler Stream Order - 10
- Strahler Stream Order - 11

Figure 16-1

Waterways, Waterbodies and Catchments in the Study Area

Sheet 1 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

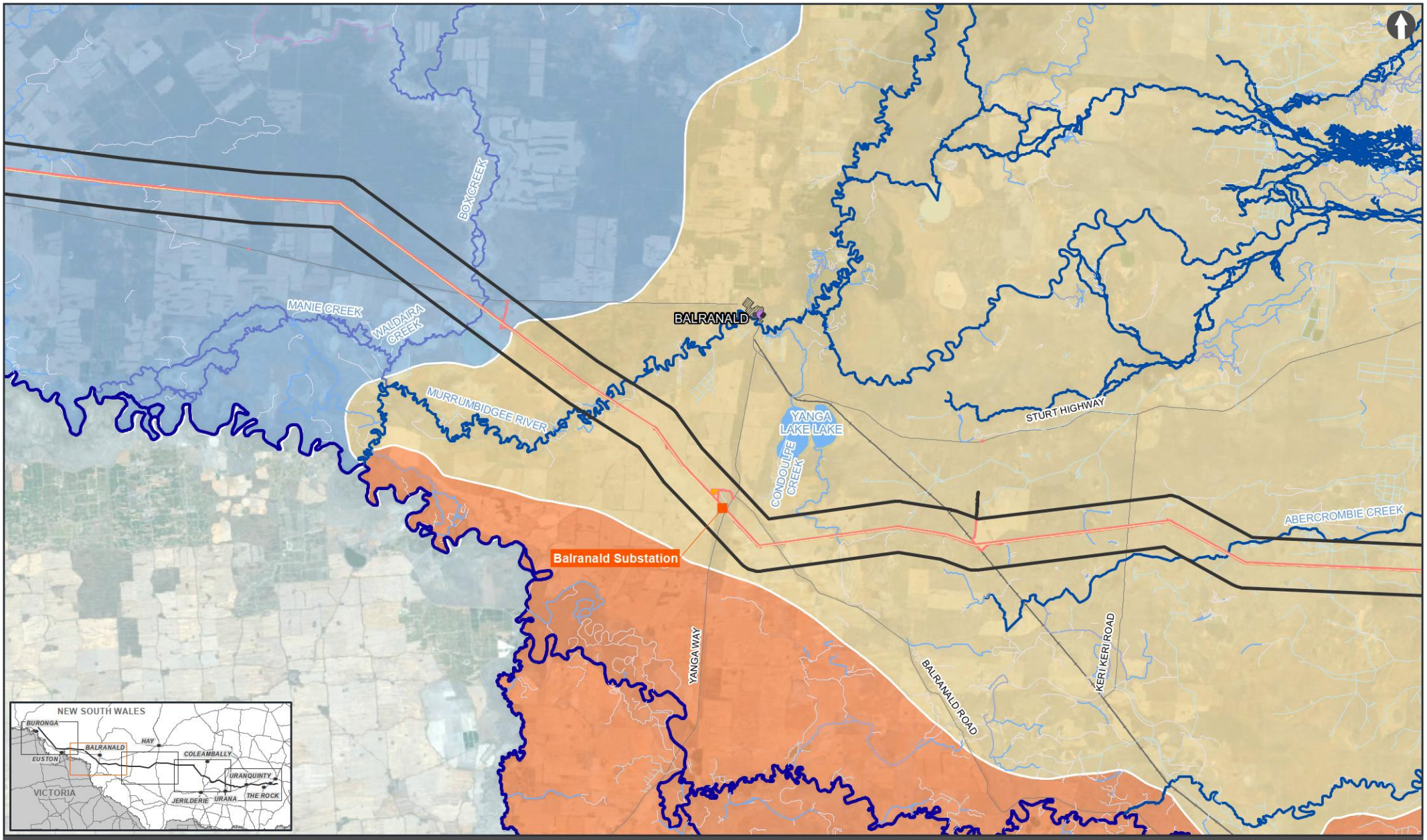

Figure 16-1

Waterways, Waterbodies and Catchments in the Study Area

Sheet 2 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

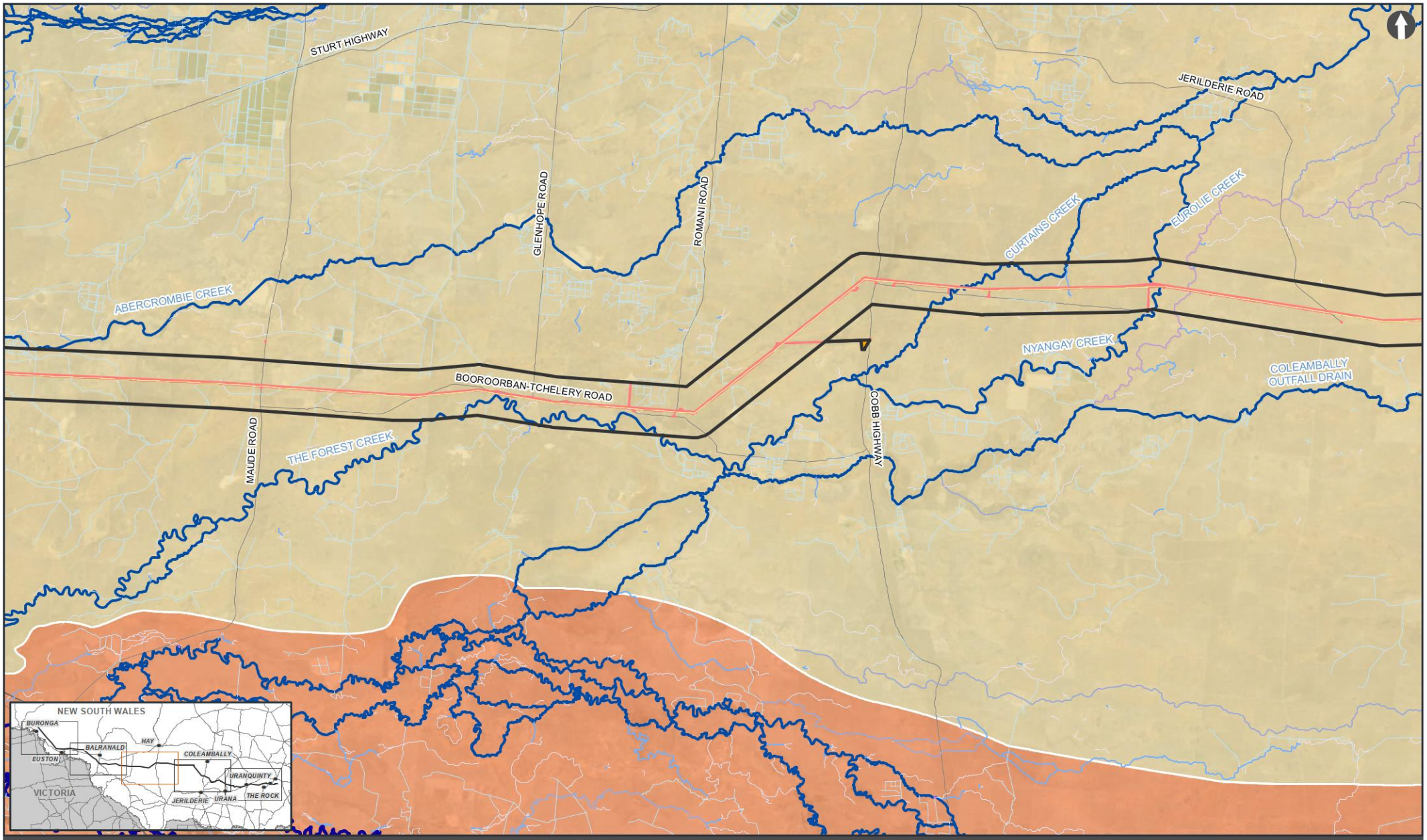

Figure 16-1

Waterways, Waterbodies and Catchments in the Study Area

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- Existing Substation
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- Built Up Areas
- Waterbody

Catchment Boundaries
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- Murrumbidgee River Basin

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Sheet 3 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

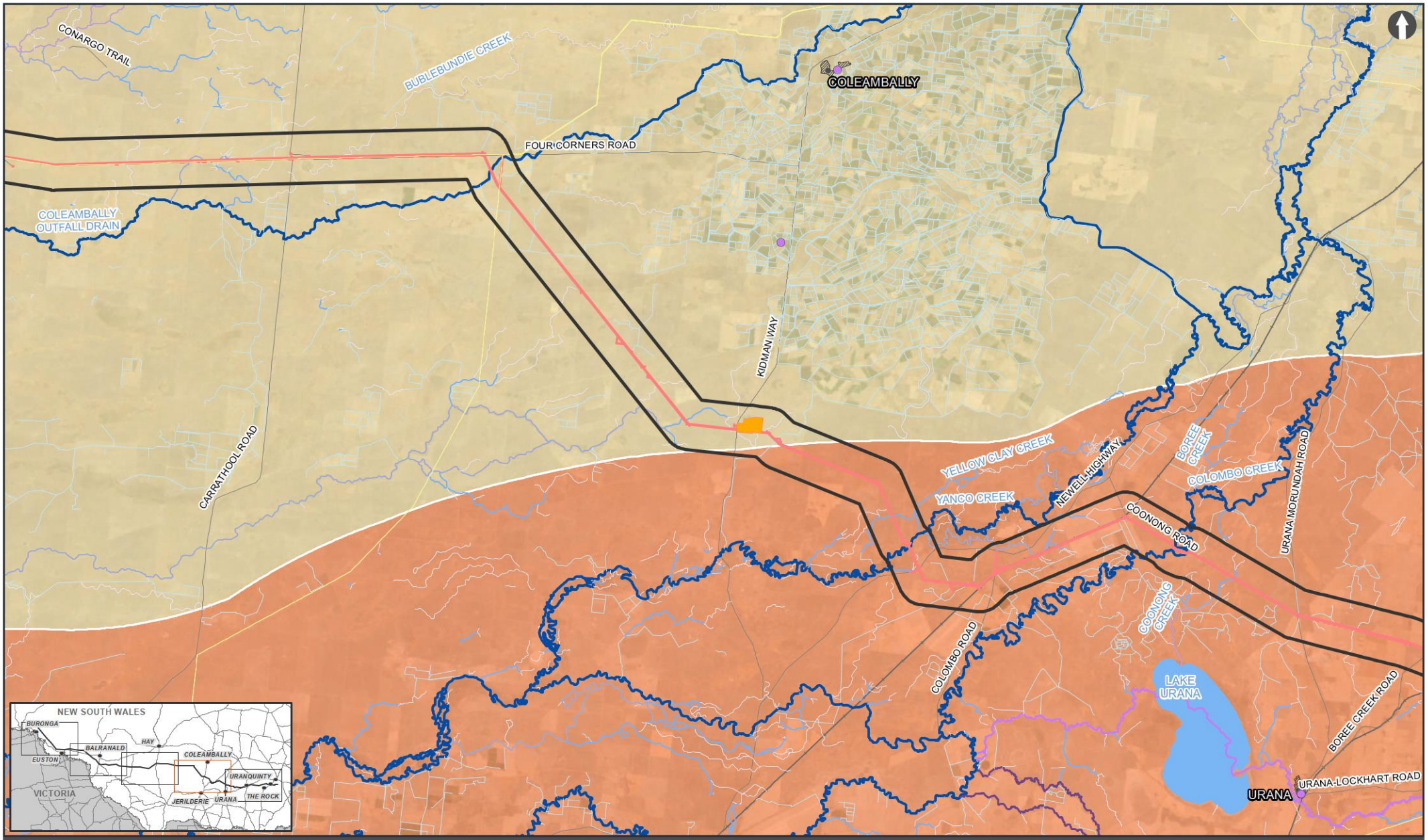

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Figure 16-1
Waterways, Waterbodies and Catchments in the Study Area

Sheet 4 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

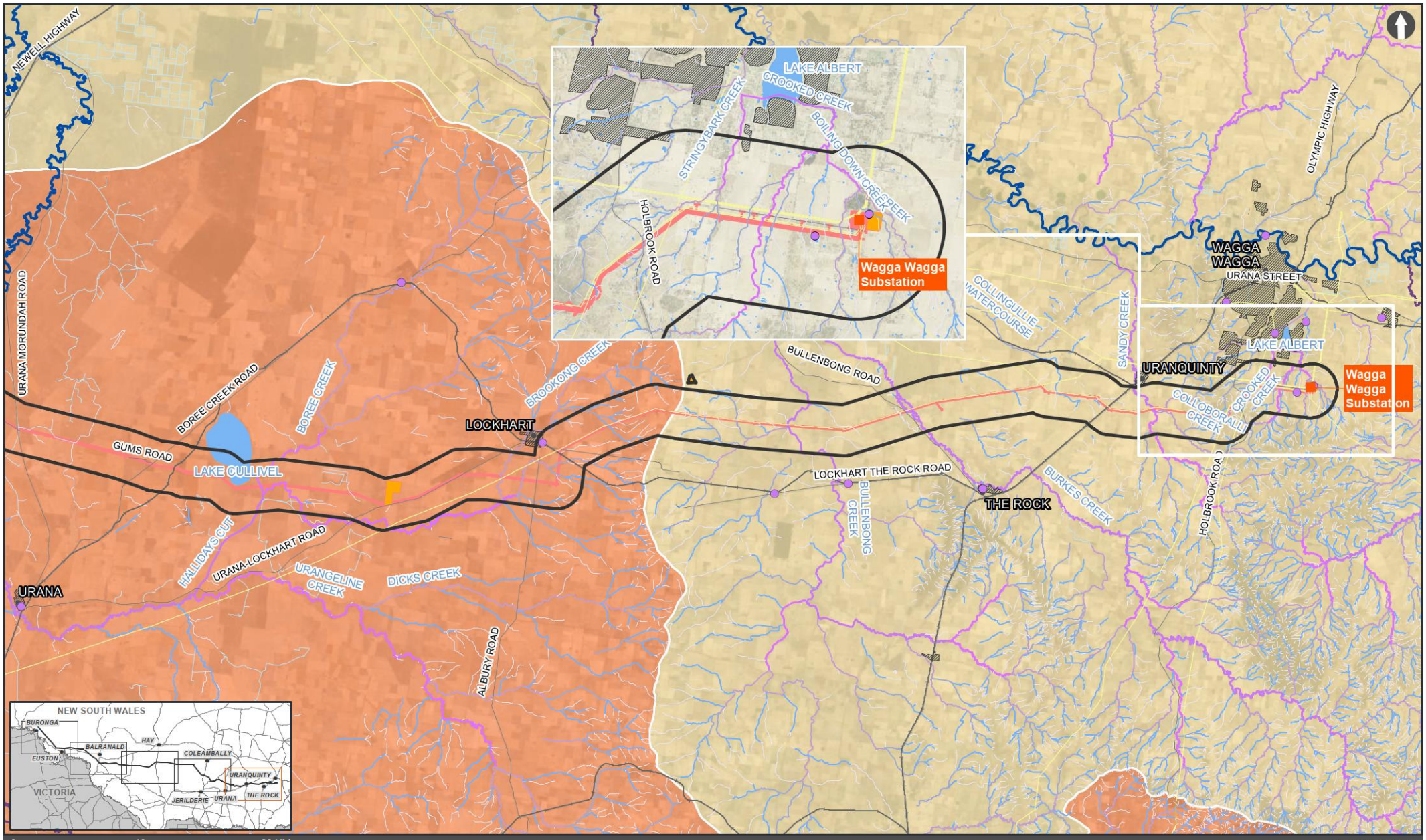

Figure 16-1

Waterways, Waterbodies and Catchments in the Study Area

Sheet 5 of 5

Project Components
- Construction Impact Area
- Main Construction Compounds and Accommodation
- Water Fill Point

- Existing Transmission Line Infrastructure
- Existing Substation
- Existing Railway
- Surface Water Study Area
- Built Up Areas
- Waterbody

Catchment Boundaries
- Murray River Basin
- Murrumbidgee River Basin

Strahler Stream Order
- Strahler Stream Order - 0
- Strahler Stream Order - 1
- Strahler Stream Order - 2
- Strahler Stream Order - 3
- Strahler Stream Order - 4
- Strahler Stream Order - 5
- Strahler Stream Order - 6
- Strahler Stream Order - 7
- Strahler Stream Order - 9

Source: NSWSS, ESRI, Transgrid, WSP

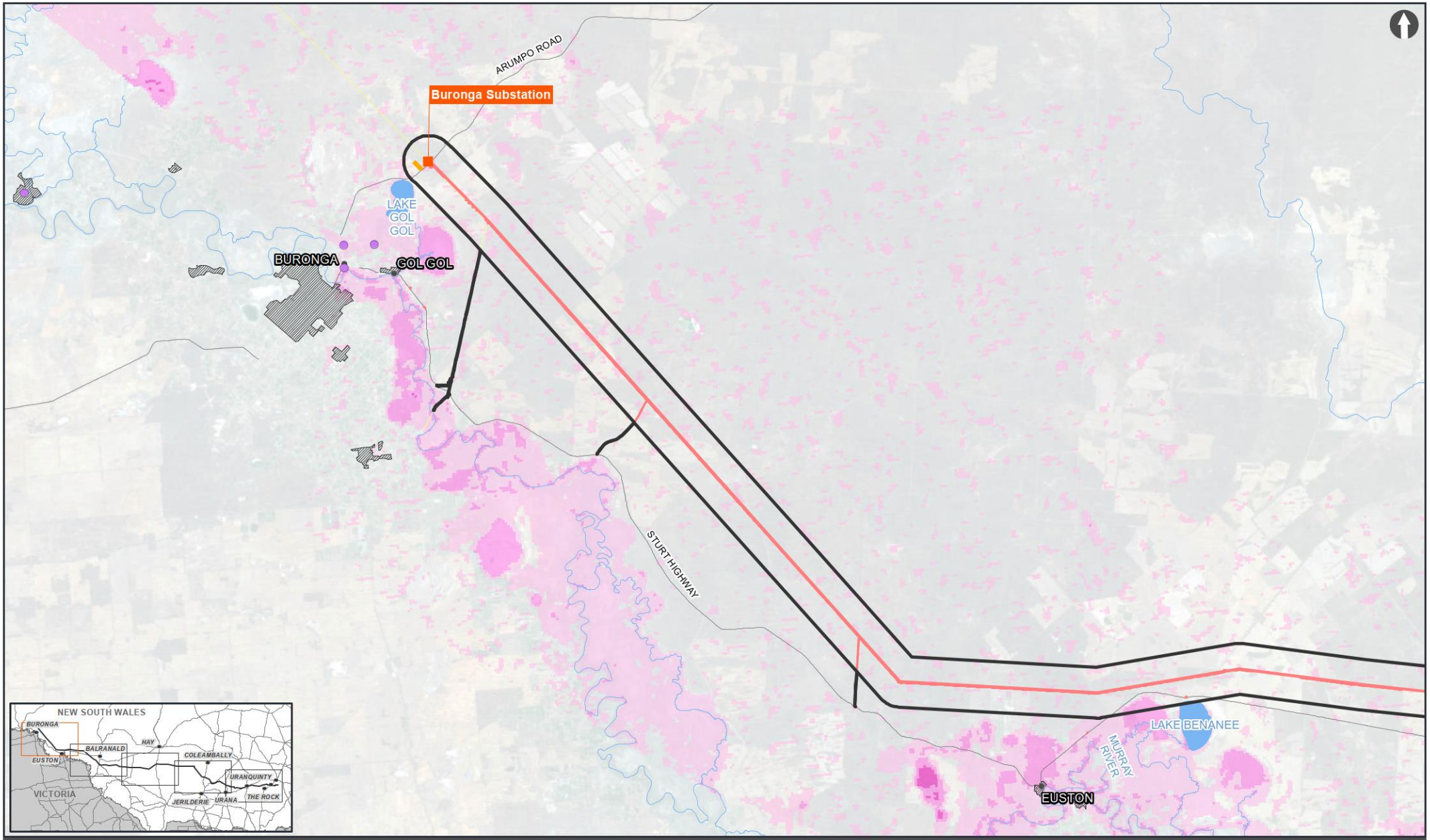

Figure 16-2

Flooding Depth in the Study Area

Sheet 1 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

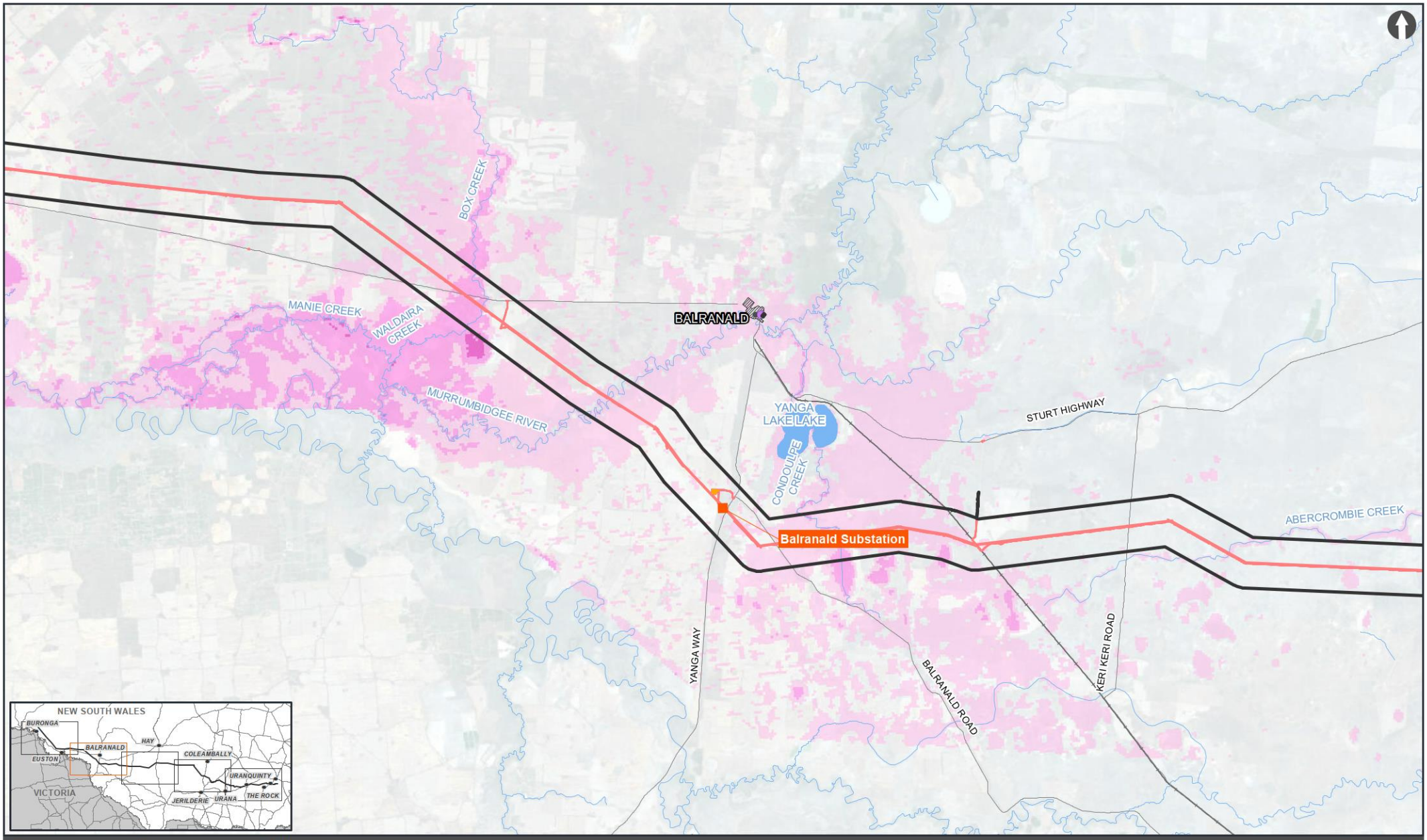

Figure 16-2
Flooding Depth in the Study Area

Project Components
- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Water Fill Point
- Waterbody
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Surface Water Study Area
- Built Up Areas

Flooding Depth (m)
- 1m - 5m
- 5m - 10m
- 10m - 20m

Sheet 2 of 5

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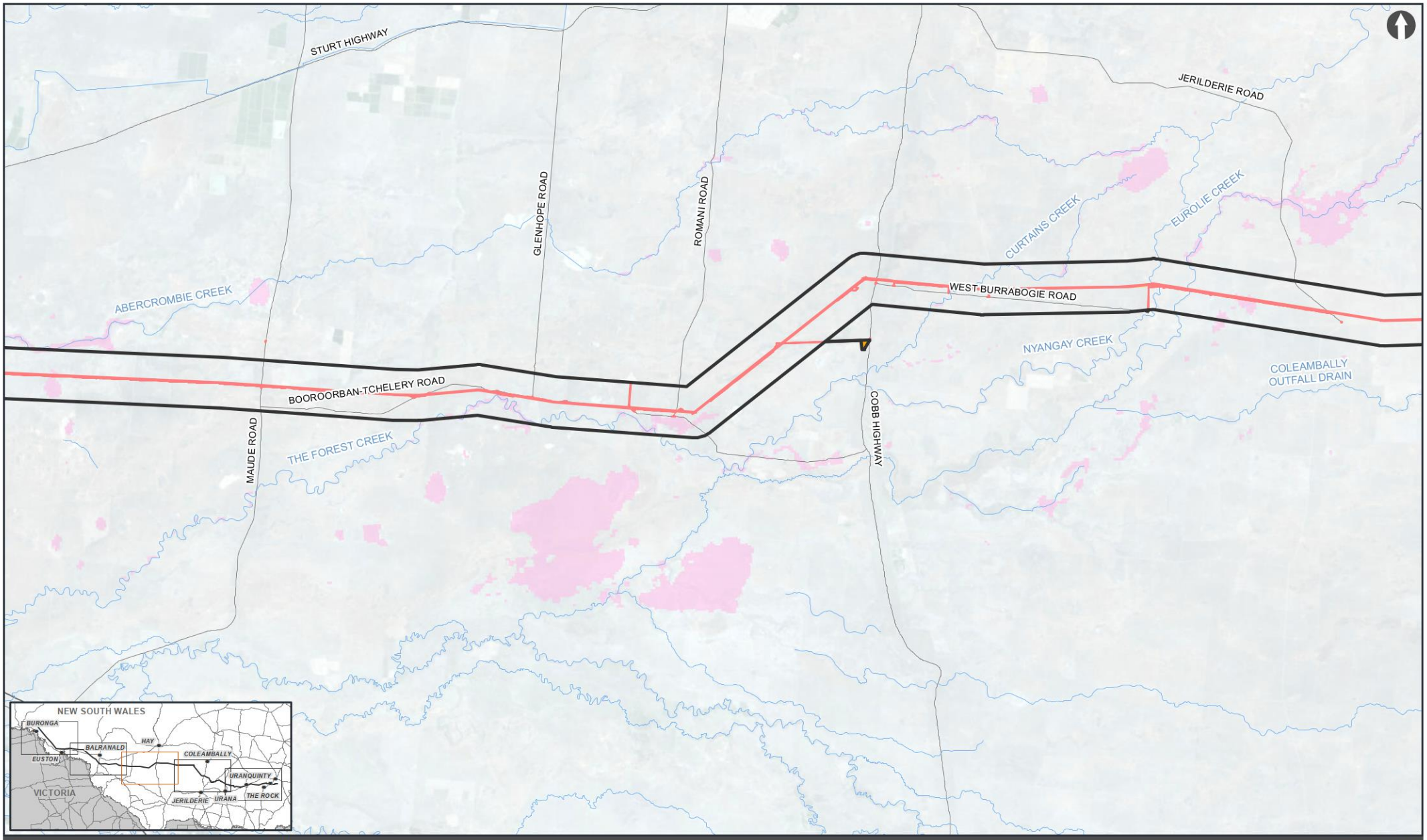
Source: NSWSS, ESRI, Transgrid, WSP



Project Components

- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Water Fill Point
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Surface Water Study Area
- Built Up Areas

Flooding Depth (m)

- 1m - 5m

Figure 16-2

Flooding Depth in the Study Area

Sheet 3 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

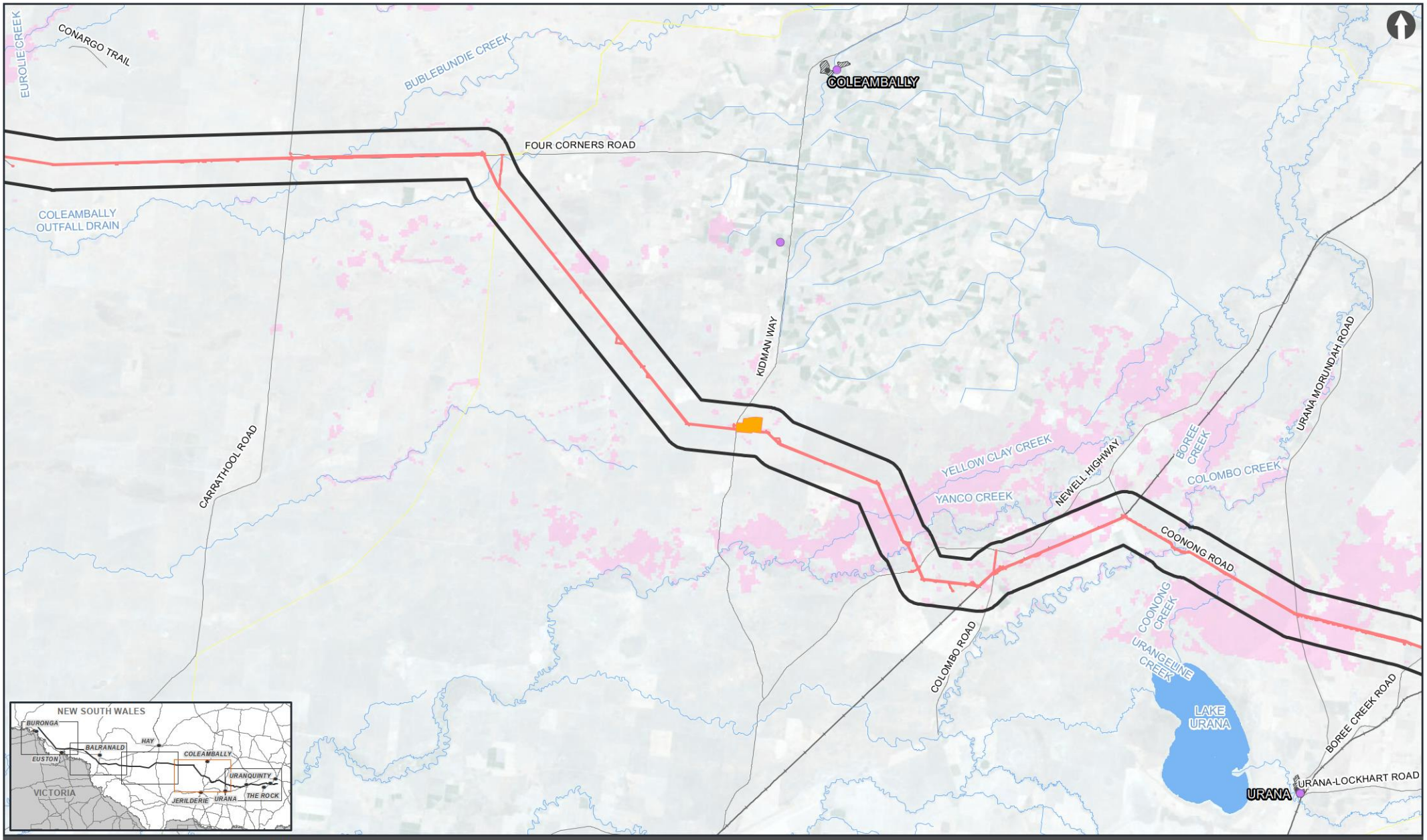

Figure 16-2

Flooding Depth in the Study Area

Project Components

- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Water Fill Point
- Waterbody
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Surface Water Study Area
- Built Up Areas

Flooding Depth (m)

- 1m - 5m

Sheet 4 of 5

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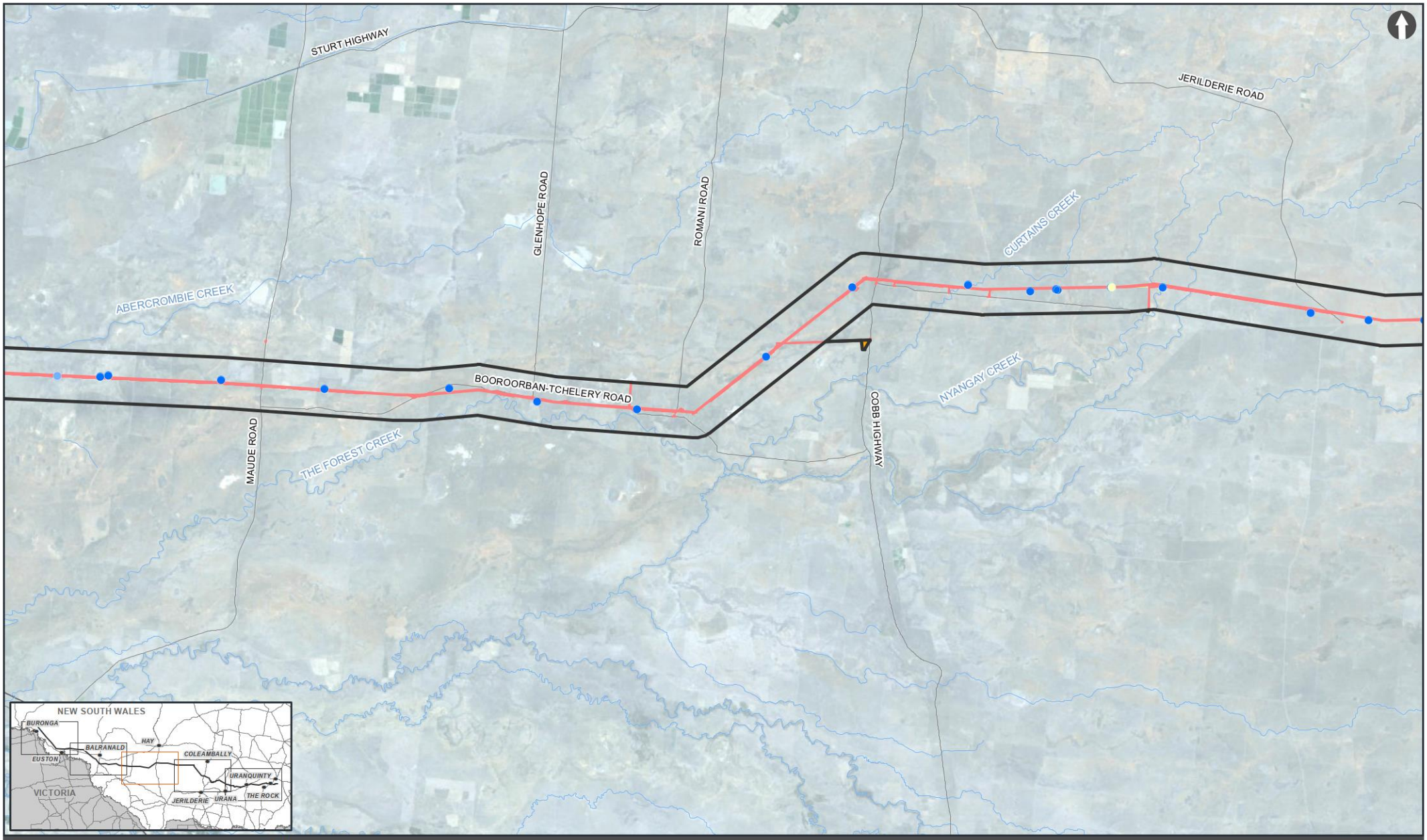
Source: NSWSS, ESRI, Transgrid, WSP



Project Components

- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Access Tracks
- Water Supply Point
- Existing Transmission Line Infrastructure
- Existing Substation
- Existing Railway
- Contamination Study Area
- Built Up Areas

Potential Areas of Contamination

- Farm Dam (18)
- Farm Dam (potential) (1)
- Scarring (potential) (1)

Figure 21-1
Potential Areas of Contamination

Sheet 3 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

16.3.4. Geomorphology

Geomorphology relates to the form, shape, size and structure of watercourses. The geomorphic condition of a watercourse is dependent on the flows, vegetation, soil types, aquatic biodiversity etc and these can be affected by human induced changes to catchments and watercourses. Watercourses in good geomorphic condition are important for overall catchment health. Table 16-2 outlines the geomorphology of the major watercourses within the study area, including classifications from NSW River Styles Mapping (DPI, 2019).

The geomorphic condition affects the aquatic biodiversity and physical habitats available in the stream. The riverine channel and bank shape and riparian vegetation is used to assess the local aquatic habitat and its potential to support aquatic biota. These physical features and stream order form the basis of the NSW River Styles Mapping. Watercourses that lack regular flow and no riparian vegetation (including first and second order streams or overland flow paths) would be in a poor geomorphic condition (no fixed channel shape or size) and high fragility because of the significant potential to change with each flow event. Recovery potential indicates the capacity of a river to return to good condition or to a realistic rehabilitated condition.

Table 16-2 Geomorphology of major watercourses within the proposal study area

Watercourse	Stream order	NSW River Style	Existing condition	Recovery potential	Description
Box Creek	8	Valley fill, fine grained	Good condition High fragility	Conservation	Non perennial river, Lower Murray Darling catchment
Murrumbidgee River	9	Meandering, fine grained	Moderate condition Low fragility	Moderate	Perennial river, Murrumbidgee catchment
Condoulpe Creek	2	Valley fill, fine grained	Moderate condition High fragility	Moderate	Unknown flow characteristics, Murrumbidgee catchment
Abercrombie Creek	9	Valley fill, fine grained	Moderate condition High fragility	Moderate	Mainly dry river, Murrumbidgee catchment
The Forest Creek	9	Valley fill, fine grained	Moderate condition High fragility	Moderate	Mainly dry river, Murrumbidgee catchment
Curtains Creek	9	Valley fill, fine grained	Moderate condition High fragility	High	Mainly dry river, Murrumbidgee catchment
Nyangay Creek	9	Valley fill, fine grained	Moderate condition High fragility	High	Mainly dry river, Murrumbidgee catchment
Eurolie Creek	4	Valley fill, fine grained	Moderate condition High fragility	High	Mainly dry river, Murrumbidgee catchment

Watercourse	Stream order	NSW River Style	Existing condition	Recovery potential	Description
Bublebundie Creek	1	Valley fill, fine grained	Moderate condition High fragility	Moderate	Mainly dry creek, Murrumbidgee catchment
Yellow Clay Creek	2	Anabranching, valley setting, continuous	Moderate condition Low fragility	Moderate	Unknown flow characteristics, Murrumbidgee catchment
Yanco Creek	9	Meandering, fine grained	Moderate condition Low fragility	Moderate	Unknown flow characteristics, Murrumbidgee catchment
Brookong Creek	5 and 4	Low sinuosity, fine grained	Moderate condition Low fragility	Moderate	Unknown flow characteristics, Murray catchment
Bullenbong Creek	6	Valley fill, fine grained	Moderate condition High fragility	Moderate	Perennial river, Murray catchment
Burkes Creek	6	Low sinuosity, fine grained	Moderate condition Moderate fragility	Moderate	Unknown flow characteristics, Murray catchment
Coloboralli Creek	Null	Low sinuosity, fine grained	Poor condition Moderate fragility	Low	Unknown flow characteristics, Murray catchment
Crooked Creek	5	Low sinuosity, sand	Poor condition High fragility	Low	Unknown flow characteristics, Murrumbidgee catchment
Boiling Down Creek	4	Channelised fill	Poor condition Moderate fragility	Low	Unknown flow characteristics, Murrumbidgee catchment

16.3.5. Water quality

The existing water quality for the Murray-Darling Basin has been periodically monitored and assessed as part of a range of management plans and other documents. Parameters monitored to assess water quality include nutrients (nitrogen and phosphorus), pH, turbidity and dissolved oxygen. These results are compared to trigger values (ANZECC, 2000), to provide a rating based on the frequency and level of samples exceeding the trigger values.

Available catchment water quality data in the study area identifies water quality within these watercourses as varied. Generally, water quality on the major rivers of the Murrumbidgee and Murray Rivers is better than in associated tributaries. Within and downstream of the study area, the Murrumbidgee and Murray Rivers commonly achieve the existing water quality targets outlined in Table 16-3. Typically, where exceedances are identified, these have been in relation to nutrients, particularly phosphorus and turbidity in tributaries to the major rivers.

There is limited specific water quality data available for watercourses along the alignment of the proposal. Given the high proportion of agricultural land within the study area, it is likely that some waterways near the proposal would not achieve the water quality criteria as laid out in the Murray Darling Basin Plan 2012 (see Table 16-3), particularly for nutrients. The sources of the high nutrient levels are likely to be diffuse and related to current and historical agricultural activities within the study area.

Table 16-3 Basin Plan 2012 water quality targets

Water quality zone	Turbidity (NTU) (annual median)	pH	Total nitrogen (ug/L)	Total phosphorus (ug/L)	Dissolved oxygen (mg/L; or % saturation) (Annual median)	Pesticides, heavy metals and other toxic contaminants[1]
Darling Valley, Middle lower (Dml)	50	6.5-8	500	50	85-110%	The protection of 95% of species
Lower Central Murray (cMl)	35	6.5-8	700	80	>8 mg/L or 90-110%	The protection of 95% of species
Castlereagh, Lachlan, Macquarie and Murrumbidgee (A3)	35	6.5-8	600	50	>7 mg/L or 60-110%	The protection of 95% of species
Upper and Middle Central Murray (cMum)	15	6.5-7.5	500	40	>7.7 mg/L or 90-110%	The protection of 95% of species
Lowland Castlereagh, Lachlan, Macquarie and Murrumbidgee (B3)	20	7.0-8.0	600	35	>8 mg/L or 90-110%	The protection of 95% of species

1. Refer to values in table 3.4.1 of the ANZECC Guidelines (Must not be exceeded)

16.3.6. Water supply and water resources

Water sharing plans are in place within Murrumbidgee Regulated Rivers, Murrumbidgee Unregulated Rivers, the Murray and Lower Darling Regulated Rivers and the Murray and Lower Darling Unregulated Rivers. The water sharing plans allocated water to the following uses:

- environmental
- economic
- Aboriginal cultural
- social and cultural.

Environmental water is a large component of the water allocation. The Environmental Water Register maintained by the Department of Industry provides a record of licenced environmental water, as well as other water intended to be used for environmental purposes. The environmental water licences active under the water sharing plans relevant to the hydrology and flooding study area are as follows:

- Murrumbidgee Regulated River Water Sources 2016 – 47 licences
- Murrumbidgee Unregulated River Water Sources 2012 – 6 licences.

As of July 2021, there were no active environmental water licences under the Murray and Lower Darling Regulated Rivers Water Sources 2016 and Murray and Lower Darling Unregulated Rivers Water Sources 2011.

In addition to environmental flows, watercourses within the study area are used to support a wide variety of uses, including domestic, stock and irrigation water supply, town water supply, recreational uses (such as fishing) and cultural heritage uses. Water supply in the study area is also supplemented by groundwater bores as well as rainwater tanks.

Two irrigation areas are also located within the study area:

- the Lowbridgee Irrigation Area, located between Maude and Balranald
- the Coleambally Irrigation Area.

16.3.7. Sensitive receivers

Sensitive receivers include both human related and environment related receivers. Within the surface water and hydrology study area the identification of receivers has been limited to the construction zone.

Human sensitive receivers include residential buildings and other buildings such as commercial buildings and farm buildings. From a review of the available aerial photography no residential or other buildings have been identified within the project easement nor within the construction zone.

Environmental sensitive receivers include surface water features such as rivers, creeks, wetlands and GDEs including:

- the major watercourses, such as Box Creek, Murrumbidgee River, Abercrombie Creek, Forest Creek, Curtains Creek, Nyangay Creek, Yanco Creek, Coleambally Outfall Drain, Colombo Creek, Halliday's Creek and Burkes Creek
- high potential aquatic and terrestrial GDEs located in the proposal study area (refer to Section 21.3) including Coloboralli Creek, Stringybark Creek, Boiling Down Creek, Sandy Creek and Lake Cullivel.

The Lowbidgee Floodplain, located in the Murrumbidgee catchment is also a significant wetland which supports numerous waterbirds and habitat for many threatened species. The Yanco Creek System also supports one of two known self-sustaining populations of the endangered Trout Cod.

16.4. Potential impacts – construction

16.4.1. Flooding

The main risk of potential flooding impacts during construction would occur where the proposal is being constructed within the vicinity of existing waterways.

The proposed Dinawan 330kV substation, the upgrade and expanded Wagga Wagga substation, main construction compounds and accommodation camps are not affected by flooding and construction at these locations would not impact flood behaviour.

The earthworks required for each transmission line tower would have the potential to cause a temporary and localised redistribution of flood flows which may have impacts on other nearby infrastructure, including structures and floodplain harvesting works. However, the earthworks required for a typical transmission tower construction would not result in large obstructions in the floodplain and are therefore not expected to have a substantial influence on flood flows and levels at any one individual tower location. Any influence would be limited to location in the immediate vicinity of each tower.

Temporary crossings may be needed for smaller tributaries that have dry creek beds and which would otherwise require long journeys to divert construction vehicles around the crossing. In wet weather events these crossings could become unusable and potentially result in localised flooding, where small embankments are placed in the waterway to allow for vehicle crossings. These minor increases would be temporary but have the potential to cause disturbance of the waterways if suitable crossing infrastructure is not included.

Construction of access tracks may result in stockpiles of earthen material. Large stockpiles in flood prone areas may result in changes to flood behaviour beyond the construction impact area as it could reduce floodplain storage, redistribute and redirect floodwaters, and subsequently impact other land and infrastructure, including floodplain harvesting works. Construction planning would manage these temporary impacts by locating stockpiles outside of flood prone areas.

While certain construction activities would need to consider potential effects on flooding, generally, the impacts of construction activities to flood behaviour are likely to be temporary, localised and insignificant. No new or additional flood impacts to buildings outside of the construction impact area are expected to result from construction activities.

16.4.2. Geomorphology

Potential impacts to geomorphic conditions resulting from construction activities could include:

- changes in low flow channel shape due to temporary works changing local runoff behaviour
- increased sediment load from runoff from construction areas.

The major waterway crossings as part of the proposal would include the Murrumbidgee River (at Balranald), Abercrombie Creek, Yanco Creek, the Coleambally Outfall Drain, Colombo Creek, Halliday's Cut (at Lake Cullivel), Burkes Creek (The Rock) and several other smaller creek crossings. Transmission line towers would be constructed at least 50 metres from the edge of the major waterways but are unlikely to be able to avoid the riparian areas of all first and second order streams.

Due to the siting of construction activities outside major waterways, no geomorphological impacts to these major waterways are expected. Temporary impacts to the low flow channel shape and sediment load for first and second order streams may result where construction activities disturb geomorphic conditions. Provided that disturbed surfaces in flow areas are adequately stabilised at the completion of construction, these impacts would be temporary and restricted to the construction phase.

16.4.3. Water quality

Water quality impacts have the potential to occur through activities including the removal of vegetation and increased sedimentation, stockpiling of material, establishment of main construction compounds and accommodation camps that increase impervious surfaces, establishment of concrete batching plants, disturbance of existing contaminated land and saline soils, chemical spills and gross pollutants. Higher risk areas for water quality impacts are those with slopes greater than 2.5 per cent that are near waterways.

Based on these activities, construction of the proposal may lead to increases of the following pollutants into waterways:

- nutrients (nitrogen and phosphorus) – commonly present in agricultural areas that may become mobilised from disturbance of agricultural land for construction work
- sediment from vegetation and topsoil clearing, soil excavation, movement and storage and stormwater runoff through disturbed sites
- chemicals, fuels and hydrocarbons from use, refuelling and maintenance of equipment and construction machinery
- concrete slurry and wastewater – from mobile concrete batching plants
- contaminants of concern related to previous land uses – heavy metals, Total recoverable hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), Polycyclic aromatic hydrocarbon (PAH), organochlorine pesticides (OCP) and organophosphorus pesticides (OPP)
- heavy metals such as zinc, lead, copper, nickel, cadmium and chromium from disturbance of contamination and use and maintenance of vehicles and plants
- problem soils such as saline and acid sulfate soils (ASS)
- gross pollutants such as paper and plastic packaging and materials from material use on construction sites and general construction staff litter.

Where there are sensitive receiving environments located along the proposal, such as the Murrumbidgee River, water quality impacts from the construction of the proposal are anticipated to be short-term and limited in extent. Additionally, the progressive nature of construction would limit the work areas and duration within which impacts may occur.

16.4.4. Water supply and wastewater

It is estimated that about 1.1 gigalitres of water would be required for construction, for the following activities:

- dust suppression on substation construction sites and transmission line tower construction sites, and on access tracks through the use of a water spray attached to a tanker vehicle (including the possible use of water reduction polymers)
- concrete batching activities for use when mixing with cement, aggregates and water for transmission line towers and substation foundations
- wetting backfill material (if it is too dry for effective compaction)
- general worker facilities at the main construction compound and camp sites.

Water would be supplied for the proposal from existing regulated sources. Based on initial consultation, 26 potential sources of water have been identified along the length of the proposal which have the potential to support the construction water needs for the proposal. Water would be purchased from the existing water market within the region or from local council facilities. Access to these sources would occur through the use of existing, licensed water extraction infrastructure only. No new points of water extraction are proposed. Use of existing water access licences would be relied upon for these points.

Wastewater would be generated from staff facilities and construction activities. The major impact from release of wastewater would be elevated nutrient levels. Wastewater treatment facilities would be constructed at the accommodation camps established for this proposal. The systems would be designed to collect wastewater from showers, kitchens, laundries and toilets, with toilet and kitchen facilities located both at the camp and the office areas. The wastewater would be treated to a suitable standard to facilitate appropriate reuse (for example for construction purposes and dust suppression) in a manner that does not pose a soil or water contamination risk. The waste stream from the wastewater treatment processes would be collected and transported to a relevant council wastewater treatment plant (or other approved/licensed facility).

Wastewater produced during the initial establishment of the proposed accommodation camps would be collected and transported to a relevant council wastewater treatment plant (or other approved/licensed facility). This process would be in place during the site establishment works and would cease once the wastewater treatment facilities become operational.

16.5. Potential impacts – operation

16.5.1. Flooding

Sections of the transmission line would be located in the floodplain. Footing connections at the base of each transmission line tower would be the only components of the tower within the floodplain. The footings would not significantly reduce floodplain storage or impede flow. As such, the proposal would not have any significant impacts to flood levels, flood depths, flood velocities or existing flood storage as a result of the transmission line towers. Any changes in flood behaviour would be localised in the vicinity of each tower. The design of each tower would be such that any flood behaviour changes would not affect their structural integrity and would account for flow direction and minimising erosion potential on the down-flow side.

Around six to ten transmission line towers would be located in the flood prone area identified near Lake Cullivel. Given the wide flat nature of the floodplain in the vicinity of Lake Cullivel the impact of the towers on flood behaviour would be insignificant. Any minor local increases in flood levels and velocities would dissipate within 50 metres of each tower footing. There is no flood sensitive development or infrastructure in close proximity to the towers at this location.

Permanent access tracks are not expected to impact flood behaviour, where they are located away from overland flow paths. Permanent watercourse crossings are not proposed at the key watercourses along the proposal.

The proposed and upgraded substations are not located within flood prone land, and permanent impacts to flood behaviour are not anticipated. At the proposed Dinawan 330kV substation, drainage infrastructure would be designed to divert external runoff and to match overland flow conditions. The final landform at the earthwork materials site, subject to landholder requirements, would be around two metres at its deepest point.

The impact to flood levels from the proposal would only be localised and would not affect the large flood extents experienced around the waterways across the proposal. The proposal is not predicted to change the flood affectation on existing structures and infrastructure. As such there is not expected to be any change to use of the roads during a flood emergency or existing flood emergency management arrangements as outlined in the relevant local flood plans.

16.5.2. Geomorphology

Similar to construction related impacts, potential operational impacts to geomorphology would include:

- changes in low flow channel shape due to placement of towers in low flow points which changes low flow runoff behaviour
- increased sediment load from runoff from permanent access tracks.

For transmission line towers located within the flood prone areas of waterways, minor, localised geomorphological impacts to the existing waterways may occur during flood events. Where the placement of the towers is within minor low flow paths of 1st and 2nd order streams, changes in the position of these flow paths and movement of sediment locally within the flow path may occur. These geomorphological impacts would not affect the main watercourse channels and regular flow regimes within the channels. No transmission towers would be located within the banks of waterways with a stream order of 7 and above, resulting in no geomorphological changes that would affect the long term health of these waterways.

Localised changes within flow paths may be experienced for the regular flood events but no significant impact is expected in large flood events, such as the 1% AEP. Where transmission line towers are located out of these minor waterways, there would not be any geomorphological impacts.

16.5.3. Water quality

There is potential for water quality impacts as a result of spills or litter generated from operation and maintenance activities along the transmission lines and at transmission line towers near waterways, however, these impacts would be minor and localised. Provided correct operation procedures and safeguards are implemented the residual likelihood of impacts would be very low. There would not be any impacts to water quality expected as a result of the presence of the transmission lines and the associated towers in the landscape.

New impervious areas at the proposed Dinawan 330kV substation have the potential to impact water quality as a result of increased run off volumes, scour potential and sediment loads. Drainage infrastructure at the new substation would be designed to minimise changes in water quality and discharge velocities with:

- hardstand areas designed to drain to a containment structure with transformers bunded to manage any spill or emergency events that could impact water quality
- suitable drainage infrastructure, including dispersion structures, to minimise potential scour and offsite water quality impacts due to runoff captured within the site
- diversion of offsite runoff around the new substation formation to natural watercourses using appropriate dispersion structures.

There would be minor changes to the impervious areas as a result of the upgrade and expansion of the Wagga Wagga substation. New stormwater would be integrated with the existing infrastructure.

Water quality impacts as a result of the operation of the proposal in all other locations would be negligible. As such operation of the proposal would not cause significant changes to the water quality environment against the identified water quality objectives.

16.5.4. Water supply and water resources

Water would be required during operation for maintenance activities and the operation of the Dinawan 330kV substations. This would require up to around 12,000 litres of water per year would be sourced from a local council or water supplier and rainwater tanks at the substation.

The long term impacts of this water use would be minor but potentially be affected during dry periods where water availability in the Murray River and rainwater tanks may be low, and competition for water resources from existing irrigation suppliers may be increased.

16.6. Management of impacts

16.6.1. Environmental management

16.6.1.1. Environment management plans

Environmental management for the proposal would be carried out in accordance with the approach as detailed in Chapter 24 (Environmental management). During construction of the proposal, a range of measures would be specified in the soil and water management sub-plan prepared as part of the CEMP. These measures are based on industry best practice to minimise potential impacts on watercourses.

The sub-plan will set out measures to mitigate and manage impacts on soil and water, including water quality and potential contaminated soils.

16.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to hydrology, flooding and water quality are listed in Table 16-4.

Table 16-4 Mitigation measures – hydrology, flooding and water quality mitigation measures

Reference	Mitigation measure	Timing	Applicable location(s)
HF1	Permanent operational infrastructure and landforms within the transmission line easement would be designed and implemented/formed to minimise any potential scour and erosion risks associated with surface water runoff.	Pre-construction and construction	All locations
HF2	Detailed construction planning would consider flood risk at construction areas. This would include: • identifying measures that would be implemented to not worsen flood impacts downstream and on other property and infrastructure during construction up to and including the five per cent AEP design flood event, and • confirming site layouts to avoid or minimise obstruction of overland flow paths and to limit the extent of flow diversion required. Practicable measures identified to minimise potential flood risks at construction areas would be implemented.	Pre-construction and construction	Transmission line and construction sites within flood prone land
HF3	A water quality monitoring program would be implemented to establish baseline water quality conditions at perennial watercourses that the transmission lines would cross, and to facilitate monitoring of any changes in water quality that may be attributable to the proposal during construction. The frequency, location and duration of sampling would be detailed in the monitoring program, but would include: • at a minimum two monitoring locations (one located upstream and one downstream of the transmission line crossing) of the proposal on Colombo Creek • downstream monitoring on the Murrumbidgee River with consideration of existing upstream WaterNSW gauges (including gauge 410130) • monitoring for total dissolved solids, total suspended solids, total nitrogen and total phosphorus. Sampling in the Murrumbidgee River and Colombo Creek would commence at least six months prior to the commencement of ground disturbing activities within the riparian zone at each respective location and then monthly during construction until completion of rehabilitation works in the respective areas.	Pre-construction and construction	Upstream and downstream of the crossing transmission line crossing for Murrumbidgee River, Colombo Creek, Irrigation channel near Dinawan 330kV substation site (between Coleambally Irrigation Area and Yanco Creek)

Reference	Mitigation measure	Timing	Applicable location(s)
	If there are exceedances of water quality criteria, then measures adopted as part of HF5 would be reviewed and revised. Monitoring would continue monthly during construction at each respective location until completion of rehabilitation works in the respective areas.		
HF4	Water supply options and management would occur in accordance with agreements between the construction contractor and relevant suppliers.	Construction	All locations
HF5	A Soil and Water CEMP sub-plan would be developed in consultation with a Certified Professional in Erosion and Sediment Control and implemented during construction. The plan would detail the processes, responsibilities and measures to manage potential soil and water quality impacts in accordance with the principles and requirements in: • *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom 2004), and *Volumes 2A and 2C* (DECCW, 2008), commonly referred to as the 'Blue Book' • *Best Practice Erosion and Sediment Control* (IESCA – 2008) • Transgrid's Environmental Guidance Notes • *Guidelines for Controlled Activities on Waterfront Land* (DPI, 2012a). The Soil and Water CEMP Sub-plan would contain appropriate measures (as a minimum) to: • minimise the extent of ground disturbance • divert surface water runoff around construction locations • install erosion controls within construction locations • collect and filter sediment from surface water runoff within construction locations • manage stockpiles to minimise erosion and sediment transport • manage saline and ASS (if present) • minimise the potential of soil and water quality impacts during storage of project wastes and potentially polluting substances • minimise the duration of soil exposure and progressively rehabilitate and stabilised disturbed areas • manage unexpected finds of contaminated materials • manage spills to reduce and address soil and water contamination.	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
HF6	Maintenance works in the vicinity of waterways would be conducted in accordance with Transgrid's Environmental Guidance Notes.	Operation	Transmission lines

16.6.3. Managing residual impacts or uncertainties

With the implementation of the mitigation measures detailed above, no significant residual impacts or uncertainties for hydrology, flooding and water quality are anticipated for the proposal.

17. Air quality

This chapter provides a summary of the assessment of potential air quality impacts of the proposal and identifies mitigation measures to address these impacts, as provided in the *Air quality impact assessment* (WSP, 2021d) (refer to Technical paper 9).

17.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to air quality and where these requirements are addressed in this EIS are outlined in Table 17-1.

Table 17-1 Secretary's environmental assessment requirements – air quality

Ref.	Secretary's environmental assessment requirements	Where addressed
Air quality		
Key issues	The EIS must address the following matters: • an assessment of the air quality impacts of the project.	Construction air quality impacts are addressed in Section 17.4. Operational air quality impacts are addressed in Section 17.5.

17.2. Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment.

17.2.1. Legislative and policy context

Air quality impacts resulting from the generation of dust and gaseous emissions were assessed for the construction and operation phases of the proposal in Technical paper 9 in line with the following:

- National Environment Protection Council (NEPC) established ambient air quality standards and goals in the *National Environment Protection (Ambient Air Quality) Measure* (NEPC, 2021)
- *Protection of the Environment Operation Act* 1997 (POEO Act). The POEO Act provides the legislative framework for the protection and enhancement of air quality in NSW. Its primary objectives are to reduce risks to harmless levels through pollution prevention, cleaner production, application of waste management hierarchy, continual environmental improvement and environmental monitoring
- (NSW) Environment Protection Authority (EPA) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016)
- Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction*.

17.2.2. Methodology

17.2.2.1. Construction

Air quality impacts for the construction phase of the proposal were assessed using two methods:

- a quantitative assessment for the proposed Dinawan 330kV substation site in accordance with the NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2016)
- a qualitative assessment for all other construction activities.

The construction assessment methods are described in the following sections.

Quantitative assessment

A quantitative air quality assessment is required for the proposed Dinawan 330kV substation site due to the proposed screening operations at the earthworks material site (refer to Chapter 6). This assessment would support an application for an Environment Protection Licence (EPL) for these construction activities under the POEO Act.

The dust emissions associated with the construction of the proposed Dinawan 330kV substation, earthworks material site, construction compound, accommodation camps and associated construction activities were assessed in accordance with Level 2 of the NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2016) (Approved Methods).

The Level 2 Approved Methods assessment is a refined dispersion modelling technique using site-specific meteorological data and requires at least one year of continuous ambient air monitoring data captured over the same period as the meteorological data. 2018 was selected as the modelling year for the assessment as it is considered to be representative of the long-term meteorological conditions at the proposed Dinawan 330kV substation site (noting that this was at the commencement of a period of drought). The assessment determined potential impacts for the following pollutants:

- total suspended particulates (TSP)
- dust deposition
- PM_{10}
- $PM_{2.5}$.

Table 17-2 outlines the background air quality criteria relevant to the quantitative assessment from the Air NEPM and the Approved Methods.

Table 17-2 Background air quality criteria

Pollutant	Averaging period	Air quality standard
Total suspended particles (TSP)	24 hours	90 µg/m^3
	Annual	No standard
PM_{10}	24 hours	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hours	25 µg/m^3
		20 µg/m^3
	Annual	8 µg/m^3
		7 µg/m^3

The quantitative air quality assessment adopted the following approach:

- generation of meteorological files using The Air Pollution Model (TAPM) (Version 4.0.5) and CALMET (Version 6.5.0)
- collection of ambient air monitoring data
- identifying the nearest sensitive receivers to the proposed Dinawan 330kV substation site
- a quantitative assessment of the potential dust impacts associated with the proposed Dinawan 330kV substation site using CALPUFF (Version 7.2.1) air dispersion modelling in accordance with the Approved Methods
- a quantitative assessment of emission estimates generated by construction activities at the Dinawan 330kV substation site using National Pollution Inventory (NPI) emission factors and the United State Environmental Protection Agency AP-42 (USEPA AP-42)
- consideration of cumulative impacts to potential regional air quality impacts combined with other projects
- identifying mitigation measures for the construction of the proposal.

Qualitative assessment

The qualitative air quality assessment undertaken for the construction phase adopted the following approach:

- a desktop review of the existing environment conditions including local topography, climate and existing ambient air quality
- an assessment of potential dust impacts by general construction work activities using the risk-based assessment in accordance with the *Guidance on the assessment of dust from demolition and construction* (IAQM). In accordance with the IAQM, the assessment considers sensitive receivers within 350 metres of the construction impact area and within 50 metres of the haulage route(s) used by construction vehicles on public roads up to 500 metres from the site entrances for the main construction compounds and accommodation camps
- an assessment of potential dust impacts generated by construction vehicles on haulage routes on public roads. This assessment considers sensitive receivers within 100 metres of sealed roads and 200 metres of unsealed roads
- an assessment of gaseous emissions generated from vehicles and fugitive sources
- an assessment of odour generated from wastewater treatment facilities

- consideration of cumulative impacts to potential regional air quality impacts combined with other projects
- identifying mitigation measures for the construction of the proposal.

The IAQM assessment approach is an evaluation of the risk of dust impacts during construction that considers the potential magnitude of dust emissions based on activity type (e.g. earthworks) and the sensitivity of the surrounding environment within proximity to the activity. This method results in a risk rating for each type of construction activity without mitigation. This risk rating is then used to determine what mitigation and management measures are required to effectively manage these risks. The NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2016) definitions for sensitive receivers were utilised for this proposal.

17.2.2.2. Operation

Gaseous emissions due to vehicle fuel combustion and wheel-generated dust on unsealed roads have the potential to be generated during routine inspection, maintenance or emergency. A qualitative assessment based on the likely frequency of these events were detailed in Technical paper 9.

Mitigation measures during the operation of the proposal have been provided.

17.3. Existing environment

17.3.1. Topography

The terrain across the proposal study area from Buronga to Balranald is relatively flat with elevations typically ranging from between around 53 metres and 70 metres. The terrain from Balranald gradually increases to around 315 metres at Wagga Wagga (refer to Chapter 20 for further detail).

17.3.2. Climate and meteorology

The Bureau of Meteorology (BoM) collects meteorological data at Automatic Weather Station (AWS) across Australia and can be used for determining climate statistics over a long period. Meteorological conditions are important for determining the direction and rate at which emissions from a source disperses.

Climate data was reviewed from the following AWS in proximity to the proposal study area:

- Mildura Airport AWS is located about 23 kilometres to the south-west of the closest section of the transmission line
- Balranald RSL AWS is located about 12 kilometres to the north-east of the closest section of transmission line
- Wagga Wagga Aerodrome Meteorological Observation (AMO) is located about 7.5 kilometres to the north-east of the closest section of the transmission line.

The climate statistics data recorded by BoM in proximity to the proposal study area are presented in Section 4.3 of Technical paper 9. The climate statistics indicate:

- Mildura Airport AWS experiences average temperatures ranging from 33.3 degrees Celsius in January to 4.4 degrees Celsius in July and an average rainfall of 273.5 millimetres
- Balranald RSL AWS experiences average temperatures ranging from 33.5 degrees Celsius in January to 3.8 degrees Celsius in July and an average rainfall of 327.7 millimetres
- Wagga Wagga AMO experiences average temperatures ranging from 33 degrees Celsius in January to 3.1 degrees Celsius in July and an average rainfall of 558.3 millimetres.

Detailed wind condition data was only available from the Mildura Airport AWS, Hay Airport AWS and Wagga Wagga Aerodrome AMO within the proposal study area. The wind roses presented in Figure 4-1 to Figure 4-3 of Technical paper 9 present the frequency, seasonal and annual strength and direction of wind over the past five years at the stations respectively. The wind roses indicate:

- the typical winds at Mildura Airport AWS are most frequently from a southerly direction and moderately from the west and north north-east with a calm wind frequency of 2.71 per cent
- the typical winds at Hay Airport AWS are most frequently from a south-westerly direction with a calm wind frequency of 2.7 per cent
- the typical winds at Wagga Wagga Aerodrome AMO are most frequently easterly with a calm wind frequency of 5.9 per cent.

17.3.3. Ambient air quality

17.3.3.1. Existing emission sources

The proposal study area consists of predominantly rural land uses with few industrial facilities or residences. The main existing emissions are wind-blown dust from exposed land, agricultural activities and from vehicular traffic using the local road network. Wagga Wagga is a city at the eastern extent of the proposal and the air quality is influenced is influenced by industrial emissions, higher levels of traffic emissions and other diffuse sources.

A National Pollutant Inventory (NPI) database review was conducted to identify existing emission sources in the vicinity of the proposal study area. Forty-five industrial facilities located in the LGAs in which the proposal study area is located reported their emissions to the NPI for the 2019/2020 reporting period. Industrial facilities included (but are not limited to) gas supply, meat processing, fossil fuel manufacturing and waste oil refining. Emissions were also reported to the NPI for the 2019/2020 period from a range of diffuse sources, including (but not limited to) fuel combustion, windblown dust and rail freight transport.

17.3.3.2. Background air quality

The NSW Government monitors air quality across NSW. There are three ambient air quality monitoring stations (AAQMS) which monitor particulate matter (dust) in proximity to the proposal study area, including:

- Buronga AAQMS, located about eight kilometres to the west of the proposal
- Hay AAQMS, located about 30 kilometres north of the proposal
- Wagga Wagga North AAQMS, located about 9.5 kilometres north of the proposal.

The data collected from Buronga AAQMS and Hay AAQMS included total suspended particles (TSP), PM_{10} and $PM_{2.5}$ and is considered indicative of particulate matter concentrations in a rural area. The results from Buronga AAQMS and Hay AAQMS suggest that over five years there were no exceedances of the annual TSP criterion, one exceedances of the annual PM_{10} and $PM_{2.5}$ criteria, and multiple exceedances of the maximum 24 hour criteria for PM_{10} and $PM_{2.5}$ for all years monitored.

The data collected from Wagga Wagga North AAQMS included PM_{10} and $PM_{2.5}$ and is broadly representative of a regional urban setting. The results from Wagga Wagga North AAQMS suggest that both annual average $PM_{2.5}$ concentrations and maximum 24 hour averages exceeded the Air NEPM standards for all years monitored.

The exceedances recorded at the AAQMS could be due to a range of events including dust storms, bushfire smoke, fog or other dust events in the region.

17.3.4. Sensitive receivers

A sensitive receiver for the purposes of this assessment is a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area, and considers the location of any known or likely future sensitive receiver.

Sensitive receivers located within the distances from the proposal outlined in Section 17.2.2 are shown in Figure 17-1. The closest receiver to the proposal is located about 50 metres from the transmission lines at Cullivel. However, most identified sensitive receivers are located more than 100 metres from the proposal.

No sensitive receivers were identified within 350 metres of the proposed Balranald construction compound and accommodation camp site, Cobb Highway construction compound and accommodation camp sites and the Lockhart construction compound and accommodation camp (Albury Road option).

The nearest sensitive receiver to the proposed Dinawan 330kV substation site is located about 4.5 kilometres from the site.

There are a substantial number of sensitive receivers within 100 metres of sealed roads and 200 metres of unsealed roads across the full proposal length and the identified haulage routes. The number and density of receivers within these distances increases closer to towns. These areas with higher numbers of receivers are generally located on sealed roads (refer Appendix C of Technical paper 9).

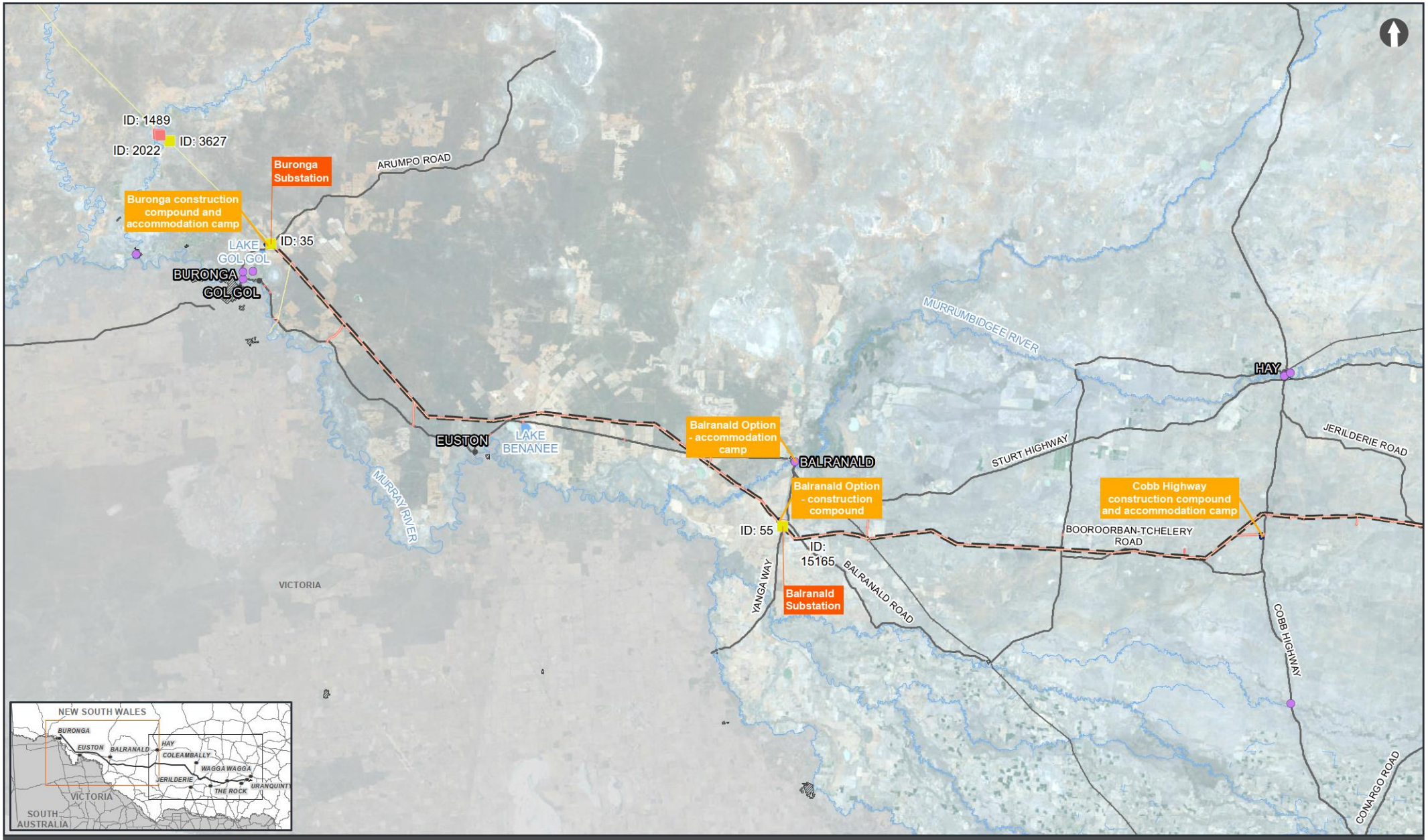

Figure 17-1

Sensitive Receptors

Project Components

- Construction Impact Area
- Water Fill Point
- Within 350m of the Proposal Alignment
- Within 350m of Main Construction Compounds and Accomodation Sites
- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Built Up Areas
- Waterbody

Sensitive Receptors

- Residential dwelling (2)
- Utility facility (3)

Sheet 1 of 2

Source: NSWSS, ESRI, Transgrid, WSP

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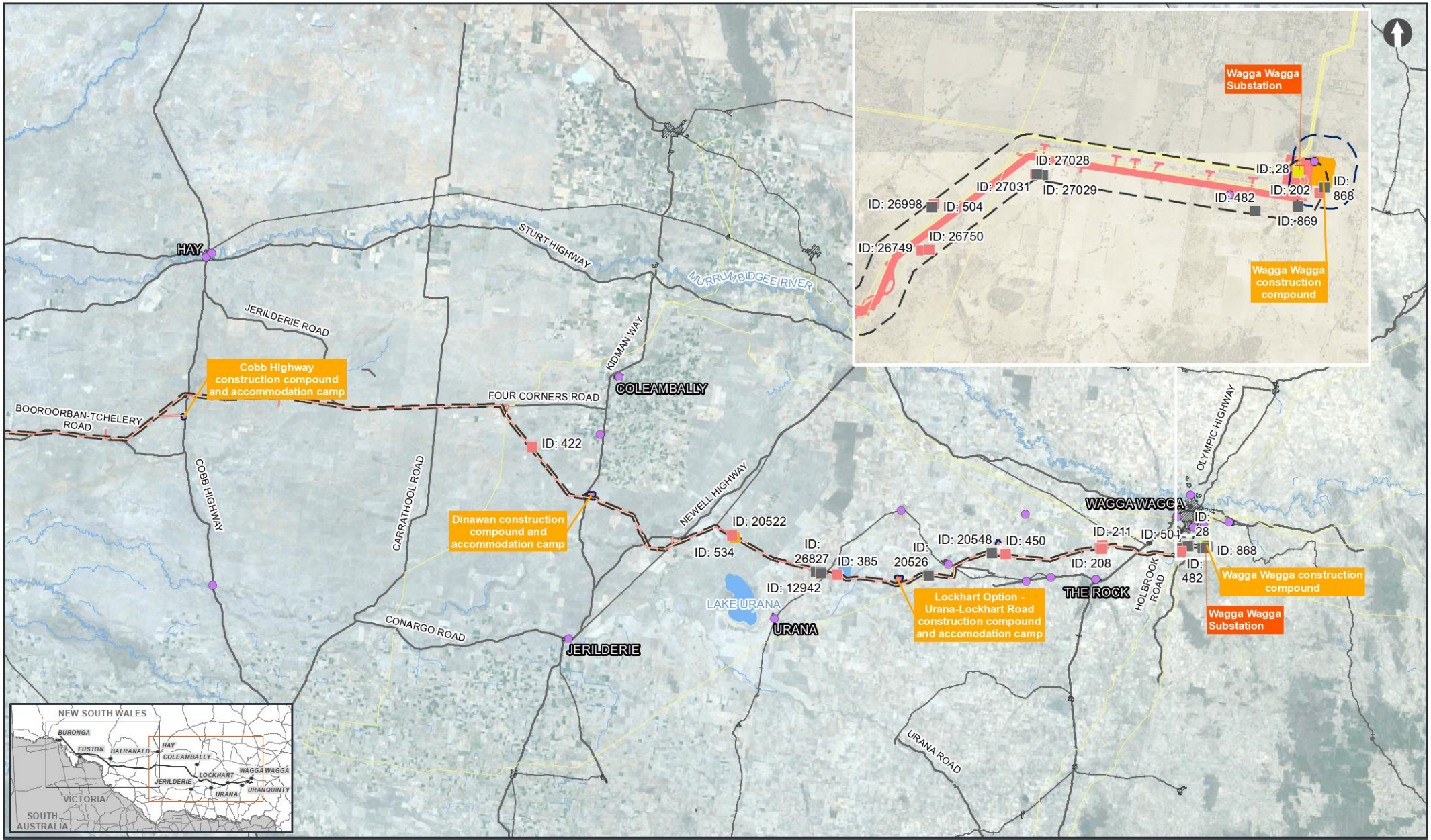

Project Components
- Construction Impact Area
- Water Fill Point
- Within 350m of the Proposal Alignment
- Within 350m of Main Construction Compounds and Accomodation Sites

- Existing Substation
- Existing Transmission Line Infrastructure
- Existing Railway
- Built Up Areas
- Waterbody

Sensitive Receptors
- Community facility (1)
- Industry facility (13)
- Residential dwelling (13)
- Utility facility (1)

Figure 17-1
Sensitive Receptors

Sheet 2 of 2

Source: NSWSS, ESRI, Transgrid, WSP

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17.4. Potential impacts – construction

17.4.1. Overview

Construction of the proposal would broadly involve the following key activities that would impact air quality without mitigation:

- earthworks
- main construction works
- construction compounds and accommodation camp construction and operations
- access track construction and usage
- movement of heavy vehicles on haulage routes.

These key activities may result in:

- dust emissions from earthworks and egress
- gaseous emissions including:
  - combustion and pollutant emissions from construction vehicles and plant exhaust
  - fugitive emissions from construction compounds
- odour from wastewater treatment plants.

The construction methodology including the plant and equipment (as presented in Chapter 6) is indicative and would be confirmed during construction methodology refinement.

17.4.2. Dust

Dust impacts depend on the quantity and drift potential of the particles in the atmosphere. Larger particles (the larger particle fractions of total suspended particulates (TSP)) settle out closer to the source due to their larger mass. The deposition of the particles can cause nuisance and aesthetic impacts on the receiving environment. Finer particles (PM_{10} and $PM_{2.5}$) remain entrained longer and therefore dispersed at greater distances from the source. The fine nature of these particles also has the potential for human health impacts if not adequately controlled.

While dust generation would typically be localised during the majority of the construction activities, the following activities have the potential to generate dust:

- vegetation clearing and grubbing
- installation of new temporary and permanent construction tracks
- earthworks such as creation of substation footings or excavation for tower structures
- civil works at the proposed Dinawan 330kV substation and Wagga substation sites
- dirt, mud or other materials tracked onto a sealed public roadway by a vehicle leaving a construction site (generally referred to as egress)
- potential dust emission sources at the main construction compound and accommodation camp sites including:
  - the operation of concrete batching plant(s)
  - vehicle movements on unsealed roads/surfaces
  - wind erosion from stockpiles and exposed areas
  - materials drop off, loading and handling at the laydown area
  - screening operations

- plant, equipment and activities likely to generate dust include:
  - use of earth working plant including excavators, bulldozers and front-end loaders
  - heavy vehicles dumping soil and aggregate
  - scraper/graders
  - wheel generated dust from vehicle movements on unsealed surfaces.

17.4.2.1. Predicted impact from dust emissions

Using the modelling and risk based assessment methods described in Section 17.2.2, the potential dust emission magnitude for earthworks, construction works and egress activities were evaluated.

For the proposed Dinawan 330kV substation site, the outcomes of the air dispersion modelling assessment indicated the level of risk to dust impacts as low to negligible at all sensitive receiver locations for TSP, PM_{10} and $PM_{2.5}$, with pollutant concentrations generally below the criteria outlined in Table 17-2. Five sensitive receivers were identified as potentially being dust affected, with cumulative 24 hour PM_{10} concentrations exceeding the assessment criterion on one additional day due to the proposal. Cumulative annual average PM_{10} and $PM_{2.5}$ concentrations were exceeded for all sensitive receivers, noting that this is due to the existing background concentration already being above the criterion before the contribution from the proposal is added.

For all other proposal components the outcomes of the risk assessment indicated the level of risk to dust impacts as low to negligible (refer Section 5.3 of Technical paper 9).

Construction vehicles travelling on haulage routes have the potential to generate dust that may have an amenity impact on nearby sensitive receivers. The size of the impact would be dependent on a range of factors including the type and condition of the road (i.e. sealed or unsealed), vehicle speed and prevailing meteorological conditions.

Dust generated from construction vehicles on unsealed roads on the haulage routes has the potential to be high particularly under certain conditions (dry surface roads and high winds). However, the impacts would be intermittent, of short duration and would likely only impact a small number of receivers at any given time.

Overall, dust impacts from the proposal would be temporary and of relatively short duration, and would be able to be adequately managed through the implementation of the mitigation measures identified in Section 17.6.2.

17.4.3. Gaseous emissions

Gaseous emissions such as Carbon Monoxide (CO), oxides of Nitrogen (NO_x), Sulphur Dioxide (SO_2), Volatile Organic Compounds (VOCs) and Polycyclic Aromatic Hydrocarbons (PAHs) would be generated from vehicles and fugitive sources during the construction phase.

17.4.3.1. Vehicle emissions

Diesel fuel combustion from vehicle movements and on-site plant and machinery operation would generate CO, NO_x, SO_2 and trace amounts of non-combustible hydrocarbons (i.e. VOCs and PAHs). The emission rates and potential impact on surrounding areas would depend on the number and power output of the combustion engines, the quality of fuel used, the condition of the engines and the intensity of use.

During construction, equipment and material would be transported to each tower site along the alignment, the proposed Dinawan 330kV substation site, the Wagga Wagga substation, or the main construction compound and camp sites.

Fuel combustion emissions from plant and equipment along the transmission line easement would be intermittent and transient. Given the anticipated duration of works at any given location, the likely numbers of emission sources, and scheduling of activities (i.e. not all machinery would be operating in the same location simultaneously), gaseous emissions are not anticipated to substantially influence local air quality.

17.4.3.2. Fugitive emissions

Petroleum, diesel, liquefied natural gas and mineral petroleum based oils stored in the storage and laydown areas at the main construction compound and camp sites have the potential to generate fugitive emissions. These emissions are expected to be minor and readily dispersed within the sites. With appropriate handling and storage, air quality impacts from these fugitive sources would be negligible.

Emissions would be able to be adequately managed through the implementation of the mitigation measures identified in Section 17.6.2.

17.4.4. Odour

The proposed accommodation camp wastewater treatment plants are anticipated to consist of a generally contained system that would include biological and chemical treatment, filtration and disinfection. In an event that inorganic materials accumulate on the screens, waste bins are not emptied regularly or not properly closed, or waste sludge is not appropriately stored before off-site removal to a licensed facility, odour emissions may potentially impact on the receiving environment.

In general, there is low potential for odour generation at the wastewater facilities, given the relatively small scale of the treatment plants with no large open sources. If odour emissions do occur, they are likely to be infrequent, of short duration and of low intensity. Off-site receivers are not expected to be adversely impacted by odour emissions given the approximate distance of the wastewater treatment plants.

Potential odour emissions would be able to be adequately managed through the implementation of the mitigation measures identified in Section 17.6.2.

17.5. Potential impacts – operation

During normal operations, no air emissions would be generated from the operation of transmission lines or the proposed Dinawan 330kV substation (or existing substations at Wagga Wagga).

It is noted that sulphur hexafluoride (SF_6) is a gas used as an insulating medium in the switchgear to be located at the existing Wagga Wagga and proposed Dinawan 330kV substations. SF_6 is pressurised and contained within the equipment, so under normal operating conditions there would be no emission of the gas expected. There is expected to be negligible venting of the gas during the filling process, as well as in abnormal operating conditions should a leak develop in the equipment. The equipment would be monitored in real-time for leaks so that a maintenance crew can identify and repair the source of the leak. In outdoor and well ventilated spaces, SF_6 presents no immediate health risk to the community or the environment. However, SF_6 is considered a significant potential greenhouse gas and all reasonable steps would be taken in the construction, operation and decommissioning of the equipment to minimise the stray venting of SF_6 gas to the atmosphere – ensuring an overall minimal impact.

During routine inspection, maintenance or emergency works, light vehicles or light aircraft would be used to transport personnel to sections along the transmission line easement. This would generate emissions as a result of fuel combustion and dust generation from light vehicles travelling on unsealed roads. The routine inspections, maintenance and emergency works would be infrequent, and the number of vehicles required during these events would be small. Therefore, the gaseous and dust emissions during operation would be negligible, and the impacts on surrounding areas would not be of significance.

17.6. Management of impacts

17.6.1. Environmental management

Environmental management for the proposal would be carried out in accordance with the approach as detailed in Chapter 24 (Environmental management).

Impacts to air quality are primarily expected during construction of the proposal. Standard mitigation measures would manage impacts to acceptable levels, which would be detailed in an air quality management sub-plan (AQMP), which would stipulate processes and procedures for dust and gaseous emission management, monitoring, reporting and communications, including:

- measures to minimise the potential for dust emissions, including dust suppression
- air quality monitoring requirements and compliance management. This includes monitoring of meteorological conditions in order to implement appropriate responses to changing weather conditions, and regular visual inspections.

17.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to air quality are listed in Table 17-3.

Table 17-3 Mitigation measures – Air quality

Reference	Mitigation measure	Timing	Applicable location(s)
AQ1	To minimise particulate and gaseous emissions during construction, the following measures (as a minimum) would be implemented where practicable and appropriate: • use of water sprays or surfactants as required for dust suppression • adjust the intensity of dust generating activities based on observed dust levels and weather forecasts • protect stockpiled materials from wind erosion to minimise dust generation and position stockpiles as far as practicable away from any nearby receptors • limit vehicle movements to designated entry/exit routes and parking areas • implement measures to minimise the tracking of dust generating material onto paved roads	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
	• inspect and clean paved roads in the vicinity of site access points as required to minimise dust generation (up to 100 metres either side of the access point) • cover the loads of potential dust producing materials • minimise the extent of ground disturbance as far as practicable • stabilise disturbed areas as soon as practicable. The effectiveness of the installed controls would be monitored, and additional controls implemented as required to address any performance issues identified.		
AQ2	Ensure that all vehicles and machinery are fitted with appropriate emission control equipment and maintained in a proper and efficient manner in line with guidelines contained in the National Environment Protection (Diesel Vehicle Emissions) Measure 2009.	Construction	All locations
AQ3	To minimise emissions from concrete batching plants, the following measures (as a minimum) would be considered and implemented where practicable and appropriate: • store all aggregate and sand in appropriate storage bins or bays to minimise dust generation, and ensure that the material does not exceed the height of the bay • fit cement silos and hoppers with dust filters and emergency pressure alert and automatic cut off overfill protection • fully seal all inspection points and hatches • ensure that all transfer methods adopted address and minimise potential dust generation • transfer of cement from storage to batching using sealed steel augers. The effectiveness of the installed controls would be monitored and additional controls implemented as required to address any performance issues identified.	Construction	Concrete batching plant(s)

Reference	Mitigation measure	Timing	Applicable location(s)
AQ4	To minimise dust emissions during screening activities, the following measures (as a minimum) would be considered and implemented where practicable and appropriate: • ensure screen covers are fitted to the screening equipment • control dust emissions from screening activities using water sprinklers, where required and appropriate • inspect the water sprinklers on a regular basis and maintain as required to ensure operational efficiency • where practicable, install wind breaks in appropriate locations adjacent to the dust generating equipment and processes • prior to screening, dampen the rocks during dry weather conditions. The effectiveness of the installed controls would be visually monitored and additional controls implemented as required to address any performance issues identified.	Construction	Dinawan 330kV substation earthworks material site
AQ5	To minimise potential odour emissions and impacts from the wastewater treatment plants, the following measures would be considered and implemented where practicable and appropriate: • prevent excessive inorganic material accumulating on the screens by disposing of screened material in waste bins on a regular basis • place waste bins containing screened material and sludge as far away as practicable from the construction compound and accommodation sites • ensure waste bins are fully closed at all times • remove screened material and sludge from site at regular intervals and dispose in an appropriate manner. The effectiveness of the installed controls would be monitored and additional controls implemented as required to address any performance issues identified.	Construction	Cobb Highway, Dinawan and Lockhart construction compound and accommodation sites

Reference	Mitigation measure	Timing	Applicable location(s)
AQ6	During atmospheric conditions that are conducive to dust generation, dust generation from project-related traffic movements on unsealed roads and access tracks (routes) in close proximity to sensitive receivers would be visually monitored. Where dust from project-related traffic movements is impacting or has the potential to impact the sensitive receivers, measures to minimise dust emissions and potential associated amenity impacts would be implemented. The following measures would be implemented where practicable and appropriate: • lower the speed of project-related traffic along the routes • apply dust suppression (for example using water carts or the application soil binders) on appropriate sections of the route in the vicinity of potentially affected sensitive receivers. The effectiveness of the implemented controls would be visually monitored and additional controls identified and implemented as required and where practicable such as. • minimise the volume of project-related traffic using the routes • use alternative routes. The measures would remain implemented until more suitable atmospheric conditions prevail or the controls are no longer required to minimise potential dust impacts.	Construction	All locations

17.6.3. Managing residual impacts or uncertainties

The risks of dust impacts from construction at the proposed Dinawan 330kV substation site would be minimised with mitigation measures in place. However, predicted 24-hour PM10 concentration levels indicated one additional exceedance due to the proposal over the modelled year. Further management measures would be required, especially during periods of high winds (greater than five metres per second) and dry soil conditions.

The risks of dust impacts from all other construction activities, including from traffic on haulage routes, are negligible or low prior to mitigation. With further specific mitigation measures in place, the residual dust impacts would not be of significance.

Gaseous emissions generated from vehicles and fugitive sources during construction would be minimised with mitigation measures in place and air quality impacts would not be of significance.

Odour emissions from the on-site wastewater treatment plants would be low. The systems would be contained and managed to ensure odour generated is minimised.

18. Noise and vibration

This chapter provides an assessment of potential noise and vibration impacts of the proposal and identifies mitigation measures to address these impacts. It summarises the *Noise and Vibration Impact Assessment* (WSP, 2021e) (refer Technical paper 10).

18.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to noise and vibration and where these requirements are addressed in this EIS are outlined in Table 18-1.

Table 18-1 Secretary's environmental assessment requirements – noise and vibration

Ref.	Secretary's environmental assessment requirements	Where addressed
Amenity		
Key issues	The EIS must address the following matters: • an assessment of the construction, operational and road noise and vibration impacts of the project.	Construction noise and vibration is addressed in Section 18.4. Operational noise is addressed in Section 18.5.

18.2. Assessment approach

18.2.1. Legislative and policy context

Potential noise and vibration impacts resulting from construction of the proposal were assessed in line with the following legislation and key strategic and policy guidelines:

- *Interim Construction Noise Guideline* (ICNG) (DECCW, 2009), which contains procedures for determining proposal specific Noise Management Levels (NMLs) that are based on the existing background noise surrounding the proposal. Sensitive receivers are considered likely to be affected by construction noise where a relevant NML is predicted to be exceeded. The NMLs adopted for the noise assessment of the proposal are used as the criteria (see Section 18.2.3)
- *Australian Standard (AS) 1055: Description and measurement of environmental noise*, which has been used to characterise the existing acoustic environment surrounding the proposal
- *ISO 8297 – Determination of Sound Power Levels of Multisource Industrial Plants for Evaluation of Sound Pressure Levels in the Environment (Engineering Method)*, which has been used to determine the sound levels of construction plant and equipment required for the proposal
- *NSW Road Noise Policy* (RNP) (DECCW, 2011), which provides a method for assessing construction traffic impacts on public roads and has been used in the construction traffic noise assessment (see Section 18.2.3)
- *Assessing Vibration: A Technical Guideline* (AVTG) (DEC, 2006), which is used to assess human comfort vibration impacts on sensitive receivers and has been used in the construction vibration assessment (see Section 18.2.3)
- *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2* (BS7385) (BSI, 1993), which has been used to assess vibration impacts (structural damage) on non-heritage sensitive structures (see Section 18.2.3)

- *AS 2187.2-2006 Explosives – Storage, Transport and Use provides guidance for the assessment of cosmetic damage to buildings caused by vibration*, which has been used to assess vibration impacts (cosmetic damage) on non-heritage sensitive structures (see Section 18.2.3)
- *DIN 4150-3 Structural vibration Part 3: Effects of vibration on structures* (DIN 4150-3:1999-02), which has been used to assess vibration impacts on heritage sensitive structures (see Section 18.2.3)
- Technical Basis for Guidelines to Minimise Annoyance Due to Blast Overpressure and Ground Vibration (ANZECC, 1990)
- AS 2187.2 Explosives – Storage, Transport and use Part 2: Use of Explosives (AS 2187.2).

Potential noise and vibration impacts resulting from operation of the proposal were assessed in accordance with the following key strategic and policy guidelines:

- *Noise Policy for Industry* (NPfI) (EPA, 2017), which provides a framework and criteria for the consistent assessment of the impact and control of noise from industrial developments. It includes a method for assessing sleep disturbance and maximum noise level for industrial noise sources, which has been used in the selection of NMLs and criteria for the operational noise assessment (see Section 18.2.4)
- *NSW Road Noise Policy* (RNP) (DECCW, 2011), which provides a method for assessing traffic impacts on public roads, which has been used in the operational traffic noise assessment (see Section 18.2.4).

18.2.2. Methodology

The methodology adopted for the noise and vibration assessment included:

- identifying potential sensitive receivers within and surrounding the proposal study area (see Section 18.3.2)
- identifying existing noise levels in the area by undertaking noise monitoring and measurements, including:
  - long term (unattended) noise monitoring between 18 October and 4 November 2020
  - short term (attended) noise monitoring on 19 and 20 October 2020
  - measuring temperature and humidity to identify the likelihood of weather conditions that may influence noise levels experienced
- establishing noise and vibration criteria to provide a basis for assessing the potential for impacts (refer to Sections 18.2.3 and 18.2.4)
- assessing the construction noise and vibration impacts of the proposal based on several representative construction scenarios (see Section 18.2.3) and conservative assumptions to provide flexibility, including that:
  - construction activities associated with the transmission line could be located anywhere within the transmission line corridor of the construction impact area
  - all construction equipment could be operational at the same time
  - blasting at tower footings has been assumed to occur in certain areas with the final locations to be determined following further geotechnical investigations. The assessment has also calculated the Maximum Instantaneous Charge (MIC) to allow compliance with the blasting criteria outlined in Section 18.2.3
- assessing the operational noise and vibration of the proposal. This included:
  - a model of the proposed Dinawan 330kV substation using SoundPLAN 8.2 modelling software
  - assessing the proposed transmission lines based on audible noise risk scenarios based on the transmission line alignment
  - assessing the potential cumulative impacts in accordance with the NPfI

- assessing the road traffic noise impacts of the proposal based on estimations of traffic volumes and haulage routes of the proposal during construction and operation, and assessment of increases with existing and predicted future traffic volumes. In the assessment for construction traffic noise, potential impacts are categorised into low, medium or high risks to account for the intended duration of impact and the increase in road noise (refer to 18.2.2 for further discussion). An increase of 10 dB has been applied in this categorisation, which is generally perceived to be a doubling in the noise level
- identifying mitigation and management measures to minimise potential impacts.

A detailed description of the assessment methodology is provided in Chapter 3 of Technical paper 10.

18.2.3. Construction noise and vibration assessment approach

18.2.3.1. Construction noise impact assessment scenarios

Several representative scenarios have been developed based on an indicative construction methodology to assess the likely airborne noise impacts from the various construction stages of the proposal.

The quantities and types of plant and equipment that have been assumed to be operating during each scenario is outlined in Appendix B-1 in Technical paper 10.

In general, the transmission line construction scenarios are progressive (would move along the alignment and would not impact the same receivers for the duration of the scenario). The proposed Dinawan 330kV substation, main construction compounds and accommodation camps would be in fixed locations and may impact the same receivers for the duration of the scenario. These scenarios represent the 'worst-case', as it is assumed that several items of construction equipment would be in use at the same time at the closest point to each receiver. In reality, it is anticipated that the worst-case noise levels would only last for short periods of time during the construction duration, and there would be periods when no (or limited) noisy construction activities occur.

For the assessment of construction traffic noise impacts, the increase in traffic noise has been estimated at sensitive receivers located within 350 metres of each haulage route. The traffic volumes (with and without proposal) are provided in Technical paper 11.

18.2.3.2. Construction hours

Construction of the proposal would generally be carried out between 7 am and 7 pm Monday to Sunday (referred to as the base construction hours). Standard construction hours are defined by the ICNG as Monday to Friday between 7 am and 6 pm, and Saturday between 8 am and 1 pm, with no work on Sundays or public holidays. As such, construction scenarios have been assessed for potential noise impacts within and outside standard working hours.

As outlined in Section 6.10.2, works would be carried out within standard construction hours where sensitive receivers are noise affected by construction works (that is, where construction noise is above the NMLs) or conducted outside of these hours where such works are required/justifiable in accordance with the ICNG (DECCW, 2009).

Accommodation camp facilities would be operational 24 hours a day, Monday to Sunday.

A range of additional activities may be required outside of the base construction hours (refer to Section 6.10.2). An out of hours work protocol would be developed to ensure that construction works that are predicted to exceed the NMLs at sensitive receivers are adequately managed. The out of hours work protocol is discussed in Section 18.6.

18.2.3.3. Construction noise management levels

Table 18-2 outlines the construction NMLs applicable to residential receivers. These levels developed for the proposal using the existing background noise levels in accordance with the ICNG. In addition, residential receivers are considered highly noise affected and may have a strong reaction to noise if the noise levels experienced at the receiver are above 75 $L_{eq\ 15\ min}$ dBA.

Table 18-2 NMLs for residential receivers

Noise Management levels (NML), L_{eq} 15 min dBA			
Standard construction working hours [1]	**Out of hours work (OOHW) periods [2]**		
Day	**Day**	**Evening**	**Night**
45	40	35	35

1. Standard construction hours are defined as Monday – Friday: 7 am – 6 pm, Saturday: 8 am – 1 pm with no work on Sundays or public holidays
2. Out of hours work time periods are defined as:

   Day: 7 am to 8 am Saturday, 1 pm to 6 pm Saturday and 8 am to 6 pm on Sunday and public holidays
   Evening: 6 pm to 10 pm Monday to Sunday
   Night: 10 pm to 7 am Monday to Saturday, 10 pm to 8 am Sunday

The NMLs adopted for non-residential receiver types within and surrounding the proposal study area are as follows:

- Educational facilities – 45 $L_{eq\ 15\ min}$ dBA (for internal noise levels)
- Industrial facilities – 75 $L_{eq\ 15\ min}$ dBA (for external noise levels)
- Places of worship – 45 $L_{eq\ 15\ min}$ dBA (for internal noise levels)
- Passive recreational areas – 60 $L_{eq\ 15\ min}$ dBA (for external noise levels)
- Active recreational areas – 65 $L_{eq\ 15\ min}$ dBA (for external noise levels).

NMLs are not mandatory limits. However, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable mitigation measures to minimise noise emissions are to be investigated and applied.

18.2.3.4. Construction vibration criteria

Table 18-3 outlines the minimum working distances for typical items of vibration intensive equipment to minimise potential for vibration related impacts.

Where vibration intensive equipment such as vibratory rollers, hydraulic hammers, bored piling rigs or jackhammers are used at a greater distance from sensitive receivers than the specified minimum working distance, there is negligible risk of structural damage or impacts on human comfort. Where recommended minimum working distances are not met, more detailed consideration of potential vibration impacts and the construction approach would occur during detailed design.

Table 18-3 Minimum working distances for vibration intensive plant

Equipment	Rating/ description	Minimum working distance (m)		
		Human response (DEC, 2006)	Cosmetic damage to non-heritage structures (BSI, 1993)	Damage to heritage structures (DIN 4150-3:1999-02)
Vibratory roller	<100 kN (typically 2-4t)	20	6	16
	>300 kN (typically 13-18t)	100	20	54
Small hydraulic hammer	300 kg – 5 to 12t excavator	7	2	5
Medium hydraulic hammer	900 kg – 12 to 18t excavator	23	7	15
Large hydraulic hammer	1600 kg – 18 to 34t excavator	73	22	44
Pile boring	≤800 mm	n/a	2	5
Piling rig – hammer	12t down force	50	15	115

18.2.3.5. Construction blasting

Table 18-4 outlines the maximum levels and blast overpressure and ground vibration criteria to maintain the amenity of residential receivers from *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) and *AS 2187.2 Explosives – Storage, Transport and use Part 2: Use of Explosives.*

The guidelines also provide a long-term goal of two millimetres per second for peak particle vibration velocity.

The criteria for amenity is more conservative than that required for the protection of structures, however for structures which may be particularly susceptible to ground vibration, AS 2187.2 1893 recommends a criterion of five millimetres per second peak particle velocity.

Where blasting is to occur in the vicinity of heritage structures, relevant ground vibration criteria would be adopted based on German Standard DIN 4150-3 for vibration (refer to the discussion on construction vibration criteria above).

Table 18-4 Vibration and air blast criteria (ANZECC, 1990)

Measure	Unit	Criterion for 95% of blasts	Criteria for 100% of blasts
Vibration	mm/s PPV[1]	5	10
Air blast (peak)	dBL	115	120

1. Millimetres per second peak particle velocity

18.2.3.6. Construction traffic noise criteria

The potential impacts from construction traffic when travelling on public roads are assessed under the RNP. An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2 dB due to construction traffic. Where this is considered likely, further assessment is required using the relevant road traffic noise criteria in Table 18-5, and mitigation options should be investigated.

Table 18-5 Road traffic noise criteria for receivers on existing roads affected by the additional traffic from land use developments (DECCW, 2011)

Road type	External road traffic noise criteria[1]	
	Day 7 am – 10 pm	Night 10 pm – 7 am
Freeway/arterial/sub-arterial roads	60 dB $L_{Aeq\ 15hr}$	55 dB $L_{Aeq\ 9hr}$
Local roads	55 dB $L_{Aeq\ 1hr}$	50 dB $L_{Aeq\ 1hr}$

1. Façade corrected noise levels.

18.2.4. Operational noise assessment approach

18.2.4.1. Project noise trigger levels

Table 18-6 outlines the project noise trigger levels (PNTLs) determined for the proposal in accordance with the NPfI, taking into account the project intrusiveness and project amenity noise levels (refer to Section 6.1.3 of Technical paper 10 for more information).

Table 18-6 Summary of Project Noise Trigger Levels for the proposal (EPA, 2017)

Receiver location	Assessment/ receiver type	Project noise trigger levels dBA $L_{eq,15\ min}$		
		Day[1]	Evening[1]	Night[1]
All residences	Intrusiveness	40	35	35
	Amenity	48	43	38
	PNTL – Residential	40	35	35

1. Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and public holidays; Evening: the period from 6 pm to 10 pm; Night: the remaining periods.

18.2.4.2. Operational traffic noise

As per construction traffic noise, the potential impacts from traffic associated with operation of the proposal are assessed under the RNP. An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2 dB due to proposal-generated traffic. Where this is considered likely, further assessment is required using the following relevant road traffic noise criteria in Table 18-7, and mitigation options should be investigated.

Table 18-7 Road traffic noise criteria for receivers on existing roads affected by the additional traffic from land use developments (DECCW, 2011)

Road type	External road traffic noise criteria[1]	
	Day 7 am – 10 pm	Night 10 pm – 7 am
Freeway/arterial/sub-arterial roads	60 dB $L_{Aeq\ 15hr}$	55 dB $L_{Aeq\ 9hr}$
Local roads	55 dB $L_{Aeq\ 1hr}$	50 dB $L_{Aeq\ 1hr}$

1. Façade corrected noise levels

18.3. Existing environment

18.3.1. Existing noise levels

Existing noise levels within and surrounding the proposal study area are predominantly influenced by the surrounding agricultural and rural residential land uses as well as local traffic. Wagga Wagga is a rural township at the eastern extent of the proposal, in which noise levels are influenced by industrial, commercial and urban residential land uses and higher levels of local traffic.

Table 18-8 provides the noise levels that were measured during the unattended noise monitoring between 18 October and 4 November 2020 at 211 Liddles Lane, Jerilderie (referred to as noise monitoring location NM1) and 83 Ashfords Road, Wagga Wagga (referred to as NM2). The noise monitoring locations were selected as they were considered to be representative of the existing background noise levels that would be experienced across the proposal study area.

Table 18-8 Unattended noise measurement results at NM1

Noise monitoring locations	Measured Noise Level (dBA)					
	Rating background level (RBL) dBA			Ambient noise level $L_{eq,15,min}$		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
211 Liddles Lane, Jerilderie (NM1)	32	30	27	52	51	48
83 Ashfords Road, Wagga Wagga (NM2)	31	29	26	46	43	38

1. Time periods defined as – Day: 7 am to 6 pm Monday to Saturday, 8 am to 6 pm Sunday; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am Monday to Saturday, 10 pm to 8 am Sunday
2. Where background levels are below the minimum assumed RBLs outlined in the NPfI, they have been adjusted to 35 dBA during the day period, and 30 dBA during the evening and night periods in accordance with the NPfI

During the attended noise monitoring near the proposal study area, the main noise sources observed included birds, insects, motor vehicles, agricultural equipment and the existing Wagga Wagga substation, which is typical of rural and natural sounds and is expected to be generally consistent across the proposal study area. The noise levels observed were generally consistent with the findings of the unattended noise monitoring. Further information on the monitoring results is available in Section 4.3 of Technical paper 10.

18.3.2. Sensitive receivers

Locations that may be occupied by people and are potentially sensitive to noise and vibration are referred to as sensitive receivers. There are about 6,000 sensitive receivers that have been identified within the following areas:

- five kilometres of the transmission lines
- three kilometres of construction compounds and accommodation camps
- eight kilometres of the proposed Dinawan 330kV substation.

The locations of the sensitive receivers, showing the potential level of impact for each of the construction impacts (transmission line construction, substation construction etc) are shown in Appendix B and Appendix C of Technical paper 10.

All heritage structures identified within the proposal study area have also been considered as potential vibration sensitive receivers as vibration can affect sensitive structures or buildings. Other heritage items, such as isolated artefacts and trees are not considered to be vibration sensitive.

18.4. Potential impacts – construction

18.4.1. Construction noise

18.4.1.1. Transmission line construction works

Exceedances of NMLs at sensitive receivers would depend on the work stage, with access and clearing, earthworks and civil construction works, installation of tower footings (in areas of hard rock only), and tower assembly and erection generating the highest noise levels. Individual work stages at each transmission tower would be transitory and short-term (typically under or just over one week) with periods of no activity that would provide respite to sensitive receivers (refer to Chapter 6).

Worst-case noise impacts are expected during the access and clearing work stage during which:

- up to 166 receivers (including one non-residential receiver) are predicted to exceed the NML during standard construction hours
- up to 745 residential receivers are predicted to exceed the NMLs outside standard construction hours during the day (if out of hours works are required)
- up to 1,633 residential receivers are predicted to exceed the NMLs outside standard construction hours during the evening/night (if out of hours works are required).

The predicted exceedances are dispersed across the corridor, with a higher density of impacted sensitive receivers in the eastern end of the corridor between Lockhart and Wagga Wagga.

As discussed in Section 18.2.3, the noise scenarios were based on conservative assumptions to understand the potential 'worst case' impacts including assuming that several items of construction equipment would be in use at the same time at the closest point to each receiver, and does not take into account screening of activities (such as by terrain) or mitigation measures. In reality, these 'worst case' assumptions are unlikely to occur. As such, assessment represents the maximum predicted noise level at sensitive receivers. The typical noise levels experienced during construction would be expected to be below these predicted noise levels and each receiver would only be affected for a short duration as the construction activities would be intermittent with periods of no activity between key construction activities.

Out of hours works for the transmission line would generally be conducted between 7 am and 7 pm, and would not extend substantially into the evening or night time periods. As outlined in Chapter 6, where noise levels are predicted to be above NMLs, works would only be carried out within the ICNG standard construction hours unless works outside these areas are required and justified in accordance with the ICNG. Except for emergencies, these works would be carried out in accordance with the out of hours work protocol (refer to Section 6.10.2.1 and Section 18.6.2).

Predicted impacts at sensitive receivers would be confirmed during design refinement, and reasonable and feasible mitigation would be implemented where exceedances of NMLs are predicted, including an out of hours work protocol (refer to Section 18.6).

18.4.1.2. Substation sites, main construction compounds and accommodation camps

Buronga construction compound and accommodation camp

The proposal would use the construction compound and camp at Buronga identified and assessed in the approved EnergyConnect (NSW – Western Section). That assessment found no risk of noise impacts as a result of activities at this location. The use of this site under this proposal would not change the type or intensity of activities at this location and as such, no l noise impacts are predicted to be associated with this site.

Balranald construction compound and accommodation camp

Activities during all work stages and time periods at the Balranald construction compound and optional accommodation camp would comply with the NMLs. Based on the NML compliance, no receivers are predicted to be adversely impacted by construction or use of these sites during and outside standard construction hours.

Cobb Highway construction compound and accommodation camp

NML exceedances are predicted at one residential receiver during and outside standard construction hours. Exceedances at this receiver are likely to be minor (up to 10dB) and limited to only the construction and decommissioning work stages of the main construction compound and accommodation camp (up to six weeks).

Proposed Dinawan 330kV substation and associated construction compound, accommodation camp and laydown

The proposed Dinawan 330kV substation and the associated construction compound, accommodation camp and laydown are located approximately four kilometres from the nearest sensitive receiver. Based on the distances to sensitive receivers, no receivers are predicted to be adversely impacted by construction or use of these sites during and outside standard construction hours.

Lockhart (County-Boundary Road) construction compound and accommodation camp

During the construction and decommissioning work stages of this site, up to nine residential receivers are predicted to exceed NMLs during and outside standard construction hours. Maximum exceedances would be 10 dB to 20 dB above the NMLs (depending on the time of day). These activities would only occur for up to six weeks.

During the operation of the main construction compound and accommodation camp, one receiver would exceed the NML by up to 10 dB during the evening/night. However, the operation of the construction compound would be limited to 7 am to 7 pm, seven days a week and would not extend significantly into the evening/night.

Lockhart (Urana-Lockhart Road) construction compound and accommodation camp

NML exceedances from the Urana-Lockhart Road construction compound and accommodation camp are predicted at up to seven residential receivers during and outside standard construction hours. In most instances, these exceedances would only occur during the construction and decommissioning work stages. Exceedances of the NML would be up to 38dB at the most affected receiver. These work stages would occur for up to six weeks.

During the operation of the main construction compound and accommodation camp:

- exceedances up to 20 dB are predicted at one residential receiver during the day (during and outside standard construction hours)
- exceedances up to 30 dB are predicted at three residential receivers during the evening/night.

However, the operation of the construction compound would be limited to 7 am to 7 pm, seven days a week and would not extend significantly into the evening/night. When the main construction compound is not in operation, exceedances would only occur at one residential receiver outside standard hours and up to 10 dB.

Wagga Wagga main construction compound

During the construction and decommissioning work stages of the main construction compound, NML exceedances are predicted at up to 20 residential receivers during standard construction hours, up to 82 residential receivers during the day (outside standard construction hours) and at up to 174 residential receivers during the evening/night. For the majority of these residential receivers, exceedances would be less than 20 dB with only up to five residential receivers predicted to exceed NML by more than 20 dB. These activities would only occur for up to six weeks.

During the operation of the main construction compound, NML exceedances are predicted at up to five residential receivers during the day (during and outside standard construction hours) and up to 11 residential receivers during the evening/night. Exceedances are typically up to 20 dB with only one receiver predicted to exceed the NML by more than 20 dB (evening/night only).

Activities at this site would be limited to 7 am to 7 pm, seven days a week and would not extend significantly into the evening and night.

Wagga Wagga substation upgrade and expansion

The closest residential receivers are located around 330 metres south east of the Wagga Wagga substation. Worst-case noise impacts are expected during the earthworks work stage during which:

- up to 26 residential receivers are predicted to exceed the NML during the day (standard construction hours)
- up to 95 residential receivers are predicted to exceed the NMLs during the day (outside standard construction hours), where out of hours works are required
- up to 350 residential receivers are predicted to exceed the NMLs during the evening/night (outside standard construction hours), where out of hours works are required.

The majority of receivers predicted to experience NML exceedances are located in suburban districts to the north of the substation. While evening/night NML exceedances are possible, works would generally be conducted between 7 am and 7 pm, and would not extend substantially into evening or night-time periods.

No non-residential sensitive receivers are predicted to be impacted during upgrade and expansion works at the Wagga Wagga substation.

18.4.1.3. Concurrent construction activities

There is the potential for concurrent construction activities occurring in proximity to sensitive receivers as a result of the construction of the transmission line, substations and the construction compounds and accommodation camps. Based on the results of the above assessment, and considering the proximity of the nearest receivers to Buronga substation and main construction compound and accommodation camp sites, the risk of notable construction impacts at the nearest receivers would be low, with concurrent noise levels not exceeding 3 dB above the highest predicted individual impact.

18.4.2. Construction vibration

As the construction activities could occur anywhere within the construction impact area, there is the potential that vibration intensive equipment could be used within the minimum working distances for cosmetic damage, human response and heritage sensitivity (outlined in Table 18-4). The potential for vibration impacts at these receivers would be minimised through refinement of the construction methodology, such as the selection of alternative equipment if works need to occur within minimum working distances.

No vibration impacts are expected for receivers outside of the construction impact area for the transmission line as they would be located beyond the minimum working distances for potential vibration impacts, with the exception of one receiver at Cullivel. At this location, human comfort criteria may be exceeded during access and clearing, earthworks and civil construction works, and final completion stages of construction.

No vibration related impacts are anticipated as a result of construction works at the proposed new and upgraded substations or activities at the main construction compounds and accommodation camps as no receivers have been identified within the safe working distances.

18.4.3. Blasting

Blasting may be required in two areas of hard rock near the Lockhart construction compound and accommodation camp and three areas near the Wagga Wagga construction compound. The nearest sensitive receivers to where blasting may be required range from around 130 metres to 360 metres. Based on these separation distances, the preliminary assessment has determined the Maximum Instantaneous Charge limit that would be required to achieve the recommended ground vibration and overpressure limits (refer to Section 5.4.2 of Technical paper 10).

Blasting would be confirmed during design finalisation (refer to Chapter 6) and further assessment would be required, including:

- proposed blast locations, methodology, charge, delay interval and spacing
- calculated vibration and overpressure
- distance limits for specific Maximum Interval Charge (MIC).

Based on the outcomes of this assessment, management and mitigation may be required at the nearest affected sensitive receivers.

A Blast Management Strategy would be prepared in accordance with AS 2187.2 Explosives – Storage, Transport and use Part 2: Use of Explosives. This strategy would be developed to demonstrate that blasting and associated activities would not generate unacceptable noise and vibration impacts at residences, other sensitive receivers and/or utilities (such as pipelines).

18.4.4. Construction road traffic noise

The haulage routes in the traffic and transport study area are discussed Section 19.3. Construction of the proposal is expected to generate light and heavy vehicle movements and up to 80 heavy vehicle movements on some of these roads, which has the potential to result in road traffic noise impacts at the nearest sensitive receivers.

The use of the haulage routes would vary according to the activity – in both volume of construction vehicles and the duration of use. Around 26 per cent of the haulage routes would only be used for the full duration of construction. The remainder would only be used for a portion of the construction program (typically three to nine months), would typically carry lower daily traffic movements and would have periods of inactivity between key construction phases (for example, between the erection of a transmission line tower and stringing activities).

To reflect this expected pattern of use across the haulage routes, the road traffic noise assessment has categorised the potential risk of impact as follows:

- Low. This represents haulage roads that would only be used for a portion of the construction program and where sensitive receivers would experience an increase in road traffic noise by less than 10 dB.
- Medium. This represents:
  - haulage roads that would only be used for a portion of the construction program and where sensitive receivers would experience an increase in road traffic noise by more than 10 dB, and
  - haulage roads that would be used for the full duration of the construction program and where sensitive receivers would experience an increase in road traffic noise less than 10 dB.

- High. This represents haulage roads that would be used for the full duration of the construction program and where sensitive receivers would experience an increase in road traffic noise more than 10 dB. These sensitive receivers are rated as high as they could experience a more consistent and elevated noise level throughout construction.

As outlined in Section 18.2.2, an increase of 10 dB is generally perceived to be a doubling in the noise level.

Table B-6-3 in Technical paper 10 presents the results of the construction traffic noise modelling on each road and shows the number of receivers predicted to exceed the road noise trigger level. Due to the large number of receivers assessed (greater than 23,000), individual results for each property are not presented.

As summarised in Table 18-9, road traffic noise levels would increase by more than 2 dB at 14,976 properties due to the relatively large increases in vehicle volumes on these roads (due to low existing vehicle volumes). Increases up to 2 dB are considered to be barely perceptible to the average person (DECCW, 2011).

Of the 14,976 receivers, the total road traffic noise levels would also exceed the applicable RNP criterion at 16 receivers near the following roads:

- Moulamein Road (Murray River LGA) which would be used intermittently throughout construction. The proposal would generate around 20 construction vehicles per day when in use (10 light vehicles and 10 heavy vehicles)
- Hendersons Road (Lockhart LGA), which would be used for around six months. The proposal would typically generate around 36 daily movements (20 light vehicles and 16 heavy vehicles) but would peak up to 160 daily movements for short durations (60 light vehicles and 100 heavy vehicles)
- Pearson Street (Wagga Wagga LGA), which would be used throughout the construction program. The proposal would typically generate around 60 construction vehicles per day when in use (40 light vehicles and 20 heavy vehicles), but would peak up to 200 daily movements for short durations (100 light vehicles and 100 heavy vehicles)
- Rowan Road (Wagga Wagga LGA), which would be used for around three months. The proposal would typically generate around 36 daily movements (20 light vehicles and 16 heavy vehicles) but would peak up to 70 daily movements for short durations (30 light vehicles and 40 heavy vehicles)
- Elizabeth Avenue (Wagga Wagga LGA), which would be used throughout the construction program. The proposal would typically generate around 86 construction vehicles per day when in use (50 light vehicles and 36 heavy vehicles), but would peak up to 200 daily movements for short durations (100 light vehicles and 100 heavy vehicles).

Table 18-9 Summary of receivers that would experience construction traffic road noise

Risk level	Number of receivers		
	Exceedance of more than 2 dB	Exceedance of the applicable RNP criterion	Exceeding both triggers
Low	2,768	3	3
Medium	12,104	21	13
High	104	0	0
Total	14,976	24	16

While the construction traffic noise assessment predicts a substantial number of properties experiencing noise increases from construction traffic, almost all of these increases are predicted to remain below 10 dB. The assessment also presents the worst-case scenario. Typical noise levels are likely to be lower than those predicted exceedances. Noise impacts would also be intermittent throughout the construction program as not all roads would be used daily for the full program duration. Noise management measures have been recommended in Section 18.6 to minimise the potential for noise disturbance from construction traffic.

18.5. Potential impacts – operation

18.5.1. Operational noise

18.5.1.1. Transmission lines

The proposed new high voltage transmission lines may generate audible noise during operation associated with accumulation of pollution and water droplets on the conductor surface of the transmission lines, which can result in corona discharge noise. This corona discharge noise is more prominent during rain, mist or fog and often sounds like a 'crackling noise'.

To assess the potential risk of impact from the noise generated by the transmission lines, an audible risk assessment was completed for the proposal by BECA, the Project EnergyConnect Audible Noise and Radio Frequency Interference Study (BECA, 2020).

Table 18-10 outlines the audible risk zones that were calculated for the proposed transmission line as well as the number of sensitive receivers that have been identified within each. The significance of the predicted impacts has been determined based on guidance provided in NPfI and summarised in Table 18-11.

The audible risk zones were calculated for two scenarios by determining the distance from an indicative transmission line beyond which the most stringent project noise trigger level of 35 dBA would be met at surrounding receivers.

This assessment also considered potential cumulative noise impacts associated with the sections of the proposed transmission line that would run close and parallel to existing transmission lines. The assessment found that:

- the existing 220kV transmission lines are expected to have a significantly lower noise impact than the proposed 330kV transmission lines and would therefore have negligible contribution to any cumulative operational noise impact
- there is potential for cumulative noise impacts for around 24 kilometres of the proposed line out from the Wagga Wagga substation where the proposal would be located adjacent to existing 330kV transmission lines. As such, these have been considered further in Table 18-10.

The results show that operational noise would potentially exceed operational criteria during wet weather for between 14 and 23 receivers. These wet weather conditions are predicted to occur for between 20 and 40 per cent of the days in the year based on historical meteorological data, noting that these conditions can occur for only short durations on these days. During heavier rain events, the noise generated by the rain itself would be substantial and would potentially mask any noise from operation of the transmission line. Noise disturbance under such circumstances is therefore likely to be low risk.

Table 18-10 Audible risk zones surrounding the proposed transmission line

Scenario	Transmission line voltages	Audible noise risk zone distance from transmission line (m)	Number of sensitive receivers within the audible noise risk zone	Number of additional sensitive receivers within the audible noise risk zone considering cumulative noise impacts	Total number of sensitive receivers within the audible risk zone
Base	330kV Buronga substation to Dinawan 330kV substation	442	8	6	14
	500kV Dinawan 330kV substation to Wagga Wagga substation	358			
Base + 1% SVG[1]	330kV Buronga substation to Dinawan 330kV substation	548	12	11	23
	500kV Dinawan 330kV substation to Wagga Wagga substation	451			

1. The allowance of one per cent increase in SVG (Surface Voltage Gradient) is understood to be caused by a 0.5 metre reduction in phase and circuit spacings, which could occur during ongoing refinement of the geometry of the transmission towers.

Table 18-11 Significance of audible noise impact as per the NPfI

Significance of impact[1]	Base Case Scenario	Base + 1% SVG[2] Scenario
	Number of receivers	Number of receivers
Negligible	6	12
Marginal	0	0
Moderate	6	9
Significant	2	2
Total	**14**	**23**

1. As defined by the NPfI (refer to Table 8-1 of Technical paper 10), which defines the significance of impact according to exceedances and relationship with the recommended amenity criteria
2. The allowance of one per cent increase in SVG (Surface Voltage Gradient) is understood to be caused by a 0.5 metre reduction in phase and circuit spacings, which could occur during ongoing refinement of the geometry of the transmission towers.

To minimise potential noise impacts, the number of sensitive receivers within the audible noise risk zones would be minimised during design refinement by locating the final transmission line alignment as far away from sensitive receivers as possible. However, at property treatment is expected to be the only feasible and reasonable mitigation due to the noise source, rural context and isolated sensitive receivers (refer to section 8.2.1 of Technical paper 10). Sensitive receivers that may experience an impact of negligible significance (being less than or equal to 2dB increase) would unlikely require mitigation.

AS/NZS 2107:2016 Acoustics—Recommended design sound levels and reverberation times for building interiors indicates a recommended internal design target for sleeping areas in residential buildings in rural areas of 25 to 30 dBA L_{eq}. For receivers that would warrant at property treatment and depending on background noise levels, an overall noise reduction between 14 to 21 dB would be required. The following noise reductions can be typically expected to be achieved under the following scenarios:

- reduction of 5 to 10 dB by a building façade with an open window or door that is not greater than 20 per cent of the overall wall area
- reduction that is equal or greater than 20 dB through a closed and well-sealed building envelope of standard timber-framed construction with external and internal cladding.

Actual noise levels would be confirmed through operational noise monitoring during the early operational phase and if requested by the landholder within two years of operations commencing. Property treatments would be subject to the outcomes of noise monitoring and further agreement with property owners (refer to mitigation measure NV10). Building condition surveys would be required to confirm if internal noise levels are achieved based on the current condition of the building or to determine what additional treatment is required.

It is noted that the section of line between proposed Dinawan 330kV substation and Wagga Wagga substation would be built under the proposal with a 500kV design (i.e. towers, conductors and components), but initially only be operated at a 330kV capacity. Once other network upgrades and their associated planning approvals are completed, this line would operate at 500kV capacity. This assessment has considered impacts associated with the operating parameters of the full 500kV capacity, which presents the potential worst case scenarios of the potential impacts of the line.

18.5.1.2. Proposed Dinawan 330kV substation

The equipment proposed at the proposed Dinawan 330kV substation would generate noise during operation, including the proposed transformers, reactors, capacitor banks, generators, heating, ventilation and air conditioning (refer to Section 6.1.2 of Technical paper 10 for further detail). The substation would also house circuit breakers, which when triggered would emit a short-term impulsive noise. Noise levels at the nearest four receivers to the proposed Dinawan 330kV substation were predicted to assess the predicted change in noise levels, including potential short-term maximum noise events.

These results show that under all scenarios, the operational noise levels associated with the Dinawan substation upgrade and expansion are predicted to comply with the relevant project noise trigger levels, and therefore no additional mitigation measures would be required. It is noted that these results are conservative, as the model assumes that all equipment at the substation would operate at the same time, whereas in reality, some equipment may not be required at all times due to the load on the electricity network.

18.5.1.3. Wagga Wagga substation

The proposal would not involve the addition of any new noise sources at upgraded and expanded Wagga Wagga substation. As such, no operational noise level changes in the vicinity of site are expected.

18.5.1.4. Optical repeater sites

The operational noise levels associated with optical repeater sites at Balranald, Booroorban and Brookong are predicted to comply with the relevant project noise trigger levels under all scenarios, with a negligible risk of impact to receivers. No additional mitigation measures would be required for the operation of these sites.

18.5.1.5. Operation and maintenance

The proposed Dinawan 330kV substation, expanded Wagga Wagga substation and transmission lines would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Likely maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of electrical equipment
- general building, asset protection zone and general landscaping maintenance
- fire detection system inspection and maintenance
- fence repair
- stormwater and drainage infrastructure maintenance.

The proposed Dinawan 330kV substation would not accommodate full-time staff or contractors. Maintenance at the substation site would typically include ad-hoc attendance (up to three times a week) of one or two operators to undertake planned and unplanned switching of equipment. It is expected that these activities would only require light vehicles and/or small to medium plant depending on the works required. Any waste generated during operation would be minimal and disposed of on an ‘as need’ basis to a licenced waste facility by the attending maintenance personnel. Noise impacts associated with ongoing operation and maintenance of the substation is expected to be minor.

The upgrade and expansion of the Wagga Wagga substation would not change the existing operational or maintenance requirements that currently occur for this infrastructure. As such, no additional noise impacts are expected.

Maintenance activities required for the transmission lines are expected to be infrequent (up to once per year). If and when required, these activities are also expected to be either transient/of short duration (e.g. flyover, drive-by) or local to a specific section of the transmission line. Consequently, any noise impacts above the existing background levels by operational maintenance works of the proposal would be negligible.

18.5.1.6. Operational vibration

Operation of the proposal is not anticipated to result in any impacts from vibration.

18.5.2. Operational road traffic noise

As discussed in Section 18.5.1, the operation and maintenance of the proposal would generate low levels of light vehicle movements from maintenance staff.

To achieve a 2 dB increase in road traffic noise, the existing traffic volumes on the affected roads would need to be increased by over 60 per cent. Given the low number of vehicle movements expected to be generated by operation of the proposal compared to existing road volumes, road traffic noise increases from operation of the proposal would be negligible.

18.6. Management of impacts

18.6.1. Environmental management

Environmental management for the proposal would be carried out in accordance with the approach as detailed in Chapter 24 (Environmental management). For construction, this would include a detailed construction noise and vibration management plan (CNVMP) which would be based on the final construction methodology and construction footprint including the confirmed schedule and locations of construction activities as well as equipment types and numbers. The approach to mitigation would be in accordance with the recommendations in the ICNG.

18.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to noise and vibration are presented in Table 18-12.

Table 18-12 Mitigation measures – noise and vibration

Reference	Mitigation measure	Timing	Applicable location(s)
NV1	A Construction Noise and Vibration Management Plan (CNVMP) would be prepared by the construction contractor prior to construction works commencing and would (as a minimum) identify: • all noise and vibration sensitive receivers • feasible and reasonable noise mitigation where management levels are likely to be exceeded • feasible and reasonable noise measures to manage traffic noise impacts on public roads where impacts are identified at any sensitive receiver due to proposal-related traffic • Feasible and reasonable vibration mitigation where vibration criteria are likely to be exceeded • describe associated noise and vibration monitoring programs • refer to complaint handling protocols for complaints related to construction noise and vibration • outline community consultation measures including notification requirements. This CNVMP would be implemented for the duration of construction.	Pre-construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
NV2	Where noise from construction is likely to result in noise affected receivers, mitigation and management measures would be implemented where practicable and appropriate. This would include (but is not limited to) the following measures: • select quieter plant and equipment and use alternative construction methods to minimise noise levels • plan and schedule concurrent noisy activities to minimise the number of items of noisy plant operating at one time and cumulative noise levels • install screens or use barriers to mitigate noise from stationary noise sources • maximise the offset distance between noisy plant and orient equipment away from sensitive receivers • use noise source controls, such as residential class mufflers, to reduce noise from all regularly-used plant including cranes, excavators and trucks • use alternative reversing alarms in place of traditional beeper reversing alarms during OOH where noise impacts have been predicted • turn off machinery when not in use • ensure equipment is well maintained and not generating excessive noise • operate machinery in a manner which reduces maximum noise level events, such as shaking excavator buckets, loading trucks from a height, steel on steel contact and dragging materials across hard surfaces • provide awareness training regarding noise mitigation measures to be implemented • notify and consult with potentially affected receivers about upcoming noisy activities • ensure that noise affected receivers outside standard construction hours and highly noise affected sensitive receivers are provided with appropriate respite.	Pre-construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
NV3	Where construction is likely to result in vibration levels that exceed relevant criteria at sensitive receivers, mitigation and management measures would be implemented where practicable and appropriate. This would include (but is not limited to) the following measures: • avoid the use of vibration-intensive plant at distances where human discomfort would result • substitute lower vibration-intensive plant and methods (for example use a smaller machine, lower power settings or alternative equipment) • sequence operations to avoid or minimise concurrent vibration-intensive activities • schedule the use of vibration-sensitive equipment during the least sensitive times of the day • confirm any vibration-sensitive heritage structures that could be impacted by the proposal works. Develop site-specific measures to avoid vibration impacts and implement the measures during vibration-intensive activities in the vicinity • inform and consult with potentially affected receivers about upcoming vibration-intensive activities.	Pre-construction and construction	All locations
NV4	Where noise from construction-related traffic is likely to result in road traffic noise increases of more than 2 dB at affected receivers, mitigation and management measures would be implemented where practicable and appropriate. This would include (but is not limited to) the following measures: • minimise proposal-related traffic movements along the route • minimise speeds for proposal-related traffic in the vicinity of affected receivers • avoid compression braking and the use of air brakes in the vicinity of affected receivers • implement driver training and measures to ensure driver awareness, speed limits, driver behaviour and designated routes are effectively communicated • limit traffic movements to daytime periods as far as possible and minimise traffic movements outside standard construction hours.	Pre-construction and construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
NV5	Activities likely to generate noise levels that exceed applicable noise management levels at sensitive receivers would be scheduled during standard construction hours wherever practicable. Other activities required outside standard construction hours that are likely to generate noise levels that exceed applicable noise management levels at any nearby sensitive receivers would be carried out in accordance with an out of hours works protocol (Mitigation measure NV6).	Construction	All locations, excluding the operation of the accommodation camps
NV6	Develop and implement an out of hours works (OOHW) protocol that details how the proposal would identify, assess and approve out of hours works outside standard construction hours that are likely to generate noise levels that exceed the relevant noise management levels at sensitive receivers. The protocol would include provisions to: • carry out additional assessments for works proposed outside standard construction hours to confirm predicted noise levels • minimise noise levels outside standard construction hours • carry out the noisiest activities as early as possible in the work shift where practicable • identify appropriate respite for noise affected receivers (where required) • notify and engage with potentially affected receivers about upcoming works outside standard construction hours and address any associated complaints. The OOHW protocol would not apply to the operation of the accommodation camps. Prior to works outside standard construction hours, engagement and consultation would occur with potentially affected receivers regarding various mitigation and management measures. Based on this consultation, appropriate mitigation and management options would be considered and implemented where feasible and reasonable to minimise the impacts.	Construction	All locations, excluding operation of the accommodation camps

Reference	Mitigation measure	Timing	Applicable location(s)
NV7	Where residences or other sensitive receivers/structures are within the minimum working distances for vibration, different construction methods with lower source vibration levels would be investigated and implemented, where feasible attended vibration measurements would be undertaken at the start of the works to determine actual vibration levels at the structure. Works would cease if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.	Pre-construction and construction	All locations
NV8	Prior to the commencement of blasting, a Blast Management Strategy would be developed. The strategy would describe the process that would be used to design each blast (depths and Maximum Instantaneous Charge for each location etc) to comply with relevant noise and vibration criteria at any nearby sensitive receivers. The strategy would also detail noise and vibration monitoring and landholder notification requirements for blasting. The strategy would be implemented for all blasting.	Construction	Blasting locations
NV9	Investigate any complaints regarding construction noise and vibration to determine if actual noise and vibration levels are as predicted and that appropriate mitigation measures have been implemented. Where required, identify and implement appropriate additional mitigation measures.	Construction	Blasting locations
NV10	For each residence where potential operational noise levels are predicted to exceed project trigger levels, noise monitoring to confirm actual operational noise levels would be carried out: • within six months of the commencement of operation (where meteorological conditions permit); and • at the request of the landowner of the residence at any time within two (2) years after the commencement of operation. The noise monitoring would occur during weather/atmospheric conditions conducive to generating the corona effect. For residences where the monitoring identifies operational noise level in excess 35 dB(A) LAeq,15min and internal noise levels in excess of 25 dB(A) as a result, consultation would occur with the landowner of the affected residence to identity if treatment is required and, if so, confirm appropriate treatments. Once appropriate treatments have been confirmed in consultation with the landholder, the treatments would be implemented within 12 months.	Operation	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
	For the 500kV line between Dinawan 330kV substation and Wagga Wagga substation this assessment would be required to occur once the line is operational at the initial 330kV voltage and subsequently once the line is increased in operational capacity to 500kV (at a point in the future following the required additional network upgrades).		

18.6.3. Managing residual impacts or uncertainties

The ICNG acknowledges that construction noise impacts cannot always be avoided where construction activities are required near sensitive receivers. The final construction strategy for the proposal would aim to minimise construction noise and vibration impacts through refinement of the methodology and construction locations, where possible. It should also be prepared in consultation with the community to take into account the communities' willingness to tolerate the level of construction noise predicted and preferences for strategies such as respite periods. The noise and vibration during construction would be managed through implementation of the identified mitigation measures. Monitoring would be carried out at some stages during construction to confirm the effectiveness of the noise and vibration mitigation measures implemented and determine whether any adjustment to the mitigation measures would be required to manage residual impacts.

In accordance with NPfI, a residual noise impact is defined as '*receivers with exceedances of the project noise trigger levels under the best-achievable acoustic outcome from a development*'. Residual noise impacts are identified after all source and pathway feasible and reasonable noise mitigation measures (in accordance with the meaning of these terms as outlined in Section 1.4 of the ICNG) have been considered. Following design refinement, if sensitive receivers are still identified to be located within the audible noise risk zones surrounding the proposed transmission line, feasible and reasonable mitigation options would be identified in accordance with the ICNG to manage the residual risk. The required measures would be confirmed following operational noise monitoring and building condition surveys at the identified receiver locations This would ensure that the operational mitigation measures would be suitable to effectively control operational noise impacts.

19. Traffic and access

This chapter provides an assessment of potential traffic and access impacts of the proposal and identified mitigation measures to address these impacts. It summarises the *Traffic and Transport Impact Assessment* (WSP, 2021f) (refer Technical paper 11).

19.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to traffic and access and where these requirements are addressed in this EIS are outlined in Table 19-1.

Table 19-1 Secretary's environmental assessment requirements – traffic and access

Ref.	Secretary's environmental assessment requirements	Where addressed
Transport		
Key issues	The EIS must address the following matters:	
	• an assessment of the transport impacts of the project on the capacity, condition, safety and efficiency of the local and State road network	Impacts during construction are addressed in Section 19.4 Impacts during operation are addressed in Section 19.5.
	• details of the ongoing maintenance works required to service assets, outlining the measures to maintain the road	Maintenance activities are described in Section 5.4 and addressed in Section 19.5 with respect to impacts on the road network.

19.2. Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment.

19.2.1. Legislative and policy context

Traffic and access impacts resulting from the proposal were assessed in line with the following legislation and key strategic and policy guidelines:

- *Roads Act 1993* – The Act aims deals with rights of members of the public to pass along public roads, rights of persons who own land adjoining a public road to have access to the public road, and the procedures for the opening and closing of a public road. This proposal is consistent with this legislation, ensuring that the appropriate processes and measures are in place to manage the impacts to users of the public roads, landholders and the opening/closing of public roads.

- *Traffic Control at Work Sites version 6.0* (Transport for NSW, 2020)) – The aim of this manual is to protect the safety for all transport mode users (vehicles, pedestrians, cyclists etc.) travelling around or passing through work sites. This guide refers to Australian Standards 1742 (*Manual of uniform traffic control devices*) (Australian Standards, 2009) and 1743 (*Road signs – specifications*) (Australian Standards, 2018) to have consistent application with the Australian Standards. Temporary works on public roads detailed in Technical paper 11 consider the practices detailed in this guideline.

- *NSW Heavy Vehicle Access Policy Framework 2018* (Transport for NSW, 2018) – which provide a framework for heavy vehicle access in NSW for both state and local council roads. As part of the proposal, heavy vehicles would be required to carry freight, including construction materials, to locations within the proposal study area. This framework provides a platform to consider areas of priority such as safety and the capacity of road infrastructure (including roads and bridges), particularly for higher density loads such as construction material, is the limitation on the movement of vehicles operating at Higher Mass Limits.

- *Towards Zero – Safe System 2016* (NSW Government, 2016) – a framework by the NSW Government that is central to moving. The mitigation measures detailed in Section 19.2 consider the principles of Safe System approach that would provide a safe temporary road environment.

19.2.2. Methodology

The methodology adopted for the traffic and transport assessment included:

- undertaking a desktop assessment to identify, describe and qualitatively assess the existing conditions of the study area, including road regulations (speed zone, heavy vehicle restrictions, oversized and overmass vehicles access), crash history, traffic volumes, active transport, and public transport
- review of the proposed construction and operational vehicular access to construction areas
- a qualitative impact assessment of the traffic and access impacts during construction. This included:
  - a road network capacity assessment to assess the impact of construction traffic movements on the surrounding road network
  - a review of the proposed haulage access requirements
- examining the operational traffic and transport impacts, such as impact on the road network due to maintenance vehicle movements, emergency vehicle access, and requirements of access by large vehicles
- identifying mitigation measures to minimise as far as practicable the traffic and access impacts of the proposal.

19.3. Existing environment

19.3.1. Existing road network

The existing road network across the proposal study area consists of a combination of national, state, regional and local roads. The key roads within the proposal study area are shown on Figure 19-1 and include:

- Sturt Highway (A20): A major east-west highway that connects Balranald to Wagga Wagga and includes Market Street (Balranald), Moama Street (Hay), Hammond Avenue and Edward Street (Wagga Wagga) within the proposal study area. The Sturt Highway is sealed with two lanes (one lane in each direction). Sturt Highway has a general speed limit of 100 or 110 kilometres per hour and 50 or 60 kilometres per hour in town centres such as Balranald.

- Newell Highway (A39): A major north-south highway that connects south-eastern Queensland and Victoria via central New South Wales (passing through towns such as Jerilderie and Dubbo). Newell Highway includes Jerilderie Street and Southey Street (Jerilderie) within the proposal study area. The Newell Highway is sealed with two lanes (one lane in each direction). Newell Highway has a general speed limit of 110 kilometres per hour and 50 kilometres per hour in town centres such as Jerilderie.

- Olympic Highway (A41): A major north-south highway in the central western NSW which provides links to the Sturt Highway at Wagga Wagga. Olympic Highway includes Colin Knott Drive, Moorong Street (Wagga Wagga) and Railway Street (The Rock) within the proposal study area. The Olympic Highway is sealed with two lanes (one lane in each direction), with four lanes (two lanes in each direction) on Moorong Street. Sturt Highway has a general speed limit of 100 kilometres per hour and 80 kilometres per hour in town centres such as Wagga Wagga.

- Riverina Highway (B58): An east-west highway that connects the Hume Highway to the Cobb Highway via Deniliquin, Finley, Berrigan, Corowa and Albury. Riverina Highway includes Finley Road (Deniliquin) and Honour Avenue (Federation) within the proposal study area. The Riverina Highway is sealed with two lanes (one lane in each direction). Riverina Highway has a general speed limit of 100 kilometres per hour and 50 kilometres per hour in town centres such as Federation.

- Cobb Highway (B75): A north-south highway that provides a key connection with the towns of Mathoura and Moama south of Deniliquin. Cobb Highway includes Hay Road, Davidson Street, Charlotte Street, Ochtertyre Street and Hardinge Street (Deniliquin) within the proposal study area. The Cobb Highway is sealed with two lanes (one lane in each direction). Cobb Highway has a general speed limit of 110 kilometres per hour and 60 kilometres per hour in town centres such as Deniliquin.

- Kidman Way (B87): A north-south highway that links the Newell Highway and the Sturt Highway. Kidman Way is sealed with two lanes (one lane in each direction) and has a general speed limit of 100 kilometres per hour.

- Murray Valley Highway (B400): A north-south highway in Victoria and NSW that connects to the Sturt Highway at Euston. Murray Valley Highway is sealed with two lanes (one lane in each direction) and has a general speed limit of 110 kilometres per hour.

- Yanga Way: A north-south state road that connects Mallee Highway to the Sturt Highway at Balranald. Yanga Way is sealed with two lanes (one lane in each direction) and has a general speed limit of 100 kilometres per hour.

In addition, 42 regional roads and 138 local roads, would be included within the proposal study area and would be required to be accessed as part of the construction of the proposal. These regional and local roads are mostly sealed except for 53 of the local roads. Overall, most of the roads forming part of the regional and local network in the study area do not contain dedicated pedestrian and cycling facilities where pedestrian and cyclist connectivity is limited.

Further detailed description of the existing road network and key roads is detailed in Section 4.1 of Technical paper 11.

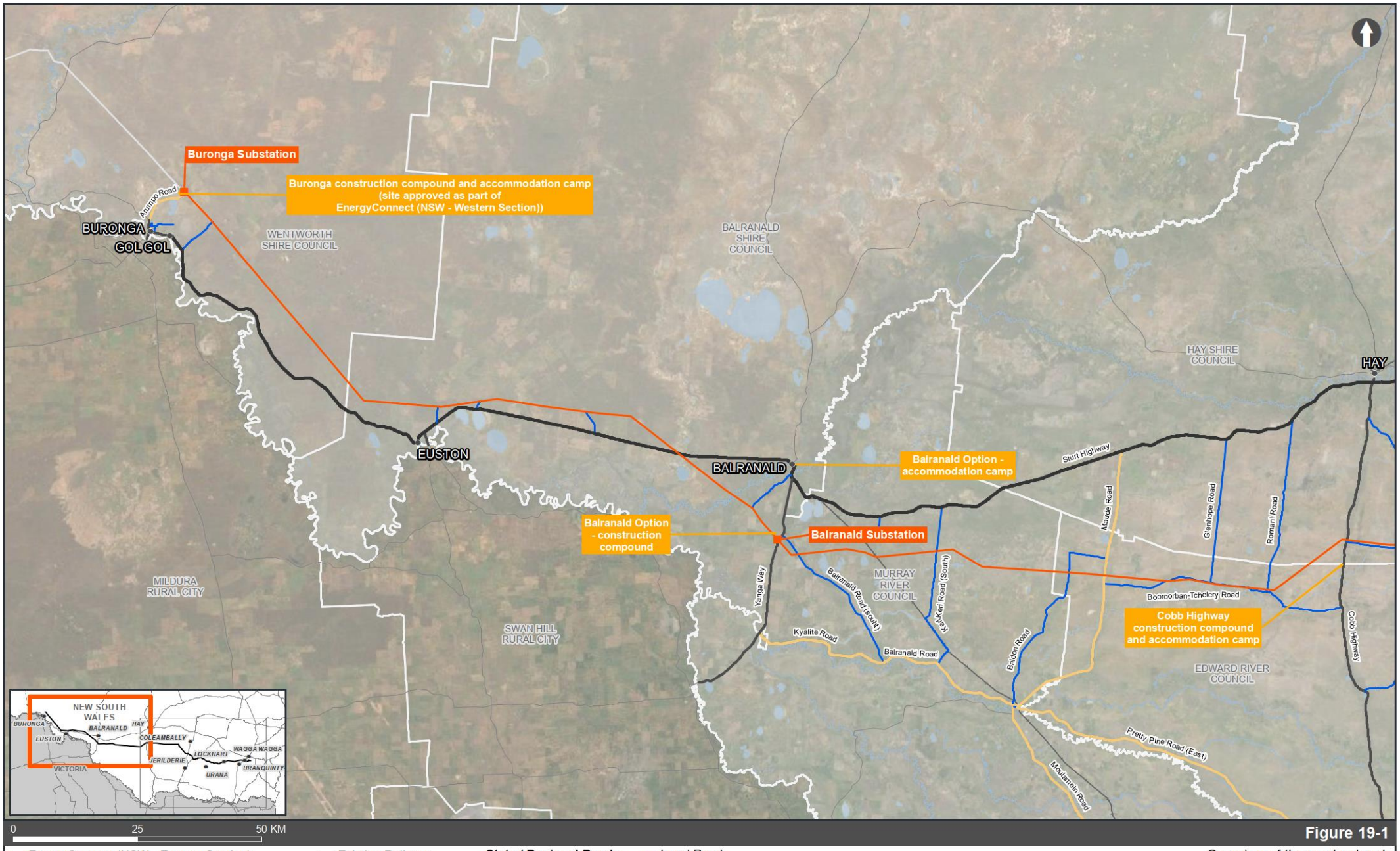

Figure 19-1

Overview of the road network

Sheet 1 of 2

- EnergyConnect (NSW - Eastern Section)
- EnergyConnect (NSW - Western Section)
- Main Construction Compounds and Accommodation Sites
- Existing Substation
- Existing Railway
- Waterbody
- Watercourse
- Local Government Areas

State / Regional Roads

- State Road and
- State Road
- Regional Road
- Local Road

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Source: NSWSS, ESRI, Transgrid, WSP

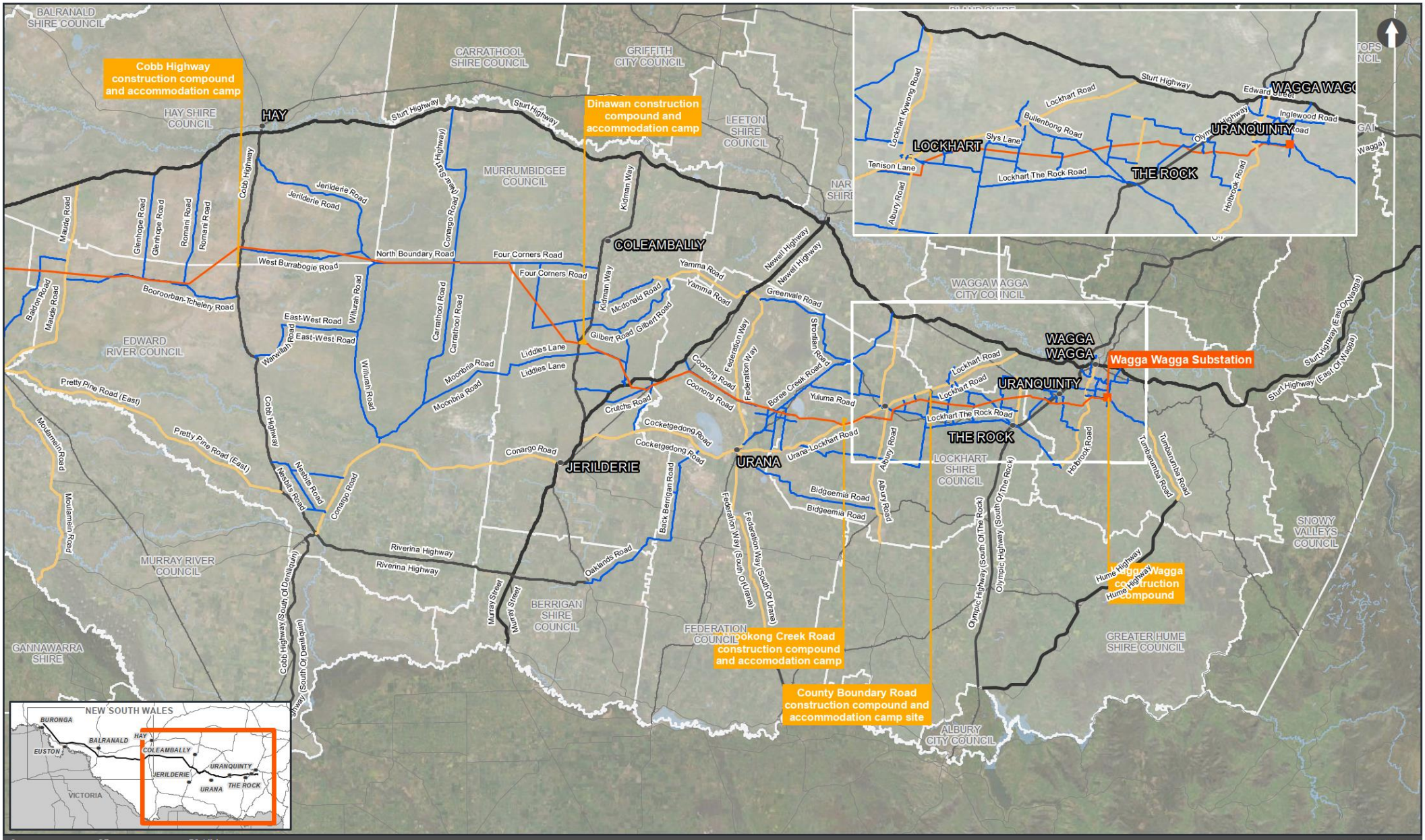

Figure 19-1

Overview of the road network

Sheet 2 of 2

EnergyConnect (NSW - Eastern Section)

EnergyConnect (NSW - Western Section)

Main Construction Compounds and Accommodation Sites

Existing Substation

Existing Railway

Waterbody

Watercourse

Local Government Areas

State / Regional Roads

State Road and AusLink

State Road

Regional Road

Local Road

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Source: NSWSS, ESRI, Transgrid, WSP

19.3.2. Traffic volumes

The state roads within the proposal study area contain the highest traffic volumes on the existing road network, with peak hourly traffic volumes typically between 50 and 200 vehicles in one direction. The busiest state road that would be used for construction haulage is Hammond Avenue, which forms part of Sturt Highway within the Wagga Wagga LGA. This road carries 900 vehicles in one direction during the peak hour.

Regional and local roads within the proposal study area experience peak hourly traffic volumes typically below 50 vehicles in one direction. A number of local roads in the Wagga Wagga town centre carry substantially higher peak hourly traffic volumes between 200 and 300 vehicles in one direction.

The unsealed roads within the proposal study area have a typical peak hour traffic flow below 20 vehicles in one direction.

The traffic volumes and their relationship with the haulage routes for the proposal (refer to Section 6.10) are summarised in Table 4.4 and Figure 4.2 of Technical paper 11.

19.3.3. Road network performance

The peak hourly volumes and capacity for roads within the proposal study area have been calculated using the *Austroads Guide to Traffic Management Part 3 – Transport Study and Analysis Methods* and are presented in Appendix E of Technical paper 11.

Most of the key roads have the Level of Service A, which provides a stable free-flow operation for vehicles to travel almost completely unimpeded within the traffic stream ample spare capacity. Two roads (Hammond Avenue, part of Sturt Highway within Wagga Wagga, and Sturt Highway between Olympic Highway and Wagga Wagga) perform at Level of Service B which still provides a reasonable free-flow operation and only slightly restricted ability to manoeuvre within the traffic stream.

With the Level of Service B or better, no regular delays or traffic congestions would be expected on the existing key roads under existing traffic conditions.

19.3.4. Heavy vehicle route restrictions

A number of state roads within the study area (i.e. Sturt Highway, Yanga Way and Kidman Way) currently permit access by restricted access vehicles, oversized and overmass vehicles, and road trains.

Other state and regional roads within the study area (such as Cobb Highway, Newell Highway and Hume Highway) currently provide approved access for certain types of heavy vehicles only.

The majority of local roads within the proposal study area typically only allow access of up to the largest general vehicle type (i.e. a semi-trailer).

The heavy vehicle restrictions on the prospective construction haulage routes from Melbourne, Sydney and Adelaide (refer to Section 6.11) are shown on Figure 19-1. Further details of the heavy vehicle route restrictions by heavy vehicle type is provided in Appendix F of Technical paper 11.

19.3.5. Public transport

Buses provide the primary public transport service in the towns in the proposal study area. The Wagga Wagga LGA is serviced by a local bus network operated by Busabout, Junee Buses (providing services to Junee, north-east of Wagga Wagga) and Allens Coaches (providing services for schools). Coach services are available for Buronga, Euston, Balranald, Hay, Urana, Lockhart and Wagga Wagga. These form part of the Transport for NSW Regional Train and Coaches Network which generally runs a single return trip daily or on a limited number of days per week.

The proposal study area crosses five railway lines including:

- Main Southern Railway operated by ARTC (operational railway line), approximately three kilometres southwest of Uranquinty
- The Rock Oakland Railway operated by Country Rail Network (operational railway line), approximately two kilometres southeast of Lockhart
- The Rock Oakland Railway operated by Country Rail Network (non-operational railway line), approximately nine kilometres northeast of Urana
- Narrandera Tocumwal Railway operated by Country Rail Network (non-operational railway line), near intersection of Colombo Road and Crutchs Road, Bundure
- Moama Balranald Railway operated by VLine (operational railway line), approximately 25 kilometres southeast of Balranald.

Further details of the public transport network within the proposal study area is provided in Section 4.4 of Technical paper 11.

19.3.6. Active transport

Active transport facilities for pedestrian and cyclists are available in the town centres within the proposal study area, including Wagga Wagga, The Rock, Urana, Lockhart, Narrandera, Jerilderie, Coleambally, Deniliquin, Hay and Balranald. Facilities typically include road shoulder and/or shared paths on key roads, through nature reserves and around local water bodies (such as the Murrumbidgee River). On-street cycling facilities are available in Narrandera, Deniliquin and Balranald.

There are typically no designated active transport facilities on roads outside of town centres within the proposal study area.

Further details of the active transport network within the proposal study area is provided in Section 4.5 of Technical paper 11.

19.4. Potential impacts – construction

19.4.1. Impact on road network

19.4.1.1. Capacity

Figure 19-2 summarises the potential impact of the construction of the proposal on the capacity of the existing road network in the traffic and transport study area. These impacts would be largely as a result of the expected additional traffic movements required to facilitate construction of the proposal.

During construction peaks, there would be an overall low increase in peak hourly traffic as a result of the proposal. The median total traffic increase would be 22 vehicles per hour in one direction and 90 per cent of the haulage roads would have a total traffic increase of up to 56 vehicles per hour in one direction, equating to less than one additional vehicle movement every one minute. All roads assessed would continue to operate at a Level of Service A or B during construction, which indicates good levels of operation in terms of road capacity. This result can be attributed to existing low traffic volumes and to the low levels of construction traffic on the proposed haulage routes compared to the existing spare road capacity.

Heavy vehicle traffic movements would be distributed throughout the day to minimise their impact on town centres' peak traffic activities, with a median heavy traffic increase of 10 vehicles per hour in one direction.

Within towns, increased construction traffic movements may attribute to temporarily reduced road capacities at some locations and cause temporary delays during the construction peak on highways or state roads where traffic demand is already high and operating speed is low. Additional traffic movements on local roads would temporarily change the existing road environment due to the existing low levels of traffic. The greatest increases in total peak hour traffic in the study area would occur on roads where existing traffic volumes are around 10 to 20 vehicles per hour in one direction. However all local roads would continue operate within capacity during construction with negligible to no change in performance.

The road capacity on unsealed roads would be reduced during construction due to increased traffic, the need for slower vehicle travel and increased gaps between vehicles (i.e. dust, restricted sight distance and reduced vehicle control). Although road capacity would be temporarily reduced, there would be negligible to no change in performance on all unsealed roads within the study area.

Short-term speed restrictions, reduced road capacity or detours may be required during the stringing of transmission lines across roads. The relevant roads authority would be notified of the proposed works and the necessary permit requirements submitted. Where feasible, temporary lane closures would be planned outside of peak traffic periods to minimise impact to the road network.

Given the low traffic volumes on adjacent road network, it is anticipated that intersections along the haulage routes would operate within capacity. Based on predicted traffic volumes on proposed access tracks for the proposal, intersections between existing roads and new access points would perform within capacity.

Overall, the proposal would not adversely affect the road capacity level of service of any construction haulage routes. Further details on the capacity of the road network within the proposal study area is provided in Table 5.12 of Technical paper 11.

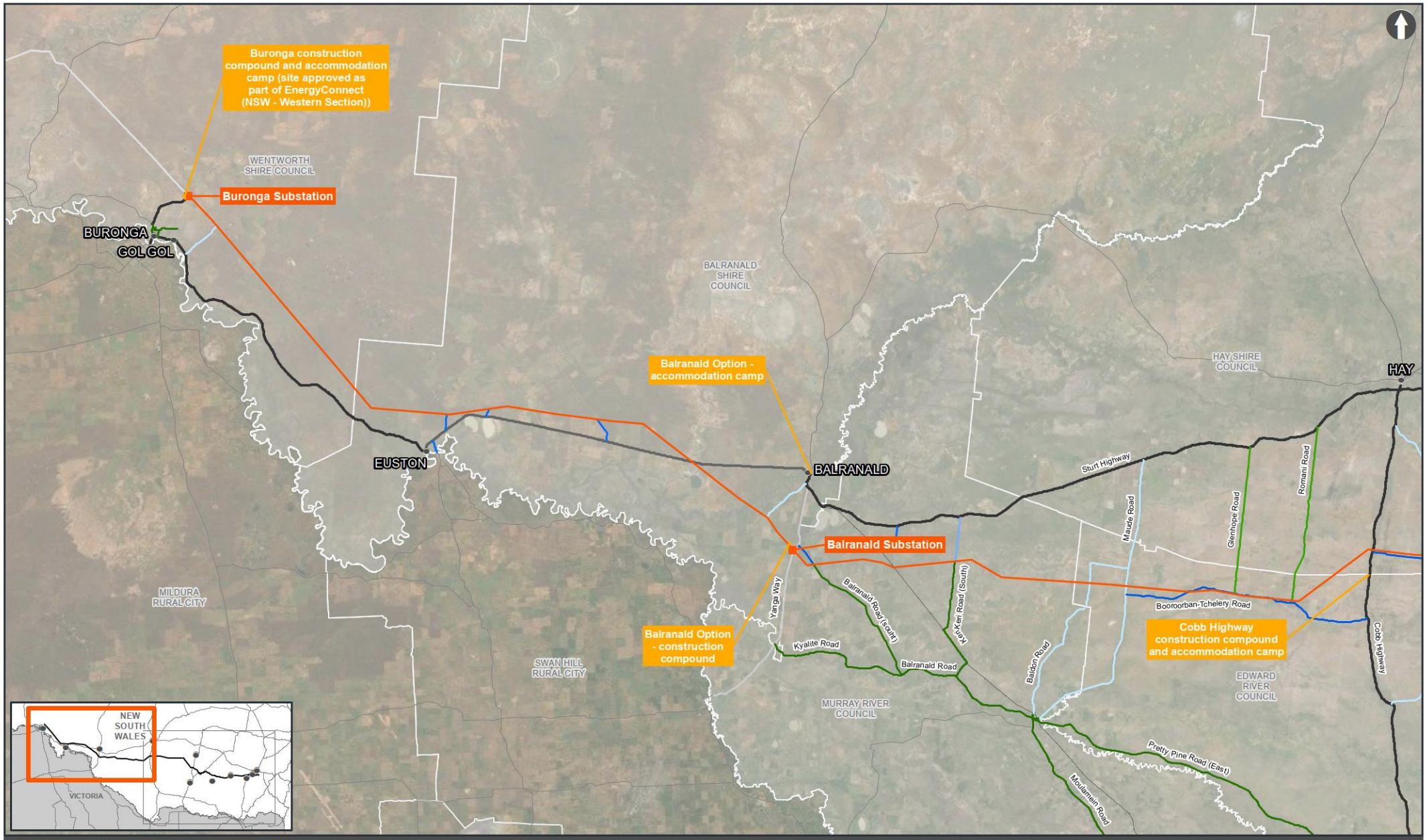

Figure 19-2

Impact of additional construction traffic on road network performance

Sheet 1 of 2

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Source: NSWSS, ESRI, Transgrid, WSP

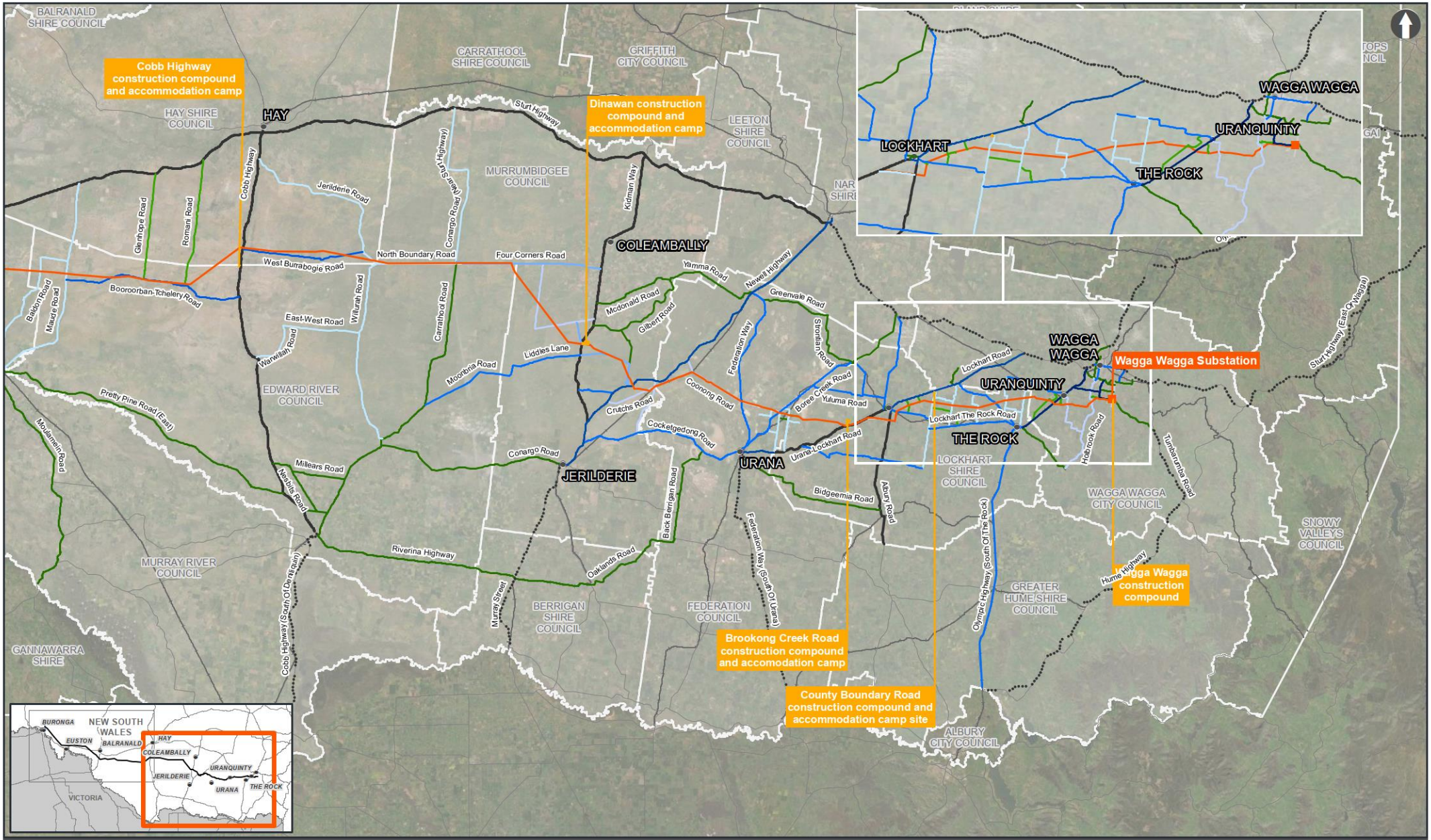

Figure 19-2

Impact of additional construction traffic on road network performance

Sheet 2 of 2

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Source: NSWSS, ESRI, Transgrid, WSP

19.4.1.2. Oversized and overmass vehicle access

Haulage routes for oversized and overmass vehicle deliveries for the proposal have been selected so that road or bridge widening or strengthening to support these types of vehicles is not required.

The proposed haulage routes considered from ports in Newcastle Port Kembla, Adelaide and Melbourne are discussed in Chapter 6. Oversized and overmass vehicles would only travel to the proposed Dinawan 330kV substation site from the port of origin using primary haulage routes along approved roads (within NSW) to access the proposed Dinawan 330kV substation site via Kidman Way. Oversized and overmass vehicles are not expected to be required to access the Wagga Wagga substation site.

The transport of oversized and overmass vehicles would be planned to minimise the impact to the surrounding road network and community with consideration of vehicle characteristics, areas or routes, and travel restrictions on the road network. The use of pilots and escort vehicles may also be required (depending on the vehicle characteristics). In NSW, this is carried out by the NSW Police.

The specific details of vehicle types and route options would be confirmed during detailed construction planning and a permit to operate oversized and overmass vehicles on the road network would be obtained by the construction contractor from the National Heavy Vehicle Regulator, where required. Permits would be required if the oversized and overmass vehicle combination does not comply with a mass, dimension or operating requirements set out in a gazette notice.

Submission of a transport management plan to comprehensively document the ‘High Risk’ oversized and overmass movements to Transport for NSW would also be required to obtain approval prior to these movements occurring.

19.4.1.3. Road condition

Construction heavy vehicle movements are likely to have minor impact to the condition of the existing sealed road network due to the increase in heavy vehicle movements on the proposed haulage routes. However, the impacts of additional heavy vehicle movements would depend on the existing pavement condition and road construction type. As such, the construction contractor would be required to undertake pre-condition surveys to record the pavement condition along the haulage routes. Following completion of construction works (and as needed through the construction period to maintain safe road conditions) the roads would be repaired to address pavement failures issues resulting from the increased construction and haulage activities from the proposal.

For unsealed roads, construction traffic is likely to impact road condition. Impacts are most likely on Spraydon Road, Urana due to the volume of proposed heavy vehicle traffic. The construction contractor would work with asset owners and local councils to make sure unsealed roads are fit for purpose during and at the completion of the construction period.

The majority of bridges and culverts on the proposed haulage routes are located on State and Regional roads that have been classified for restricted access vehicles oversized and overmass vehicles. Engagement with councils on load limits and suitability of construction haulage routes has commenced and would continue during the finalisation of the construction methodology. This would include further investigation into bridges, culverts and stock crossings on local roads and access tracks prior to construction to determine their vehicle loading limits and suitability to traverse once final construction vehicle movements are determined, and to make sure assets remain fit for purpose during and at the completion of the construction period.

19.4.2. Impacts from temporary access tracks

The construction of the transmission lines would require temporary access tracks to be created where existing tracks to reach a construction site do not currently exist. Any required temporary access tracks would be established by the construction contractor, and removed after the construction phase is finished, unless these are required for permanent access to remain, or otherwise requested to remain by the landowner. Where temporary access tracks meet existing roads, the design of intersections would consider sight distance, speed limit, proximity of adjacent roads, vehicle types requiring access and design vehicle in accordance with Austroads and ARRB guidelines.

The use of temporary access tracks and points would provide a positive impact as it would ensure direct accesses to proposed work areas are established. This is particularly beneficial to manage the traffic movements and would enable:

- appropriate wayfinding for haulage drivers and workers to the site
- appropriate temporary road and intersection design which is safe, appropriately delineated and suitable for all-weather conditions to accommodate the different types of construction vehicles
- a consolidation of accesses to different sites which would minimise disturbance to the surrounding environment, including the abutting roads.

19.4.3. Impacts on active transport

The majority of the proposal construction works would be undertaken without extensive interaction with the active transport facilities on the road network. Potential interaction would occur where the haulage route forms part of the main road network through town centres within the proposal study area. Where interaction is proposed to occur, the existing active transport infrastructure including footpaths, bicycle paths, shared paths and on-road shoulders would be retained wherever possible. Where disruption to the facilities is required, a detour of the route would be planned accordingly.

The increase in heavy vehicle movement and construction phase traffic is expected to have a minor impact on active transport on the road network, due to the low number of movements and the existing active transport facilities separating vehicles from pedestrians and cyclists.

19.4.4. Impacts on public transport

The construction of the proposal is not envisaged to require road closures which would affect existing public transport routes, or any relocation of bus zone or bus stop facilities. However, should a full or partial road closure be required, the construction contractors would liaise with the relevant public transport service providers, local council and Transport for NSW accordingly.

Some limited and occasional delays to some routes may be experienced if they coincide with peak heavy vehicle movement periods.

The stringing on transmission lines over railway lines would be undertaken during scheduled rail maintenance periods (such as rail possessions) or scheduled as to not impact passenger or freight services (for example, between scheduled train services where sufficient gaps occur to safely conduct construction works). All construction work would meet the requirements of the relevant rail authority.

19.4.5. Impacts on road safety

The haulage route to the main construction compounds, or elsewhere along the transmission line corridor from either Newcastle, Port Kembla, Melbourne or Adelaide shipping ports would each require extensive travel time and the issue of travel fatigue may be present for drivers undertaking the haulage activities. As such, effective fatigue management would be implemented for drivers.

While the proposal would increase vehicle movements on the road network within the traffic and transport study area, the assessment found that the road network would continue to operate efficiently with a good level of service (as described in Section 19.4.1). As the increase in heavy vehicle movements would be readily accommodated on the road network, the proposal would not exacerbate safety issues on the road network.

The increase of heavy vehicle movements, including oversized and overmass vehicles, may also have some impact on the pavement condition along haulage routes. While the potential road safety impacts on sealed roads would be minimal, poor pavement conditions, gravel loss and potholes on unsealed roads reduce driveability, particularly during wet weather.

Access points would be designed to allow heavy vehicles to safely enter and exit the road network and to minimise operational interruption to the road network. The design of these access provisions would consider the following criteria:

- heavy vehicle approval for access points on existing roads
- safe intersection sight distance (the minimum sight distance that should be provided on the major road at any intersection)
- minimum gap sight distance (the critical acceptance gap that drivers are prepared to accept when undertaking a crossing or turning manoeuvre at intersections)
- stopping sight distance (the distance to enable a normally alert driver, travelling at the design speed on wet pavement, to perceive, react and brake to a stop before reaching a hazard on the road ahead)
- distance to nearest adjacent side road, property access or track (at least 40 metres away from proposed access roads)
- Austroads Guidelines intersection requirements.

New access roads and site access points would be designed in accordance with Austroads and Australian Road Research Board (ARRB) guidelines for a selected design vehicle. Should the design vehicle change, further assessment would be required to ensure the suitability of the access point. Bridges and culverts along the haulage routes would also be further investigated prior to construction to ensure relevant bridge load and height limits are met to minimise safety impacts associated with heavy vehicles.

As such, it is considered that the safety impact due to increased heavy vehicle movements is minor.

19.4.6. Impacts to property access

There is expected to be minimal impacts to property access due to the rural nature of the proposal. However some properties along the proposed transmission line may be affected for short periods. In some limited circumstances, short-term restrictions for a particular property may need to be imposed, with prior consultation with the affected party.

In all instances, access to properties for residents would be maintained throughout the construction phase.

19.5. Potential impacts – operation

19.5.1. Impact on the road network

Traffic generated by the operation of the proposal would be largely associated with maintenance works, which would be minimal and infrequent. Depending on the activity, around three to 10 staff would be required to travel to and from the proposed Dinawan 330kV substation and/or the transmission line with daily movements on any typical day limited to about 10 movements. The impacts to the local road network capacity, condition and efficiency would be negligible. The proposed upgraded and expanded Wagga Wagga substation would not change the existing operational or maintenance requirements at this substation.

19.5.2. Impacts of permanent access tracks

Permanent access tracks may be constructed to support ongoing maintenance operations. However, impacts would be minimal due to the low volume of vehicles generated over this phase.

Access to the proposed easement for operational purposes would preferentially use existing public and private roads and tracks. Access easements may be required to provide Transgrid with access from the nearest public road to the easement. These access easements would be negotiated with landholders as necessary. Transgrid may install locked and signed access gates to enable access to the easement should a landholder not have a suitable existing gate nearby.

19.5.3. Impacts on active transport

The additional light vehicle traffic generated over the operational and maintenance phase of the proposal is expected to have a negligible impact on the existing active transport network.

19.5.4. Impacts on public transport

The additional light vehicle traffic generated over the operational and maintenance phase of the proposal is expected to have a negligible impact on the existing public transport network.

19.5.5. Impacts on road safety

Due to the low magnitude, the additional light vehicle traffic generated over the operational and maintenance phase of the proposal is expected to have a negligible impact on road safety for the existing road network.

19.5.6. Impacts to property access

Access to properties for residents is expected to be maintained throughout the operational and maintenance phase. Should there be a requirement for a short-term restriction for a particular property, prior consultation with the affected party would be undertaken by Transgrid.

19.6. Management of impacts

19.6.1. Environmental management

Environmental management for the proposal would be carried out in accordance with approach as detailed in Chapter 24 (Environmental management).

For construction, this would include a detailed traffic and transport management sub-plan which would be based on the final construction methodology and would form part of the CEMP. The sub-plan would be prepared in consultation with each relevant council to identify the key management and response strategies to potential delays and disruptions that may arise due to the proposal. It would include (as a minimum):

- measures to minimise disruption to pedestrians, cyclists and motorists
- management of safe vehicle access/egress from construction compounds and other construction work areas
- measures to manage oversized and overmass vehicle movements during construction, which will consider activities of adjoining land uses and safety of the public, such as entering urban areas from rural highways
- management of long-distance travel through driver fatigue management measures
- measures to ensure safe access to existing properties during construction, or provision of suitable alternatives.

19.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to traffic and access are presented in Table 19-2.

Table 19-2 Mitigation measures – Traffic and access

Reference	Mitigation measure	Timing	Applicable location(s)
TA1	A traffic and transport management sub-plan would be developed and implemented. The sub-plan would detail how potential proposal-related traffic and access impacts during construction would be minimised and managed. This plan would be prepared in consultation with the local councils and Transport for NSW.	Pre-construction and construction	All locations
TA2	The traffic and transport management sub-plan would outline the process for obtaining road occupancy licences, and preparing and implementing traffic management plans and traffic controls plans, as required by the relevant roads authority, for road works. Road occupancy licences would be obtained prior to any such occupancy.	Pre-construction and construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
TA3	Any permits required under the National Heavy Vehicle Law for oversized and overmass vehicle movements associated with the proposal would be obtained from the National Heavy Vehicle Regulator. Permit applications would be supported by a Vehicle Movement Plan prepared to identify the proposed heavy vehicle route(s). The plan would consider activities of adjoining land uses and safety of the public, particularly when entering urban areas from rural highways.	Pre-construction and construction	Construction haulage routes, access/egress points to access tracks and main construction compound and accommodation camps.
TA4	Measures that are required to address potential road safety issues associated with proposal-related use of access routes would be identified in consultation with the relevant roads authority. Any road upgrade works to facilitate construction of the proposal would be designed in accordance with Austroads guidelines as relevant. The traffic and transport management sub-plan would include a program for monitoring road safety along proposal access routes and addressing any construction-related issues identified.	Pre-construction	Construction haulage routes, access tracks, main construction compound and accommodation camp accesses
TA5	A Driver Code of Conduct would be developed and implemented. The code would define acceptable driver behaviour for proposal personnel to promote road safety and ensure that the impacts of construction-related vehicle movements on local roads and the local community are minimised.	Construction	Construction haulage routes, access tracks, main construction compound and accommodation camp accesses
TA6	Consultation with rail authorities (operators) would occur for all proposal activities required in active rail corridors. The consultation would confirm authority requirements (such as track occupancy authorisations) and necessary requirements for staff working within the rail corridor (accreditations). All works in active rail corridors would occur in accordance with the identified requirements.	Pre-construction and construction	Where the transmission line requires access within the rail corridor.

Reference	Mitigation measure	Timing	Applicable location(s)
TA7	Road condition surveys would be carried out for all local roads that would be used as construction haulage routes, in consultation with the relevant roads authority. The surveys would be carried out prior to the road being used by heavy vehicles to support construction of the proposal. A road condition monitoring and maintenance program would be developed in consultation with the relevant roads authority for all local roads used as construction haulage routes and implemented for the duration of construction. Post-construction road condition surveys would be carried out for local roads used as a construction haulage route when use by construction vehicles ceases. Damage to the roads that is attributed to the proposal would be addressed in consultation with the relevant roads authority. Roads would be reinstated to equivalent or better condition.	Pre-construction and construction	All sealed local roads (within the vicinity or 200 m of the proposal) and/or all unsealed roads on haulage routes.
TA8	A community communications strategy would be developed and implemented to manage communications in order to engage and notify local communities of major works that could disrupt the road network. The communication strategy would be developed in conjunction with the traffic and transport management sub-plan to detail the methodology, frequency and response measures in relaying information to the community and for addressing community concerns. All affected communities would be notified in advance of any disruptions to the transport network. This may be in the form of variable message signs, website notices, public notices in local publications and personal correspondence.	Pre-construction and construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
TA9	Road Occupancy Licence(s) would be sought for all temporary lane closures (as required) with the relevant roads authority prior to construction. Any road closures with significant impact, such as short-term full road closure and long-term temporary lane/road closures would be assessed on a case-by-case basis, and approval sought from the relevant road authority. Where feasible, temporary road closures are to be planned outside of the traffic peak periods to minimise impact to the road network.	Construction	All roads that intersect with the transmission line alignment (for stringing of transmission lines) or on haulage routes.
TA10	Vehicle Movement Plans would be prepared as part of the traffic and transport management sub-plan and implemented for all proposal heavy vehicle routes. The plans would identify the allowable heavy vehicle routes and include travel directions, permitted intersection turning movements, speeds, approved parking and lay-up areas, maximum allowable types/size of trucks and any traffic control required. The requirements of Vehicle Movement Plan would be communicated to all construction heavy vehicle drivers.	Construction	All roads on haulage routes, as identified in Table 4.4 of Technical paper 4.
TA11	Significant traffic generating developments in the vicinity of the proposal would be identified. Consultation would occur with those developments and the relevant roads authority regarding proposal-related vehicle movements and road works. Measures to address any potentially significant cumulative traffic and access impacts would be identified and implemented.	Construction	All locations
TA12	The appointed Construction Contractor would coordinate and appropriately manage movements on the alternative route options and communicate the changes to the affected residents and the council as part of the communication process of the traffic and transport management sub-plan. This would be implemented should local road closures be required and alternative route provided.	Construction	Local roads as identified in Table 4.4 of Technical paper 4.
TA13	A Fatigue Management Plan would be developed and implemented for proposal that addresses driver fatigue and associated regulatory requirements. This plan is to be implemented during construction.	Construction	All roads on haulage routes, as identified in Table 4.4 of Technical paper 4.

Reference	Mitigation measure	Timing	Applicable location(s)
TA14	Road and surface conditions and the traffic controls implemented at each proposal site access/egress point from the sealed road network would be monitored during construction. Any identified issues would be rectified.	Construction	Access/egress points to access tracks and the main construction compound and accommodation camps
TA15	Construction access tracks would be retained for operational access, where required and practicable in consultation with the relevant landholder.	Operation	Access tracks

19.6.3. Managing residual impacts or uncertainties

Through the implementation of the management and mitigation measures detailed in Table 19-2, residual impacts resulting from the identified transport and access impacts are anticipated to be appropriately managed without any residual impacts or uncertainties. In particular, the continued engagement with local councils would identify the required strategies to manage the predicted increase in vehicle movements on the local road networks and the appropriate measures to manage road condition (in particular on unsealed roads) due to the proposal.

20. Hazards and risks

This chapter provides an assessment of potential hazard and risk impacts of the proposal, and includes mitigation measures to address these potential hazards. This chapter summarises information in *Bushfire Impact Assessment* (Australian Bushfire Protection Planners, 2021) (refer to Technical paper 12) and *EnergyConnect Electric field and Magnetic Field Study* (Beca, 2021) (refer to Technical paper 13).

20.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to hazards and risks and where these requirements are addressed in this EIS are outlined in Table 20-1.

Table 20-1 Secretary's environmental assessment requirements – hazards and risks

Ref.	Secretary's environmental assessment requirements	Where addressed
Hazards		
Key issues	The EIS must address the following matters:	
	• an assessment of potential hazards and risks associated with electric and magnetic fields (EMF) having regard to the latest advice of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA);	Potential hazards and risks associated with EMF during operation are addressed in Section 20.5.
	• an assessment of impacts and risks to Department of Defence's Morundah Receive Station and measures required to avoid and / or minimise impacts;	Potential impacts to the Department of Defence's Morundah Receive Station are addressed in Section 20.5.4.2.
	• an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, the handling and use of any dangerous goods and potential impacts to high pressure gas pipelines	Risks to public safety, including bushfire risks, emergency egress and evacuation, dangerous goods management and potential impacts to high pressure gas pipelines are discussed as part of the construction assessment (Section 20.4) and operational assessment (Section 20.5) of this chapter.

20.2. Assessment approach

20.2.1. Legislative and policy context

The assessment of general hazards and risks focused on the potential to adversely affect human health and the quality of the surrounding environment, land uses and communities, as well as construction workers and ongoing maintenance personnel.

This included consideration of the following relevant legislation guidelines and/or standards:

- (NSW) *Work, Health and Safety Act 2011* and (NSW) Work Health and Safety and Regulation 2011 which provides work health and safety regulations for the management of contaminated waste such as asbestos as well as consideration of health and safety hazards to on-site workers associated with normal construction operations

- *Electricity Supply (Safety and Network Management) Regulation 2014* which requires network operators to take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of its network (or any part of its network) is safe and to implement safety management systems. This covers the safety of the network, people (worker and the general public), property and the environment
- *Hazardous and Offensive Development Application Guidelines*: Applying SEPP 33 (Department of Planning, 2011) (Applying SEPP 33) – presents a systematic approach to planning and assessing proposals for potentially hazardous and offensive development for the purpose of industry or storage
- *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover, 2005) – provides practical guidance and advice on how to comply with regulations
- (NSW) *Dangerous Goods (Road and Rail Transport) Act 2008* and (NSW) Dangerous Goods (Road and Rail Transport) Regulation 2014 – to regulate the transport of dangerous goods by road and rail in order to promote public safety and protect property and the environment
- *Australian Code for the Transport of Dangerous Goods by Road and Rail (Edition 7.6)* (National Transport Commission, 2018) – sets out the requirements for transporting dangerous goods by road or rail
- *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz - 100 kHz)* 2010, International Commission on Non-Ionizing Radiation Protection (ICNIRP) – the recommended guidelines from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
- Various Transgrid systems, policies and guidelines to manage hazards and risks in all stages of the delivery and implementation of its projects, including *Transmission Line Design Manual – Major New Build*, *Power System Safety Rules* (Transgrid, 2017) and *Public Electrical Safety Awareness Plan*
- *Rural Fires Act 1997* which outlines the operational role of the NSW Rural Fire Service, their functions and their powers in relation to protecting the people, infrastructure and natural environment of NSW from fire related threats
- *Planning for Bushfire Protection – 2019* (NSW Rural Fire Service, 2019) that provides and explains the legal requirements, framework and protection measures needed for all types of development on bushfire prone land in NSW
- *National Electricity Network Safety Code* (Energy Networks Australia, 2019) which, among other things, provides information on safety clearances from overhead transmission lines.

20.2.2. Methodology

20.2.2.1. General hazards and risk

A desktop assessment was undertaken to determine the potential general hazards and risk associated with the proposal. The qualitative assessment was used to identify the various construction and operational activities that may have the potential to cause risks to public health and safety (such as the use of potentially dangerous goods and materials or impacts to existing utilities).

Other work health and safety hazards are not specifically considered in this EIS. These issues would be addressed by the relevant construction contractor in accordance with relevant guidelines and legislative requirements. This includes Transgrid's *Power System Safety Rules* (Transgrid, 2017).

20.2.2.2. Bushfire

Bushfire risk is defined as the chance of a bushfire occurring that will have harmful consequences to human communities and the environment, using a range of bushfire related diagnostics detailed within Technical paper 12. Bushfire risk has two elements:

- likelihood – the chance of a bushfire occurring
- consequence – the impact of a bushfire when it occurs.

The evaluation of bushfire risk to or from the proposal are detailed in Sections 20.4.2 and 20.5.2. Risk reduction can be achieved by reducing the likelihood of a bushfire, the opportunity for a bushfire to spread or the consequence of a bushfire (on natural and built assets).

20.2.2.3. Electric and magnetic fields

Overview of electric and magnetic fields and human health

As discussed in Section 2 of the Technical paper 13, EMFs exist wherever electricity is generated, transmitted or distributed in power lines or cables, or used in electrical appliances. Electrical systems used for the transmission of electricity in Australia, including for EnergyConnect, operate at a frequency of 50 Hertz (Hz) and typically give rise to extremely low frequency (ELF) EMF in their vicinity.

ELF EMFs induce internal electric fields and currents in the body. If the external fields are strong enough, these induced electric fields can interfere with the body's nervous system causing nerve and muscle stimulation and changes in nerve cell excitability in the central nervous system.

The impact of EMF exposure on human health has been researched worldwide over decades. Many national and international review panels, set up by bodies such as the World Health Organisation (WHO), the European Commission, the US National Institute of Environmental and Health Sciences and the UK National Radiological Protection Board, have evaluated the research to assess the likelihood of health effects being associated with exposure to electric and magnetic fields. In this regard, the WHO have stated:

> *"Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals. Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields."* [1]

1 Accessed from https://www.who.int/peh-emf/about/WhatisEMF/en/index1.html on 21 July 2020.

In Australia, the ARPANSA maintains continual oversight of emerging research into the potential health effects of the EMF exposure from powerlines and other electrical sources in order to provide accurate and up-to-date advice. ARPANSA have concluded that:

> *"There is no established evidence that ELF [Extremely Low Frequency] EMF is associated with long term health effects";*
>
> *"The scientific evidence does not establish that exposure to ELF EMF found around the home, the office or near powerlines and other electrical sources is a hazard to human health"; and*
>
> *"There is no established evidence that the exposure to magnetic fields from powerlines, substations, transformers or other electrical sources, regardless of the proximity, causes any health effects[2]".*

The WHO extensively reviewed scientific literature on EMF in 2007[3]. The findings of their review are:

> *"Only acute effects have been established and there are two international exposure limit guidelines (ICNIRP, 1998 and IEEE, 2002)[4] designed to protect against these effects.*
>
> *As well as these established acute effects, there are uncertainties about the existence of chronic effects, because of the limited evidence for a link between exposure to ELF magnetic fields and childhood leukaemia[5]. Therefore the use of precautionary approaches is warranted. However, it is not recommended that limit values in exposure guidelines be reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection."*

In regards to this epidemiological research and a link to childhood leukaemia, ARPANSA state:

> *"There are problems with the methods in epidemiological studies that weaken the conclusion from these results. It is not known how magnetic fields could cause childhood leukaemia. Overall, other research including studies on cells and animals has not confirmed these results. On balance, the evidence related to childhood leukaemia is not strong." [6]*

2 Sourced from ARPANSA. 2020. Electricity and health: https://www.arpansa.gov.au/understanding-radiation/radiation-sources/more-radiation-sources/electricity
3 WHO. 2007. Environmental Health Criteria Vol. 238: Extremely low frequency fields.
4 Both these international guidelines have since been updated.
5 The International Agency for Research on Cancer (IARC) classified power frequency magnetic fields as a "Class 2B – possible carcinogen"in 2001.
6 Sourced from ARPANSA. 2020. Electricity and health: https://www.arpansa.gov.au/understanding-radiation/radiation-sources/more-radiation-sources/electricity

Other potential health effects associated with long-term exposure have been studied including other childhood cancers, cancers in adults, depression, suicide, cardiovascular disorders, reproductive dysfunction, developmental disorders and neurodegenerative disease, amongst others.

Major reviews by the WHO (2007), ICNIRP (2010) and European Commission (2015) identified that the scientific evidence supporting these other health effects is very weak or does not support it at all. This is discussed further in Section 2.3 of the Technical paper 13.

Management of electric and magnetic fields

Transgrid's position on EMF exposure, in general and specifically for the EnergyConnect, has been adopted in the light of the above findings and similar findings from other authoritative reviews. Consistent with WHO's precautionary advice, Transgrid adopts a policy of "prudent avoidance[7]" towards EMF. This is in addition to ensuring compliance with ARPANSA recommended exposure guidelines provided by ICNIRP, discussed further below. The adoption of prudent avoidance towards EMF is consistent with the guidance provided by WHO (2007):

> *"Provided that the health, social and economic benefits of electric power are not compromised, implementing very low cost precautionary procedures to reduce exposure is reasonable and warranted."*

The techniques that are available to reduce EMF exposures associated with transmission lines relate to the characteristics of EMF and can be summarised as:

- the reduction of field levels with distance from their source
- mutual cancellation of the fields from different phases.

As detailed in the corridor selection methodology for the proposal, provided in Section 3.3.1, the corridor selection process included the consideration and selection of a corridor that maximises distances to dwellings and inhabited areas wherever possible.

Low reactance phase arrangements would also be utilised for the proposal to allow mutual cancellation of the fields from different phases.

Compliance with ARPANSA recommended exposure guidelines

ARPANSA is the responsible agency in Australia for advising on exposure limits to EMF. ARPANSA has adopted the ICNIRP guidelines for limiting exposure to EMF, published in 2010. The ICNIRP guidelines are one of two international guidelines recognised by WHO and can be considered international best practice.

The ICNIRP guidelines set fundamental limits on electrical fields induced in the body by EMF. The limits which are expressed in terms of induced electric fields in the body are termed 'Basic Restrictions'.

7 In Australia, prudent avoidance was defined by the former Chief Justice of the High Court of Australia, Sir Harry Gibbs, as "doing whatever can be done at modest cost and without undue inconvenience to avoid the possible risk to health" Gibbs, Sir Harry (1991)

As Basic Restrictions can only be assessed by sophisticated computer modelling of the body, ICNIRP also sets 'Reference Levels', expressed in terms of kilovolts per metre (kV/m) and microtesla (μT) or milligauss (mG) for external EMF respectively. These levels are conservatively set such that, provided they are met, the Basic Restrictions would also be met without the need for more comprehensive analysis.

While the magnetic fields from high voltage transmission lines are normally well below the ICNIRP Reference Level, the electric fields may not be.

The ICNIRP Guideline Basic Restrictions and Reference Levels for exposure of the public are summarised in Table 20-2. These limits apply to members of the general public both children and adults. It includes individuals of all ages, and of varying health status, and this would include particularly vulnerable groups or individuals such as the frail, elderly, pregnant workers, babies and young children (definition provided from ICNIRP guidelines).

Table 20-2 EMF exposure guidelines for the general public

Field		Level
Basic restriction	Central nervous system tissues of the head	0.02 V/m
	All tissue in the head and body	0.4 V/m
Reference level guidelines	Electric field	5 kV/m
	Magnetic field	200 μT / 2000 mG

It is Transgrid policy to comply with the ICNIRP guidelines at all times and to meet the general public Reference Level for electric fields (5kV/m) where possible. However, as transmission lines of 330kV and higher can exceed the Reference Level in some locations, it is necessary to assess them further to determine compliance with the Basic Restrictions.

Accordingly, Transgrid commissioned a specialist consultant (Exponent Inc.) in 2020 to undertake an analysis to assess compliance with the Basic Restrictions. Based on this analysis, Transgrid has established that for 330kV and 500kV transmission lines, an electric field of 9.1kV/m would comply with the ICNIRP Basic Restriction (refer to Technical paper 13). The magnetic fields from high voltage transmission lines are normally well below the ICNIRP Reference Level. A summary of the exposure levels determined for the design of the proposal are summarised in Table 20-3.

Table 20-3 EMF exposure limits determined for the proposal (general public)

Field	Level
Electric field	9.1kV/m (meets ICNIRP Basic Restriction)
Magnetic field	200 μT / 2000 mG (the ICNIRP Reference Level)

The proposal has been assessed for compliance to the ICNIRP Guidelines in Table 20-2 for the following scenarios:

- time weighted average electrical loading which represents a typical daily average electrical load with both circuits of the proposal in service
- contingency scenario, which represents one circuit of the proposal in service with a higher electrical current and minimum ground clearance sag. This scenario would only occur for short periods on rare occasions.

The presentation of the findings of the assessment is summarised in Section 20.5.4 and detailed in Section 3 of Technical paper 13.

20.2.2.4. Safety in design considerations

Safe design means the integration of control measures early in the design process to eliminate or, if this is not reasonably practicable, minimise risks to health and safety throughout the life of the structure being designed (NSW *Work Health and Safety Act 2011*). It encompasses all design functions including facilities, hardware, systems, equipment, products, tooling, materials, energy controls, layout, and configuration. It is a design process aimed at achieving a balance of design objectives including practicability, cost and functionality without compromising the health and safety of those potentially affected by the product over its life.

The proposals' design has been developed by using these principles, incorporating safety considerations for construction teams, maintenance teams, landholders whose land the infrastructure would be located on, and for the community in general, together with functionality and performance to achieve the proposal's design objectives. The design process has included hazard identification, risk assessment and risk control processes to achieve safe design and eliminate hazards or minimise risks as early as possible.

The finalisation of the proposals' design would be completed using the following principles:

- completing risk assessments in developing the final design, and incorporating appropriate risk controls into the design
- incorporating safety measures into the design so that the proposal can be operated and maintained safely
- selecting the appropriate materials to be used
- developing safe methods of construction, maintenance, operation, safety testing, demolition and disposal for the entire lifecycle
- complying with relevant legislation, codes of practice and standards.

20.3. Existing environment

There are inherent hazards or risks in the existing environment relevant to the proposal study area including:

- periods of extreme weather (primarily temperature related)
- road traffic incidents/risk of road traffic events which have the potential to cause injury
- electricity, given the presence of existing power lines within the proposal study area
- bushfire.

With regard to bushfire risk, the proposal study area traverses two main types of landscapes:

- while heavily modified and disturbed, the portion of the proposed transmission line easement between Buronga and Balranald contains areas of remnant vegetation including Mallee Woodlands of mixed age, Low Open Chenopod shrub land dominated by stretches of heavily grazed and degraded to highly degraded low open chenopod of Black-bush. The fuel hazard of these areas would depend on the type of vegetation, its level of management and/or time that has lapsed since the most recent modification (e.g. fire or grazing). A review of the vegetation in and adjoining the proposal study area has determined that the Mallee Woodland, when not managed, could present between a high and extreme fuel hazard risk

- the eastern portion of the bushfire study area typically traverses areas of rural land, and land that has been developed primarily for agricultural uses such as dry-land grazing and farmland cropping (such as wheat and canola). Unmanaged grassland and cured (dry) crops could present a high to very high fuel hazard risk.

Further detail of the potential bushfire fuel hazards within the proposal study area is provided in Section 4.3.5 of Technical paper 12.

In addition, the western end of the proposal study area includes the Morundah Receiver Station (defence communications receiver facility). This site includes a 22-kilometre radius buffer surrounding the Morundah facility. Under the Urana and Lockhart LEPs, developments within this buffer that include of transmission lines of 66kV (or above) are prohibited without the consent of the Secretary of the Department of Defence (refer to Figure 20-2).

20.4. Potential impacts – construction

During construction, potential hazards and risks to the surrounding community or environment may be associated with:

- the on-site storage, handling and transport of dangerous and hazardous goods, contaminated soil and hazardous waste
- potential bushfire risks
- potential interaction with existing utilities, including existing electrical transmission lines and a high-pressure gas main
- changes to emergency egress and excavation routes.

These are described further in the following sections.

20.4.1. Dangerous goods and hazardous materials

During construction, various hazardous materials and chemicals would be required to be used and/or stored on site.

Typically, hazardous materials and chemicals which would be utilised during construction would include (but not limited to):

- acetylene
- adhesives, glues, epoxies etc.
- concrete and other mortar products
- contact cleaners
- cold-galvanising spray
- fuels, oils and lubricants (such as diesel, unleaded petrol, thinners, etc.)
- paints and other paint markers.

The main construction compounds and other ancillary construction sites would be sited and arranged so that hazardous materials are stored appropriately and at a suitable distance from any nearby sensitive receivers or accommodation elements of each camp, in consideration of the risk thresholds established under Applying SEPP 33 guidelines (noting that the provisions of SEPP 33 do not strictly apply to the proposal given its CSSI status).

Establishing suitable buffer distances to sensitive receivers is expected to be achieved, given the nature of the proposed study area. However, in the event that minimum distances cannot be achieved (e.g. due to land constraints, or a requirement to store volumes of hazardous materials in excess of storage thresholds), a risk management strategy would be developed as required to confirm that the proposal would not have a significant off-site risk.

Environmental hazards and risks associated with the on-site storage and use of chemicals, fuels and materials would be managed through standard mitigation measures that would be developed as part of the CEMP. Storage of dangerous goods and hazardous substances would be in accordance with the supplier's instructions, and would comply with applicable legislation, guidelines and Australian Standards. This includes the (NSW) *Work Health and Safety Act 2011*, the (NSW) Work Health and Safety Regulation 2017 and the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005).

Dangerous goods would be transported to and from the proposal study area in accordance with the (NSW) *Dangerous Goods (Road and Rail Transport) Act 2008* and (NSW) Dangerous Goods (Road and Rail Transport) Regulation 2014, and extended routes would avoid areas (such as road tunnels) prohibited by NSW Road Rule 300-2 (carriage of dangerous goods in prohibited areas), and the equivalent legislation of SA and Victoria.

The proposal may also require the handling and transport of contaminated soil, hazardous waste and asbestos waste. The handling and transport of contaminated soils, hazardous waste and asbestos waste would be adequately managed by the measures identified in:

- Chapter 21 (Soils, contamination and groundwater)
- Chapter 22 (Waste management and resource use).

20.4.2. Bushfire impacts

During construction the bushfire ignition risk associated with the proposal, by definition, would generally only exist in those areas that are capable of supporting a bushfire. In general, the risk of bushfire impact on the proposal study area during construction would be between high and extreme (without any proposed mitigation) and would be dependent on factors such as fuel loads, weather at the time of a potential ignition and the scale (size) of fire that may occur.

Should a fire start, there would be a potential threat to construction personnel, especially where the bushfire event is fast moving such as a grassland fire, and has the potential to impact on large or multiple sections of the proposal during construction.

The potential sources of ignition of bushfires resulting from the construction of the proposal include:

- construction equipment including bulldozers, excavators and cranes – The use of heavy construction equipment including bulldozers and excavators for building roads, excavating pads and drilling bore holes would have the potential to create situations where these activities can give off sparks when steel blades encounter rock, resulting in a high level of risk of ignition of vegetation. This risk can occur over a wider area from the machine operational area

- motor vehicles – Motor vehicle exhaust systems are known to ignite grassland vegetation. Diesel powered trucks with pollution control devices in the exhaust system would have the potential to emit burning diesel particles which ignite grassland vegetation and forest ground fuels, resulting in a high level of risk of ignition of vegetation. There is also risks associated with collision of a vehicle with a power pole or infrastructure that can result in either a spark, arc from a power supply or fire from spilt fuel being ignited

- vegetation removal including mulching – The use of specialised slashers, mulching machines and bulldozers used for clearing vegetation would have the potential to create high risk situations where blades come into contact with rock outcrops. Where this occurs, there is the potential to result in sparks that may ignite surrounding materials. Mulch storage may also present a bushfire risk if a large volume of material is stored in a large pile for an extended period of time. The ability of mulch to self-combust, the production of methane (includes the potential for explosion) under favourable conditions and the potential for arson attack all contribute to the potential bushfire risk associated with storing mulch. Mulch may be used as a landscaping material or it may be generated during the proposals construction phase when removing and chipping of existing vegetation along the route

- hot works – Hot works undertaken such as welding, grinding, drilling can produce sparks which have the capacity to spread for some distance on the wind, resulting in an extreme level of risk of ignition of cured (dry) vegetation

- electrical faults in equipment – Electrical faults, including faulty power leads and generators also create a high level of risk of ignition of vegetation

- chemical fires – The inappropriate storage of incompatible or flammable chemicals have the potential to cause a chemical fire or explosion. The failure to clean up a flammable chemical spill or address leaking containers can also lead to a fire

- activities at the main construction compounds and accommodation camps, such as external cooking, electrical faults and inappropriate discarding lit cigarettes

- activities involving blasting works which may lead to ignition of the surrounding vegetation

- human activity/arson – A malicious act (e.g. arson) can occur where-ever human activity occurs and can result in high risk to the proposal and the operators of the equipment. Other potential causes of ignition are the inappropriate actions of individuals such as discarding lit cigarettes, matches or hot metal into a general waste bins etc.

20.4.3. Impacts to utilities

The proposal would require adjustment and/or upgrades to existing electrical infrastructure, and in certain cases, the decommissioning of existing infrastructure, which could pose hazards to the general community if not properly managed. As identified in Section 6.6.1, the following utility relocation and protection works are proposed as part of the proposal:

- realignment of the existing TL62 (Wagga – Jindera 330kV), TL63 (Wagga – Darlington Point 330kV) and TL51 (Wagga – Lower Tumut 330kV) transmission lines outside the Wagga Wagga substation to make way for the proposed transmission line from Dinawan. This is to make way for the proposed 330kV Dinawan transmission line (the proposal)
- conversion of overhead distribution powerlines up to and including 66kV to underground cables for the entire width of the transmission line easement, at locations where the existing powerlines cross the proposed transmission line easement. Alternately, hurdles may be erected to protect overhead lines that are unable to be undergrounded.

Potential clashes with other utility assets along the alignment have also been identified for assets such as various telecommunications and water utility assets. While the proposal would cross these utilities, it is expected that the final locations for each tower would be able to be situated so as not to impact on these utilities.

Construction methodologies for construction activities that interact directly with the identified electrical infrastructure that requires modification (or works that are in close proximity to active electrical infrastructure) would be developed to comply with relevant legislative requirements, as well as Transgrid robust systems, guidelines and procedures. This includes:

- Electricity Supply (Safety and Network Management) Regulation 2014
- Transgrid's Electrical Network Safety Management System
- *Transgrid's Public Electrical Safety Awareness Plan*.

The proposal is also known to cross an existing high-pressure gas main operated by APA Group (the Wagga Wagga to Culcairn pipeline) that runs in a generally north-south alignment to the west of the Olympic Highway (refer to Figure 20-1). This pipeline is an existing 450-millimetre diameter high-pressure gas transmission pipeline which sits within a 24-metre wide easement within existing Lot 1, DP1082889.

The proposal has sought to locate the towers either side of this pipeline (at a distance of between 140 metres and 165 metres for the closest towers either side of the pipeline based on the current design) to avoid the gas main and avoid the need for any protection works. The proposal has also been designed to cross the pipeline as a perpendicular crossing (as far as possible) to minimise interaction with the pipeline (and associated easement). Transgrid would continue to consult with APA Group as the asset owner and would continue to develop the required construction/protection methods required to undertake the proposed work within the vicinity of this asset as required.

It is also noted that electrical works near gas pipelines (including crossings such as with the proposal) have the potential to impact on the pipelines' safe operation. Appropriate design of the proposal in consideration of the existing pipeline would be undertaken as part of the finalisation of the proposals design in accordance with *Electrical Hazards on Metallic Pipelines – AS 4853:2012* (Standards Australia, 2012) and *Cathodic Protection of Metals Part 1: Pipes and Cables – AS2832.1:2015* (Standards Australia, 2015).

The need to adjust or relocate other utilities during construction is considered to be minimal. The relocation and/or protection of utilities would occur prior to the commencement of construction to avoid impacts where possible. Otherwise relocation and protection would occur during construction. Consultation with utility infrastructure providers who own and/or operate existing utility assets within the vicinity of the proposal has been commenced and would continue during the finalisation of the design and construction of the proposal to mitigate the risk of unplanned and unexpected disturbance of utilities. In rare circumstances, the relocation of utilities (which may not be currently foreseen) may result in short term outages of some utilities to surrounding areas during the work required to adjust or relocate these assets.

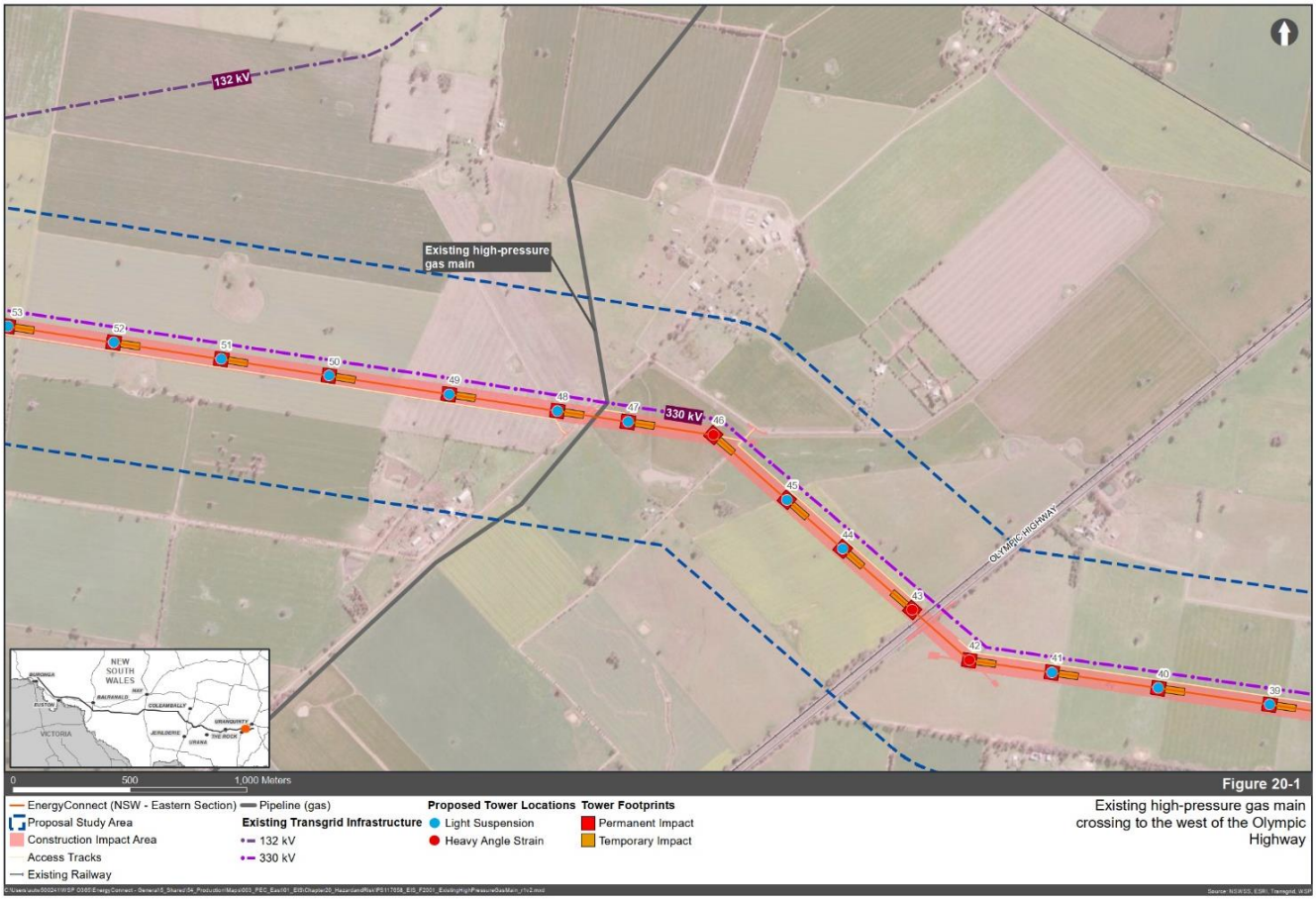


Figure 20-1 Existing high-pressure gas main crossing to the west of the Olympic Highway

20.4.4. Impacts to emergency vehicles egress and evacuation

There may be temporary detours that would result in some localised road detours during construction (such as when stringing transmission lines across major roadways). However, these would be of planned and short-duration. There is not anticipated to be any substantial change to emergency vehicle access. Construction areas would be arranged so that emergency vehicles access and evacuation routes are maintained, and if required, made available for emergency vehicle passage. Consultation would be carried out with emergency service providers in relation to changed traffic conditions and/or access points to the proposal study area.

20.5. Potential impacts – operation

During operation, potential hazards and risks to the surrounding community or environment may be associated with:

- the on-site storage, handling and transport of dangerous and hazardous goods (such as within the Dinawan 330kV substation)
- potential interaction with new or upgraded infrastructure
- EMF associated with the operation of the new transmission lines
- RFI associated with the operation of the new transmission lines
- potential bushfire risks.

These are described further in the following sections.

20.5.1. Dangerous goods and hazardous materials

During operation of the proposal, limited hazardous materials and chemicals would be required to be maintained on site at the proposed Dinawan 330kV substation and Wagga Wagga substation. Potential materials which would be required are summarised below:

- insulating oil
- weed control chemicals
- unleaded fuel.

The materials and chemicals would only be required in small amounts and below the thresholds in Applying SEPP 33. Additional small quantities of other materials may be required on-site from time to time to support occasional maintenance activities.

Further, the substation would include a separate drainage system to capture oil spills. In such an event, the spill would be contained, pumped and disposed of at a licensed facility.

Managed in accordance with the measures in Section 20.6, these materials would not pose a substantial risk to the general public during operation of the proposal.

20.5.2. Bushfire impacts

Hazards related to the operational phase would typically be grouped in to impact to infrastructure from bushfires, and impact of bushfires occurring from infrastructure operation. These impacts are summarised below.

20.5.2.1. Bushfire risk to the proposed transmission lines during operation

There is a high probability that the proposed transmission lines could be impacted by a bushfire/grassland fire when ignition occurs in any unmanaged vegetation during periods of high fire danger, when excessive dry (cured) fuel is available and/or weather conditions result in high temperatures, low humidity and strong winds travelling across the landscape (particularly from the northwest, west and southwest directions).

The transmission line towers would be up to 60 and 65 metres tall for both the 330kV and 500kV towers respectively and constructed from steel, which is a non-combustible material. This means that the towers would be high enough above the ground so that fires occurring within the grassland and woodland vegetation surrounding the proposed cleared area of the easement (refer to Section 5.4) would not be expected to generate sufficient flame height to directly impact the conductors with flame contact.

The towers and conductors would however have the potential to be impacted by radiant heat from these fire occurrences. Given the width of the proposed cleared area within the easement, the levels of radiant heat is not likely to impact upon the integrity of the tower, the conductors and their connectors (insulators).

The risk to the transmission lines under these conditions would be dependent on the scale (size) of the fire. Without mitigation, the potential risk from large scale fire events would be high to extreme. The residual risk of bushfire on the transmission lines and their supporting structures (with the maintenance regime outlined in Section 5.4 of this EIS implemented) is considered to be moderate.

20.5.2.2. Bushfire risk created by the proposed transmission lines during operation

The distribution of electricity via high voltage transmission lines and associated equipment has the potential to cause ignition of bushfire fuels, either within or adjoining the transmission line easement. Ignition sources which could be attributable to high voltage transmission lines and associated equipment include:

- trees or tree branches falling/touching conductors and bird strikes
- equipment malfunction – transmission line failure including damage caused by high winds, lightning strike or mechanical damage (i.e. aircraft strike)
- wind causing transmission lines to contact each other
- arc to ground and arc between conductors caused by Ionise particles in dense bushfire smoke
- heat causing power lines to sag and connect with the ground/vegetation/structures
- lightning strikes
- human error – faulty installation
- failure of power line including breakage of wires, poles, cross arms, insulators and associated equipment
- pole-top fires caused by dust build up on insulators, causing arcing from the conductor to the tower/cross arm
- electrically induced fire – current or voltage transfer due to fault and failure of the earthing system at transmission line structures.

The incidence of these ignition sources from transmission lines supported on high towers which are maintained clear of trees and combustible materials would be rare. However, if an ignition occurs during prolonged drought conditions when combustible fuels are available, the risk of ignition would be high, necessitating monitoring and rapid response to any incident/emergency that is likely to cause line failure.

The bushfire risk from the transmission lines infrastructure to the surrounding environment would therefore be moderate.

20.5.2.3. Bushfire risk associated with the Dinawan 330kV substation during operation

The proposed Dinawan 330kV substation site is located adjoining only agricultural grazing land. With the implementation of the proposed protection/mitigation measures (including reduction in fuel loads, management of APZs and inspections of infrastructure in accordance with *Transgrid's Bushfire Risk Management Plan*), the potential bushfire risk to the substation is considered to be low to moderate.

The generation and distribution of electricity also has the potential to cause fire ignition within the Dinawan 330kV substation. Ignition sources would include:

- equipment malfunction – transformer explosion; burn out of motors/fans; wiring failure
- human error.

The incidence of equipment malfunction would be highly rare but may include:

- transformers having the potential to explode and have the potential to spread molten metal and burning oil for some distance from the transformer
- fans and motors failing with the potential impact restricted to localised sparks and in some cases, the shedding of hot/molten metal
- overhead wiring failure which would be uncommon and is usually the result of physical damage from lightning strikes or sparks given off during light rain, as a result of dust build up on the insulators over extended dry periods.

The extent of the proposed clearance between the proposed Dinawan 330kV substation equipment and the compound fence, combined with the gravel ground cover within the compound, would mitigate the risk of the transfer of an ignition within the substation site to any surrounding vegetation.

The bushfire risk from the operation of the substation is considered to be low to moderate.

20.5.2.4. Bushfire risk associated with the Wagga Wagga substation during operation

The potential bushfire risks associated with the upgrade and expansion of the existing Wagga Wagga substation are not expected to change from the current operation of the substation.

20.5.3. Electric and magnetic fields

20.5.3.1. Transmission lines

The new transmission line infrastructure that would be delivered as part of this proposal would be designed to meet EMF exposure guidelines set out in Table 20-2 and described in Section 20.2.2.

The assessment of the proposal concept designs (as presented in Technical paper 13) found that:

- the magnetic field levels directly under the proposed line are within the ICNIRP general public exposure reference level of 200 µT (2,000 mG) in all cases, including during the contingency case of one circuit in service with increased loads
- the electric field levels directly under the proposed transmission lines are below 9.1kV/m which, as detailed in Section 20.2.2, has been shown to satisfy the ICNIRP Basic Restriction of 0.02 volts per metre (V/m) in all cases, based on the minimum ground clearance for the proposed lines. The minimum clearance is typically at the middle of the span between towers where the conductor is at its lowest, and the majority of the line is well above this clearance.

The minimum ground clearance only applies when the line is running at its maximum rating, which occurs in the contingency case in hot weather conditions only.

The assessment of maximums has been calculated for the concept design of the proposal transmission lines for the following cases:

- within the proposal easement
- outside of the proposal (or existing) easement(s)
- where existing transmission lines are adjacent and parallel to the proposal
- at crossing locations of the proposal with existing transmission lines.

The results of each of the above are provided in Technical paper 13 and in Table 20-4 to Table 20-9.

The results in Table 20-6 to Table 20-9 provide a cumulative assessment of EMF where existing or known future lines (such as the proposed 220kV line that forms part of the EnergyConnect (NSW – Western Section) run adjacent and parallel or cross under the proposed transmission line.

The EMF levels presented would be recalculated during the finalisation of the proposal's design following refinement of the tower geometries. Differences are likely to be small and in all cases would remain compliant with EMF exposure guidelines set out in Table 20-2.

Table 20-4 Maximum calculated EMF within the proposal easement

Transmission Line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic flux density (mG[1])	Electric field strength (kV/m)	Magnetic flux density (mG[1])
330kV	6.32	272	4.65	99
500kV	7.96	627	5.59	176

1. 1 microtesla (µT) equals 10 milligauss (mG).

Table 20-5 Maximum calculated EMF at the edge of the proposal easement

Transmission Line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic flux density (mG)	Electric field strength (kV/m)	Magnetic flux density (mG)
330kV	0.19	35	0.07	6.50
500kV	1.41	146	1.33	43.31

Table 20-6 Maximum calculated EMF where existing transmission lines are adjacent and parallel to the proposal

Transmission Line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic flux density (mG)	Electric field strength (kV/m)	Magnetic flux density (mG)
New 330kV parallel with circuit X5	6.33	357	4.66	219
New 330kV parallel with circuit X3	6.33	357	4.66	219
New 330kV parallel with circuit X3 & new 220kV[(1)]	6.33	440	4.66	217
New 500kV parallel with circuits 62 & 63	7.96	618	6.43	331
New 500kV parallel with circuit 63	7.93	647	6.44	345
New 500kV parallel with circuit 99A	7.96	626	5.59	177

1. The proposed 220kV line that forms part of EnergyConnect (NSW – Western Section)

Table 20-7 Maximum calculated EMF outside easements (proposal or existing) where existing transmission lines are adjacent and parallel to the proposal

Transmission Line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic flux density (mG)	Electric field strength (kV/m)	Magnetic flux density (mG)
New 330kV parallel with circuit X5 (220kV)	0.43	39	0.52	37
New 330kV parallel with circuit X3 (220kV)	0.43	39	0.52	37
New 330kV parallel with circuit X3 & new 220kV(1)	0.44	36	0.52	37
New 500kV parallel with circuits 62 & 63 (330kV)	2.08	221	1.45	82

Transmission Line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic flux density (mG)	Electric field strength (kV/m)	Magnetic flux density (mG)
New 500kV parallel with circuit 63	1.07	144	1.33	79
New 500kV parallel with circuit 99A	1.41	146	1.33	43

1. The proposed 220kV line that forms part of EnergyConnect (NSW – Western Section)

Table 20-8 Maximum calculated EMF at crossing locations of the proposal with existing transmission lines

Transmission Line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic flux density (mG)	Electric field strength (kV/m)	Magnetic flux density (mG)
New 330kV crossing circuit X5	9.04	358	8.85	255
New 330kV crossing circuit 99L (132 kV)	6.32	244	4.83	182
New 500kV crossing circuit 996 (132 kV)	7.37	506	5.52	301
New 500kV crossing circuit 62	8.98	657	7.78	344
New 500kV crossing circuit 99A (132 kV)	6.80	450	5.47	222

Table 20-9 Maximum calculated EMF at crossing locations of the proposal with existing transmission lines outside any transmission line easements

Transmission Line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic flux density (mG)	Electric field strength (kV/m)	Magnetic flux density (mG)
New 330kV crossing circuit X5	1.15	50	0.93	28
New 330kV crossing circuit 99L (132 kV)	0.62	50	0.66	27
New 500kV crossing circuit 996 (132 kV)	1.77	157	1.42	51
New 500kV crossing circuit 62	3.33	251	2.81	106
New 500kV crossing circuit 99A (132 kV)	2.63	180	1.93	70

20.5.3.2. Proposed Dinawan 330kV substation

The Dinawan 330kV substation would be enclosed by a security fence and access within the substation would be controlled to authorised persons only. The substation would be designed to ensure that the EMF in accessible areas within it would comply with the relevant ICNIRP guidelines.

The substation design would also ensure that the electric and magnetic field levels outside the substation are below the ICNIRP guideline Reference Levels for the general public. Given the above, and its relatively remote location, some 4.5 kilometres from the nearest dwelling, it is not expected that the proposed substation would result in any potential health risk.

20.5.3.3. Upgraded and expanded Wagga Wagga substation

The additional electrical equipment proposed to be installed to accommodate the upgraded and expanded Wagga Wagga substation is not expected to change the overall EMF impacts associated with the existing operation of this substation.

20.5.4. Radio frequency interference (RFI)

20.5.4.1. Potential interference with high precision agricultural systems

The high Surface Voltage Gradients (SVG) on the transmission line conductors would result in the ionisation of the air in a small region surrounding the conductor surfaces. These partial discharges, known as corona discharges, would produce RFI in public areas at ground level inside and outside the transmission line easement.

RFI limits in the design of transmission lines are defined in *AS2344:2016 Limits of electromagnetic interference from overhead a.c. powerlines and high voltage equipment installations in the frequency range 0.15 MHz to 3000 MHz*. This standard is for the protection of radio and television reception for perceived annoyance to music listeners, who are most sensitive to even low levels of interference. Higher RFI emission levels may be tolerable for less sensitive receivers or where there is greater tolerance for reduced intelligibility or increased annoyance (e.g. voice only communication channels).

In consultation with affected stakeholders, anecdotal reports of interference with high precision agricultural systems have been raised. A desktop review has identified that these high precision systems use a combination of GPS Signals, unaffected by RFI from transmission lines, and VHF signals from local base stations, with the VHF signals possibly subject to RFI from the proposed transmission lines.

Field studies of this phenomena are ongoing to determine the cause of this issue. Once the cause has been determined, the design of the proposal would seek to eliminate the source of the issue if practical or to mitigate its effect through the use of signal boosting equipment, active antennas or similar. Transgrid would provide mitigation measures (such as signal boosting equipment) in consultation with the affected landholder (refer to mitigation measure LP11).

20.5.4.2. Potential impacts to the Morundah Receiver Station buffer

Advice from initial consultation with the Department of Defence noted that the Morundah Receiver Station is required to receive signals at very low power levels and therefore the signals are very susceptible to outside RFI resulting from local background electromagnetic radiation. The Morundah Receiver Station site was specifically selected to make sure the amount of RFI is not excessive and therefore the level of the noise is low. In order to minimise interference, it is therefore preferable that new projects try to limit interference by complying with the identified exclusion zones to ensure that the level of background radio frequency noise remains appropriately low.

In finalising the route selection for the proposal, the project team engaged with the Australian Department of Defence providing technical advice regarding its facility including identification of the exclusion zone.

In order to mitigate potential impacts to this facility from the proposal, Transgrid have progressed with a transmission line easement that does not encroach into the identified buffer zone identified by the Department of Defence for the Morundah Receiver Station site as shown by the proposal alignment on Figure 20-2. As such, impacts from the proposal on the Morundah Receiver Station are not anticipated.

20.5.5. Impacts to emergency vehicles egress and evacuation

The operation of the proposal would not have impacts on emergency vehicle egress or evacuation routes.

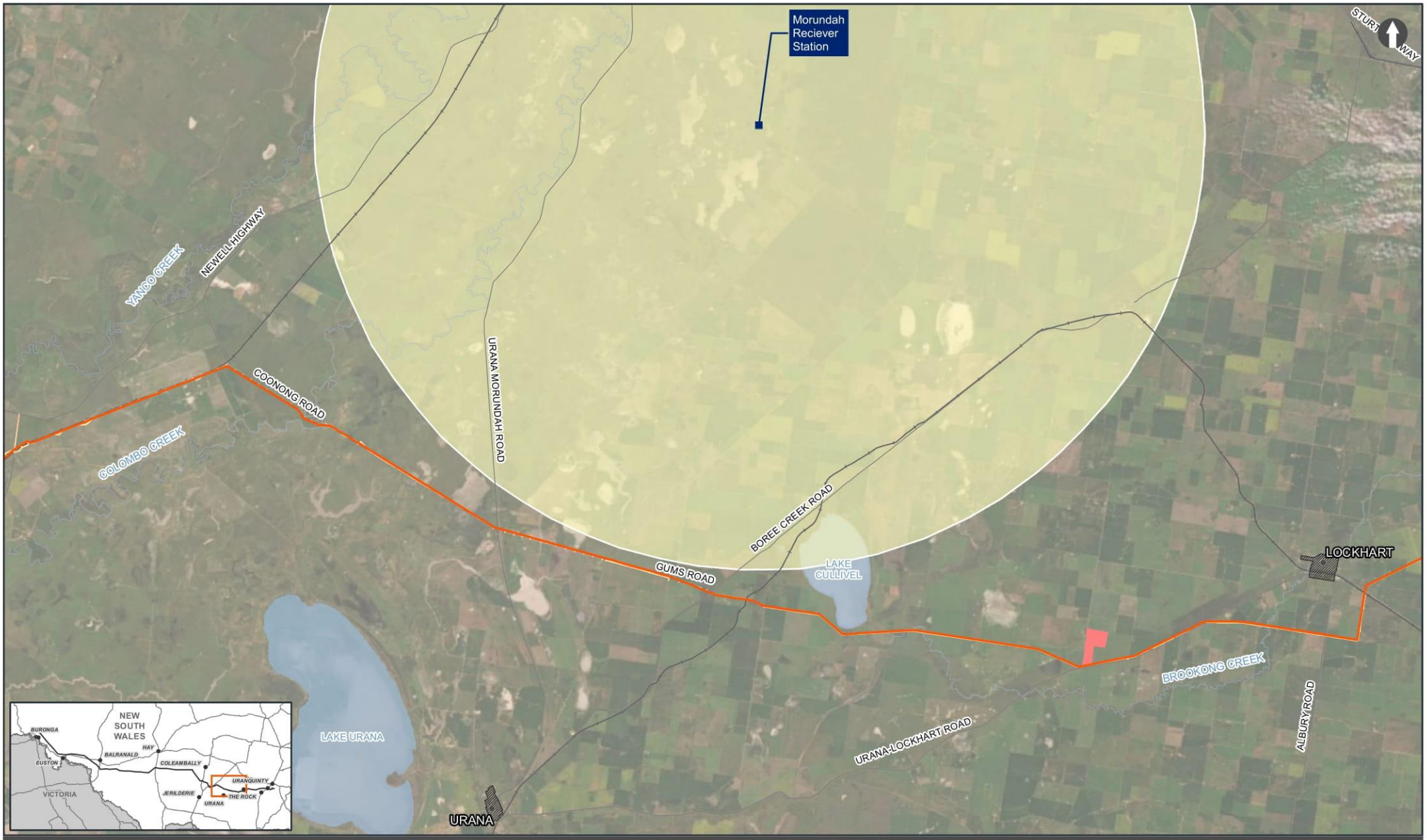


Figure 20-2

Morundah Defence Facility zone buffer in relation to the proposal

20.6. Management of impacts

20.6.1. Environmental management

Environmental management for the proposal would be carried out in accordance with approach as detailed in Chapter 24 (Environmental management).

Hazards and risks would be managed in accordance with Transgrid's Electricity Network Safety Management system, policies and guidelines. This would seek to avoid, to the greatest extent possible, risks to public safety and achieve the desired outcomes in relation to the hazards identified in this chapter.

A bushfire risk management sub-plan would be prepared for construction of the proposal, including:

- protocols for the relocation of workers to nominated safe refuge zones during a bushfire emergency, either within or remote to the work zone (Bushfire Emergency and Evacuation Plan (BEEP))
- protocols for the management of bushfire risk and fuel management during construction. This would include restriction and/or prevention of certain activities that present bushfire risks on days with a fire danger rating of equal to or greater than 'high', and as directed by relevant state authorities
- training to inform construction workers of bushfire risks and preventative actions, including risks associated with the operation (and maintenance) of vehicles, plant and equipment.

The CEMP would also include strategies and measures for:

- management of hazardous materials and dangerous goods
- management of other hazards and risks to the general public and the environment.

20.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to hazards and risk are presented in Table 20-10.

Table 20-10 Mitigation measures – hazards and risk

Reference	Mitigation measure	Timing	Applicable location(s)
HR1	The proposal would be designed and constructed in accordance with the *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz) – 100 kHz)* (ICNIRP, 2010) The design would meet the EMF exposure guidelines set out in Table 19-2 of the EIS and worst case scenarios within Transgrid's *Transmission Line Design Manual – Major New Build*.	Pre-construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
HR2	A minimum 50-metre-wide managed APZ would be provided to the hazard perimeter of the fixed construction equipment and camp site buildings unless an alternative fire protection approach that achieves the same level of bushfire risk management is identified by a suitably qualified specialist. Any APZ would be regularly maintained to provide a maximum grass height of 100 millimetres – 150 millimetres during the prescribed Bushfire Danger Period and when the grassland fuel reaches 70 per cent cured. Vegetation inside the main construction compounds and accommodation camp sites would be regularly maintained to a maximum height of 75 millimetres.	Pre-construction and construction	Main construction compounds and accommodation camps
HR3	Buildings within the construction compound and camp site would be constructed to comply with Section 3 and Section 5 (BAL 12.5) of *Construction of Buildings in Bushfire Prone Areas – AS 3959:2018* (Standards Australia, 2018). The sub-floor space of each building would be enclosed with stainless steel flymesh securely fixed to the external wall(s) and buried into the ground, unless an alternative fire protection approach that achieves the same level of bushfire risk management is identified by a suitably qualified specialist.	Pre-construction and construction	Main construction compounds and accommodation camps
HR4	Water for fire-fighting operations would be confirmed prior to during construction with consideration to occupancy density and site layout. This would include onsite static water supply and fire-fighting hose reels when working in areas where vehicles may travel through environments such as areas of: • known rocks where equipment such as bulldozers and excavators may create sparks • long cured (dry) vegetation (grass and crops). All weather access having a minimum width of four metres would be provided to the static water supply tanks.	Pre-construction and construction	Main construction compounds and accommodation camps
HR5	Appropriate construction methods and protection measures for crossing of the high-pressure gas transmission pipeline west Olympic Highway would be confirmed in consultation with APA Group and implemented during construction activities in the vicinity.	Pre-construction and construction	High-pressure gas transmission pipeline crossing, west of Olympic Highway
HR6	Security measures would be implemented to minimise the risk of ignition leading to bushfire(s). Sources of potential ignition would be secured at the end of each shift or as sites are left unattended.	Construction	Main construction compound and accommodation camp sites

Reference	Mitigation measure	Timing	Applicable location(s)
HR7	Consultation with emergency services (the NSW Rural Fire Service and Fire and Rescue NSW) would be undertaken prior to construction to ensure emergency access provisions are provided during operation.	Construction	All locations
HR8	Prior to occupation of the construction camps and offices, all bushfire protection and mitigation measures would be certified as compliant with relevant regulatory requirements by a suitably qualified bushfire consultant.	Construction (prior to camp occupation)	All locations
HR9	Controls to minimise potential ignition of vegetation would be implemented and a water supply (suitable extinguisher) and trained operator on hand during all outdoor hot works/grinding activities, and during vegetation slashing within and adjacent to the construction compounds and accommodation camps. No outdoor hot works would be undertaken during periods of Total Fire Ban and Catastrophic Fire Weather Days unless there is a suitable fire suppression unit present on site and only with prior agreement with local fire services.	Construction	All locations
HR10	To reduce the level of risk of ignition of the surrounding vegetation Transgrid would need to engage appropriate measures to ensure fire-fighting resources are available before blasting occurs.	Construction	All locations blasting proposed
HR11	All chemicals, fuels or other hazardous substances would be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of any bunded area shall be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s shall be shown on the site plans.	Construction	All locations
HR12	Equipment would be checked in accordance with Australian Standard requirements for potential electrical faults, including faulty power leads and generators.	Construction	All locations
HR13	Dangerous goods and hazardous substances would be transported in accordance with relevant legislation and codes, including the *Dangerous Goods (Road and Rail Transport) Act 2008*, Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998 and the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2018).	Construction	All locations
HR14	Appropriate spill containment equipment would be provided and located at strategic, accessible locations.	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
HR15	Security measures would be implemented to minimise the risk of arson within and adjoining construction areas. The location of appropriate security measures would be determined using a risk-based approach.	Construction	All locations
HR16	All chemicals or other hazardous substances at the Dinawan 330kV substation and existing Wagga Wagga substation would be stored in bunded and weatherproof facilities away from drainage lines, and in accordance with supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of the bunded area would be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s would be shown on the site plans.	Operation	Dinawan 330kV substation
HR17	Emergency spill procedures would be implemented to avoid and manage accidental spillages of fuels, chemicals or fluids during operation and maintenance activities in accordance with the Transgrid's HSE Guideline. Environmental spill kits would be provided at strategic, accessible locations, and staff would be trained in spill response procedures.	Operation	All locations
HR18	The Wagga Wagga substation Emergency Response Manual would be updated to include the new proposed design and required revised emergency response procedures.	Pre-operation	Wagga Wagga substation
HR19	An Emergency Response Manual would be prepared for the proposed Dinawan 330kV substation and include emergency response procedures.	Pre-operation	Dinawan 330kV substation
HR20	The proposal would be designed, operated and maintained in accordance with Transgrid's Bushfire Risk Management Plan. This includes reduction in fuel loads, management of APZs and inspections of infrastructure.	Operation	All locations

20.6.3. Managing residual impacts or uncertainties

Through the implementation of the standard mitigations detailed in Section 19.6, residual impacts resulting from the identified hazard and risk would be appropriately managed.

With respect to EMF, Transgrid adopts a precautionary approach to the management of EMF for all of their projects by:

- taking EMF into account in the design and location of new facilities, such as this proposal
- closely monitoring ongoing research and reviews by scientific panels and international policy developments
- regularly reviewing Transgrid's policies and practices in light of the latest scientific information
- measuring field strengths in and around Transgrid installations and other places where appropriate
- providing up-to-date information to interested parties on request.

21. Soils, contamination and groundwater

This chapter provides an assessment of potential soils, contamination and groundwater impacts of the proposal and identifies measures to address these impacts. This chapter summarises information in the *Contaminated land impact assessment* (WSP, 2021g) (refer to Technical paper 14) and *Groundwater impact assessment* (WSP, 2021h) (refer to Technical paper 15).

21.1. Environmental assessment requirements

21.1.1. Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to soils and contamination and where these requirements are addressed in this EIS are outlined in Table 21-1.

Table 21-1 Secretary's environmental assessment requirements – soils and contamination

Ref.	Secretary's environmental assessment requirements	Where addressed
Land		
Key issues	The EIS must address the following matters	
	• an assessment of impacts of the project on soils and land capability of the site and surrounds;	Issues relevant to soils and land capability are discussed in Section 21.4 and Section 21.5 for construction and operation respectively.
	• an assessment of the risk of soil contamination and disturbance of land (including associated with naturally occurring asbestos in the vicinity of the site)	Issues relevant to contamination risk and disturbance are discussed in Sections 21.4.2 and 21.5.2.
Water		
Key issues	The EIS must address the following matters	
	• details of water requirements, supply arrangements and wastewater disposal arrangements for construction and operation;	Issues relevant to groundwater are discussed in Sections 21.4 and 21.5. Issues relevant to surface water are discussed in Chapter 16.
	• an assessment of the impacts of the project on groundwater aquifers and groundwater dependent ecosystems having regard to the *NSW Aquifer Interference Policy* and relevant Water Sharing Plans; and	These matters are discussed in Section 21.4.3.

21.2. Assessment approach

21.2.1. Legislation and policies

There is no legislation specifically relevant to the assessment of soils. Notwithstanding the assessment was completed with consideration of the following guidelines:

- NSW EES guidance on urban and regional salinity
- *Landslide risk management guidelines* (Australian Geomechanics Society, 2007)
- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and Volume 2 (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries) (Department of Environment and Climate Change, 2008a)
- Soil and Landscape Issues in Environmental Impact Assessment (Department of Land and Water Conservation, 2000).
- Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee (ASSMAC), 1998).

Legislation relevant to the assessment of contamination includes the *Contaminated Land Management Act 1997* (CLM Act), State Environmental Planning Policy 55 – Remediation of Land (SEPP 55) and the *National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013* (National Environmental Protection Measure, 2013). Other relevant guidelines which informed the assessment included:

- *Managing Land Contamination Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning, and NSW Environment Protection Authority (NSW EPA), 1998)
- *Guidelines for the NSW Site Auditor Scheme* (2nd edition) (DEC 2006)
- Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (NSW EPA, 2015)
- *Contaminated Land Management, Guidelines for the NSW Site Auditor Scheme* (3rd edition) (NSW EPA 2017)
- *Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2011)
- *Managing Asbestos in or on Soil* (SafeWork NSW, 2014)
- *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WA Department of Health, 2009)
- PFAS National Environmental Management Plan (PFAS NEMP) (Heads of EPAs Australia and New Zealand (HEPA), 2020).

Legislation relevant to the regulation of groundwater includes the *Water Act 1912* and the WM Act. In addition to this legislation, the assessment was completed with reference to the following guidelines and policies:

- *Murray–Darling Basin Plan* (the Basin Plan) (Murray-Darling Basin Authority, 2012)
- Relevant Water Sharing Plans established under the WM Act, including:
  - Murrumbidgee Alluvial Groundwater Sources 2020
  - NSW Murray-Darling Basin Porous Rock Groundwater Sources 2020
  - NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2020
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018 revision (ANZG, 2018)
- NSW Aquifer Interference Policy (DPI, 2012c)
- *NSW Groundwater Quality Protection Policy* (Department of Land and Water Conservation, 1997a)

- *NSW Groundwater Dependent Ecosystems Policy* (Department of Land and Water Conservation, 2002)
- *NSW Groundwater Quantity Management Policy* (Department of Land and Water Conservation, 1997b).

The *Water Management (General) Regulation 2018* also specifies procedural, technical and licence requirements and exemptions under the WM Act. Under this regulation a water access licence or a water use approval is exempt if groundwater extraction is less than three mega litres in any one water calendar year (commencing on 1 July each year).

21.2.2. Methodology

21.2.2.1. Soils and contamination

The study area for the soils and contamination assessment is the proposal study area. However, desktop searches for potential current and former contaminant sources has considered a broader area (between two and 10 kilometres depending on the potential source). The assessment methodology for the soil and contamination impact assessment involved:

- reviewing desktop information to describe the existing environment, including:
  - historical aerial photographs
  - Australian Soil Resource Information System (maintained by the CSIRO)
  - eSPADE geology and soil landscape mapping
  - ASS risk mapping
  - naturally occurring asbestos risk mapping
  - maps published by the Geological Survey of NSW and Australian Soils Resource Information System (ASRIS)
- completing searches of relevant public databases to identify registered sites or areas which may contain contamination. This included the NSW EPA Contaminated Sites Register, a list of sites which have been notified to the EPA, environment protection licences held under the POEO Act, the NSW EPA PFAS investigation program, the Australian Department of Defence database for unexploded ordnance, and the NSW DPI register of cattle dip sites, and the NSW Government database of former gasworks sites
- reviewing previous geotechnical and contamination investigations to determine areas of potential contamination concern
- identifying potential impacts to soil which may occur during construction and operation of the proposal
- assessing potential risks from contamination during construction and operation of the proposal, including completion of a risk assessment for contamination based on potential activities which may disturb contamination (or result in contamination), and potential risk from pathways to sensitive receivers
- identifying mitigation measures

Further detail on the assessment of contamination is provided in the contamination impact assessment (refer to Technical paper 14).

21.2.2.2. Groundwater

The study area for the groundwater assessment is a four kilometre wide corridor (i.e. two kilometres on either side of the transmission line easement).

The assessment methodology for the groundwater impact assessment involved:

- reviewing desktop information to describe the existing environment, including:
  - publicly available databases relevant to climate, soils, geology and hydrogeology, including the NGIS (BOM, 2020) to identify registered groundwater bores and GDEs
  - a review of previous geotechnical investigations completed for the proposal
- a qualitative assessment of the potential groundwater impacts from the proposal
- identifying mitigation measures to manage the potential impacts identified.

Further detail on the assessment of groundwater is provided in the groundwater impact assessment (refer to Technical paper 15).

21.2.3. Aquifer interference

Potential groundwater impacts were assessed with reference to the minimal impact considerations for highly productive groundwater for sources in the *NSW Aquifer Interference Policy* (DPI, 2012c). The following groundwater source categories, and minimum impact criteria, are relevant to the proposal:

- highly productive (high yields and electrical conductivity of 500 microsiemens per centimetre) groundwater source, including the following minimum impact criteria:
  - water table – less than or equal to 10 per cent cumulative variation in the water table at a distance of 40 metres from any high priority groundwater dependant ecosystem or high priority culturally significant site
  - water table – a maximum two metre water table decline at any water supply work
  - water pressure – a cumulative pressure head decline of not more than forty per cent of the 'post-water sharing plan' pressure head above the base of the water source to a maximum of a two metres decline, at any water supply work.
  - water quality – any change in groundwater quality should not lower the beneficial use category of the groundwater source beyond a distance of 40 metres from the activity
- less productive (porous rock and not highly connected to surface water sources), including the following minimum impact criteria:
  - water table – Less than or equal to 10 per cent cumulative variation in the water table at a distance of 40 metres from any high priority groundwater dependant ecosystem or high priority culturally significant site
  - water table – A maximum two metre water table decline at any water supply work
  - water pressure – A pressure head decline of not more than two metres at any water supply work
  - water quality – Any change in groundwater quality should not lower the beneficial use category of the groundwater source beyond a distance of 40 metres from the activity
  - water quality – No increase of more than one per cent per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity.

21.3. Existing environment

21.3.1. Topography

The topography of the proposal study area is largely flat rising to the east. The topography ranges from approximately 50 mAHD at the western extent of the alignment to around 250 metres at the eastern extent of the alignment.

21.3.2. Geology

The geology underlying the soils, contamination and groundwater study area includes the Woorinen Formation, Shepparton Formation, Mount Flankey Granite and Wagga Group. Around 70 per cent (about 300 kilometres) of the study area is covered in aeolian (meaning deposited by wind) sediments of the Shepparton Formation, comprising unconsolidated-poorly consolidated mottled variegated clay-silty clays, coarse to fine sand and gravel and is known to form extensive flat alluvial floodplains.

21.3.3. Soils

The soils along the soils, contamination and groundwater study area are mapped as primarily vertosols according to Australian Soil Classification (CSIRO, 2016a) found along the main watercourses sand and alluvial plains in proximity to the Murrumbidgee, Darling, and Darling – Anabranch Rivers. Published soil mapping along the alignment indicates that the regional geology and soils are expected to be predominantly transported Quaternary-aged sediments deposited in alluvial flood plains, and dune. The predominant soil types are typically sand and clay or a mixture of the two.

21.3.3.1. Saline soils

Almost all of the proposal study area is mapped as having low salinity potential (broadscale state mapping). A minor area north of Wagga Wagga has been identified as having high salinity potential and is not within the vicinity of the proposal. Soil conductivity testing undertaken by SMEC 2020 did however indicate some variable salinity conditions across the study area with some soil results indicating moderately saline and very saline soil conditions. An assessment of soil aggressivity undertaken by (SMEC, 2020) with reference to *Piled Footings Design and Installation - AS2159-2009* (Standards Australia, 2009) indicated that the soils are highly alkaline, with high levels of sodicity.

21.3.3.2. Acid sulfate soils

Acid sulfate soils (ASS) (including potential acid sulfate soils (PASS)) are naturally occurring soils containing iron sulphides. On exposure to air, such as during excavation or other mechanisms of disturbance, these iron sulfides oxidise can create sulfuric acid, which can impact the surrounding environment. This increase in acidity can also result in the mobilisation of aluminium, iron and manganese from the soils. Published ASS mapping indicates there is an extremely low probability of these soils occurring across the proposal study area, with the potential exception of low lying areas surrounding lakes and river beds, which are mapped as high probability of containing ASS.

21.3.3.3. Naturally occurring asbestos

Naturally occurring asbestos refers to the mineral component found in certain types of soils and rocks. There are no mapped areas indicating naturally occurring asbestos minerals may be present within the proposal study area.

21.3.4. Contamination

Searches of the NSW EPA contaminated land database (NSW EPA, 2020) and sites notified to the NSW EPA identified one site regulated under the CLM Act, and a number of sites of potential contamination within the contamination study area. This site is a former dry cleaning facility located around 1.5 kilometres south east of the proposed water fill point at Narrung Sewage Treatment Works, Wagga Wagga.

The majority of the proposal study area is utilised for agriculture, including land for livestock grazing and cropping. These broad areas are sparsely intersected by infrastructure including roads and electrical easements.

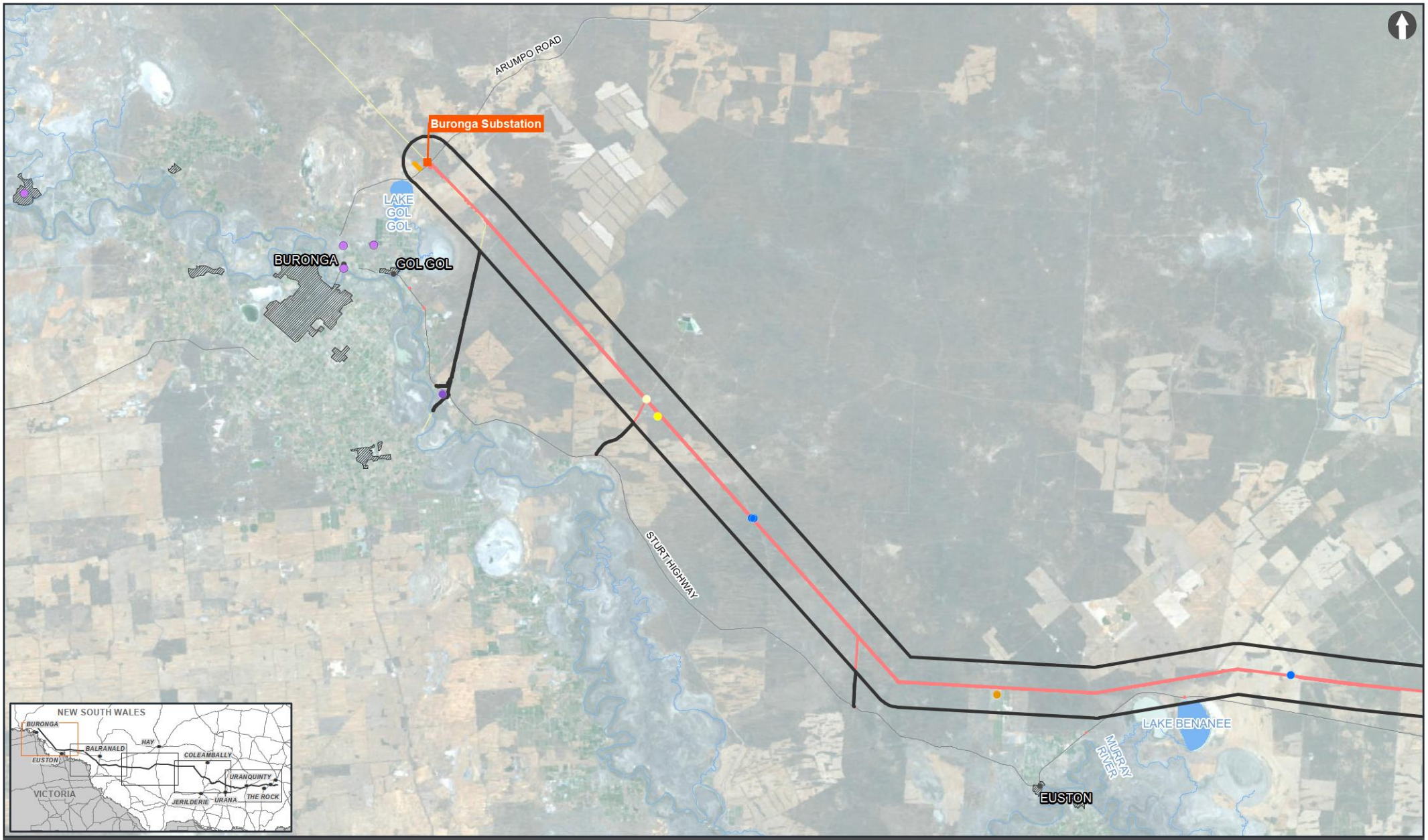
A review of previous investigations completed within the proposal study area did not confirm the presence of any areas with significant contamination. However, a number of areas of potential contamination were identified. The areas of potential contamination identified through review of previous investigations, and additional areas identified through further review of aerial photographs of the proposal study area are summarised in Table 21-2 and shown in Figure 21-1.

As identified below, the construction impact area crosses an unexploded ordnance (UXO) area of substantial risk. Department of Defence (DoD) has recommended that specialist advice is obtained. A detailed UXO Risk Assessment and UXO Management Plan should be developed as necessary. Defence recommends that any development, land usage re-zoning proposals or other significant changes in proposed activities for land parcels classified as Substantial should only proceed once an appropriate UXO Risk Assessment has been conducted by a suitable specialist and mitigations implemented to address the risks identified.

Table 21-2 Potential areas of contamination

Location	Area of potential contamination
Within construction impact area.	
Portions of the construction impact area, where existing infrastructure for transmission line is present.	Existing transmission line infrastructure. Spills from maintenance activities on site, Asbestos paints on tower infrastructure.
Portions of the construction impact area, where land is disturbed for agricultural purposes. This land makes up approximately 29.6% of the contamination and soil study area in the form of grazing modified pastures, cropping and irrigated cropping.	Cleared agricultural land. Historical use of pesticides, and foliants, large scale land use and the use of heavy machinery.
Portions of the construction impact area, where construction impact area is adjacent to or intersecting a farm dam	Farm dams. Areas of potential contaminant sediment build-up.
Oaks Plain located north east of Buronga.	UXO – Substantial Category. Confirmed historical military activities resulting in UXOs.
Cleared land at Lot 26 DP836099	Potential scaring/earthworks sites. Areas of potential fill.

Location	Area of potential contamination
Within the soils and contamination study area	
Cleared land at Lot 26 DP836099	Potential quarries. Areas of potential fill.
Agricultural land at: • Lot 2 DP1108316 – north east of Waldaira Lake • Lot 2 DP703764 • Lot 3 DP706781 • Lot 43 DP756399 • Adjacent to Brookong Creek Rd – Lot 1 DP722976 • Lot 100 DP1256996 – 132 Ashfors Rd, Gregadoo, NSW 2650 • Lot 26 DP836099	Potential scaring/earthworks sites. Areas of potential fill.
Agricultural land at: • Lot 89 DP74555 • Lot 2 DP1004135 East of Boyds Rd	Stockpiled material (SMEC 2020). Fill material of unknown origin and quality.
Landfill at Lot 100 DP1256996 132 Ashfors Rd, Gregadoo, NSW 2650	Waste Management Facility (Wagga Wagga City Council). Potential fill material of unknown origin and quality, potential leachate and landfill gas.
PFAS sites - Wagga Wagga RAAF base PMAP.	Potential PFAS contamination of groundwater.
One service station at Bencubbin Ave, Coleambally NSW Lot 35 DP234758. Two service stations along Adams St.	Potential petroleum hydrocarbon contamination of groundwater.
Former landfill at Lot 1 DP260462 Narrung Street, Wagga Wagga	Potential groundwater leachate and landfill gas (under assessment).



Project Components

- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Access Tracks
- Water Supply Point
- Existing Transmission Line Infrastructure
- Existing Substation
- Existing Railway
- Contamination Study Area
- Built Up Areas

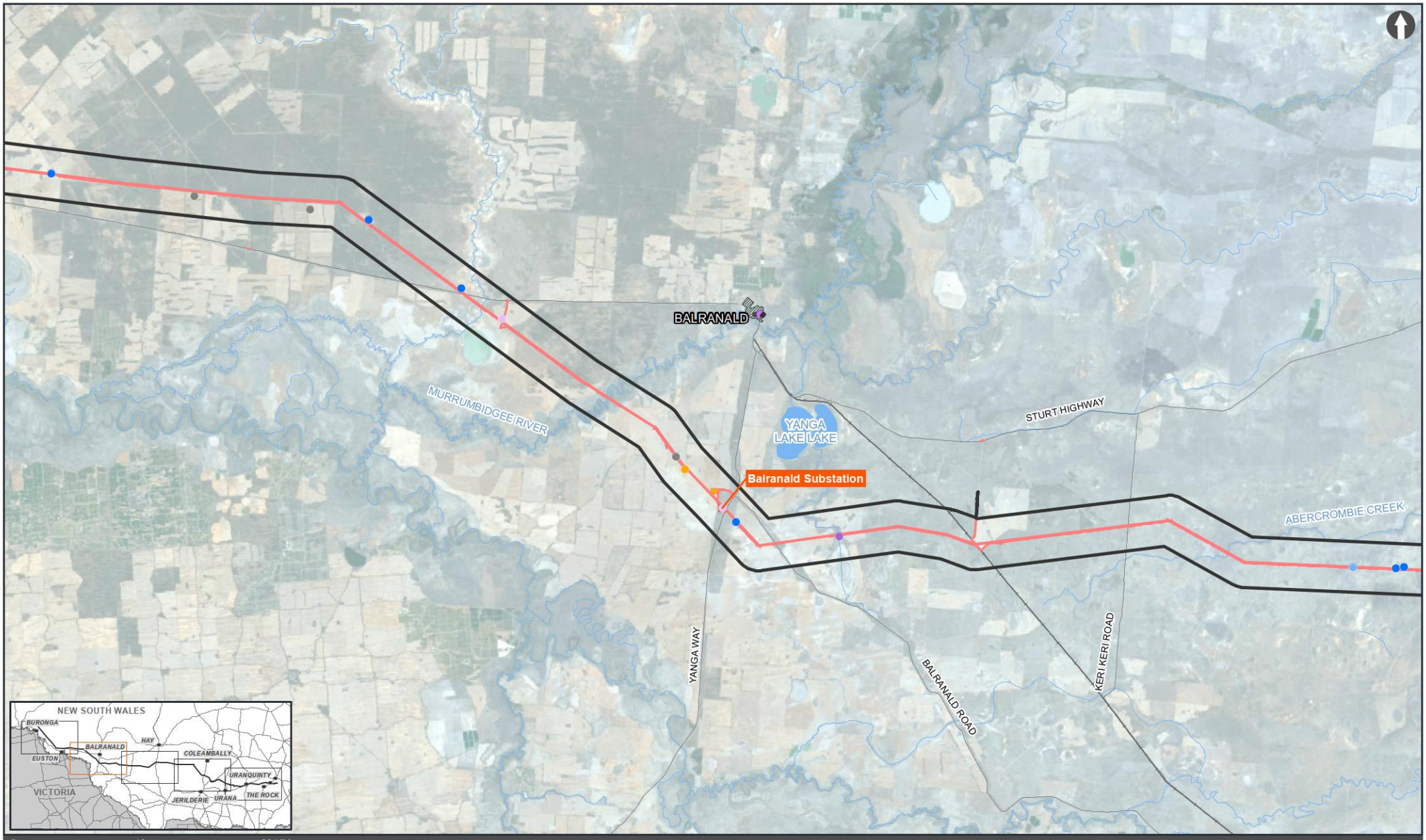
Potential Areas of Contamination

- AEC - SMEC 2020d (1)
- Cleared Agricultural Land (1)
- Farm Dam (3)
- Scarring (potential) (1)
- Scarring - Potential Quarry (1)

Figure 21-1
Potential Areas of Contamination

Sheet 1 of 5

Source: NSWSS, ESRI, Transgrid, WSP



Project Components
- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Access Tracks
- Water Supply Point
- Existing Transmission Line Infrastructure
- Existing Substation
- Existing Railway
- Contamination Study Area
- Built Up Areas

Potential Areas of Contamination
- Farm Dam (6)
- Farm Dam (potential) (1)
- Farm Infrastructure (1)
- Unknown (3)
- Unknown (infrastructure) (2)
- Unknown (potential scarring) (1)

Figure 21-1
Potential Areas of Contamination

Sheet 2 of 5

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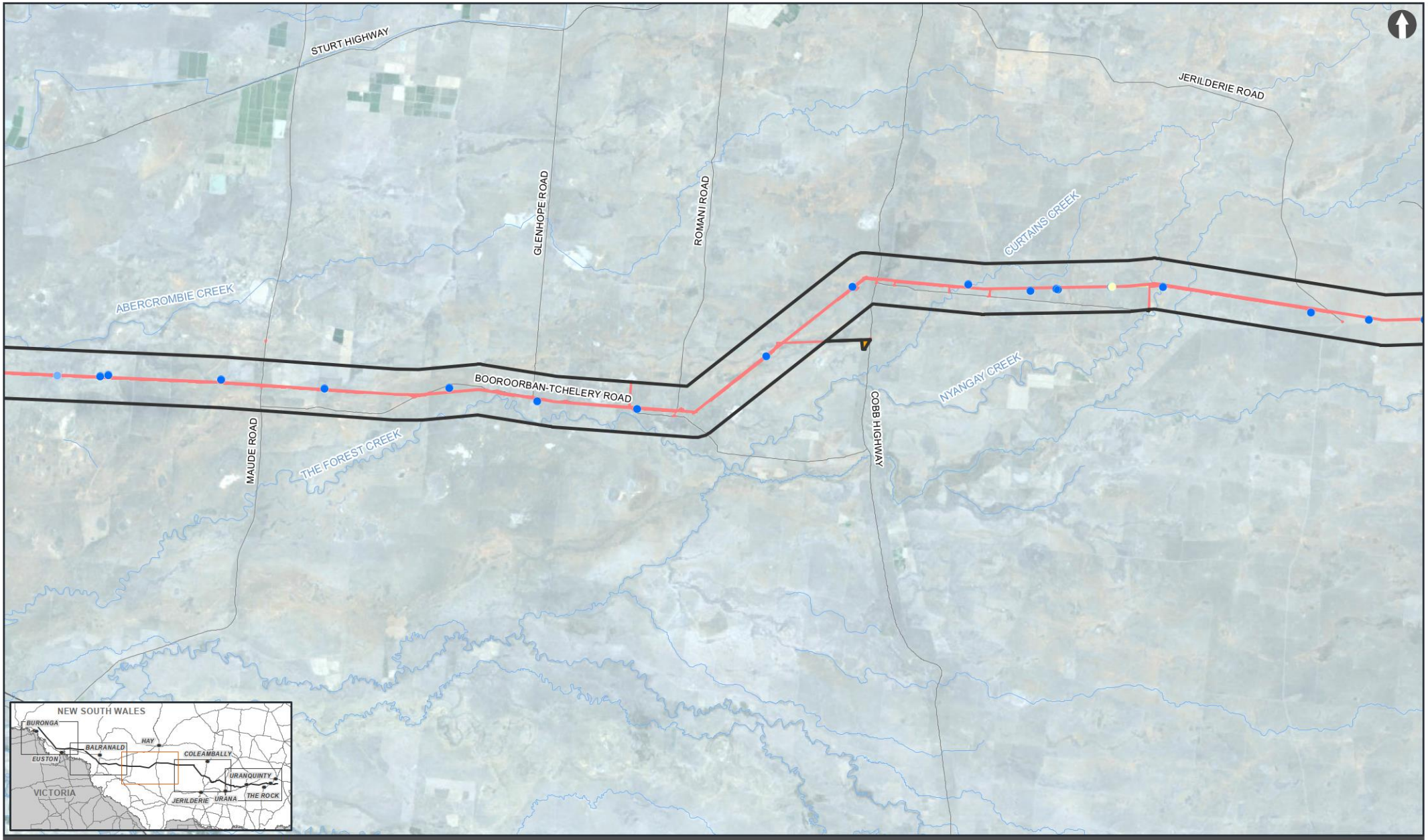
Source: NSWSS, ESRI, Transgrid, WSP



Project Components

- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Access Tracks
- Water Supply Point
- Existing Transmission Line Infrastructure
- Existing Substation
- Existing Railway
- Contamination Study Area
- Built Up Areas

Potential Areas of Contamination

- Farm Dam (18)
- Farm Dam (potential) (1)
- Scarring (potential) (1)

Figure 21-1
Potential Areas of Contamination

Sheet 3 of 5

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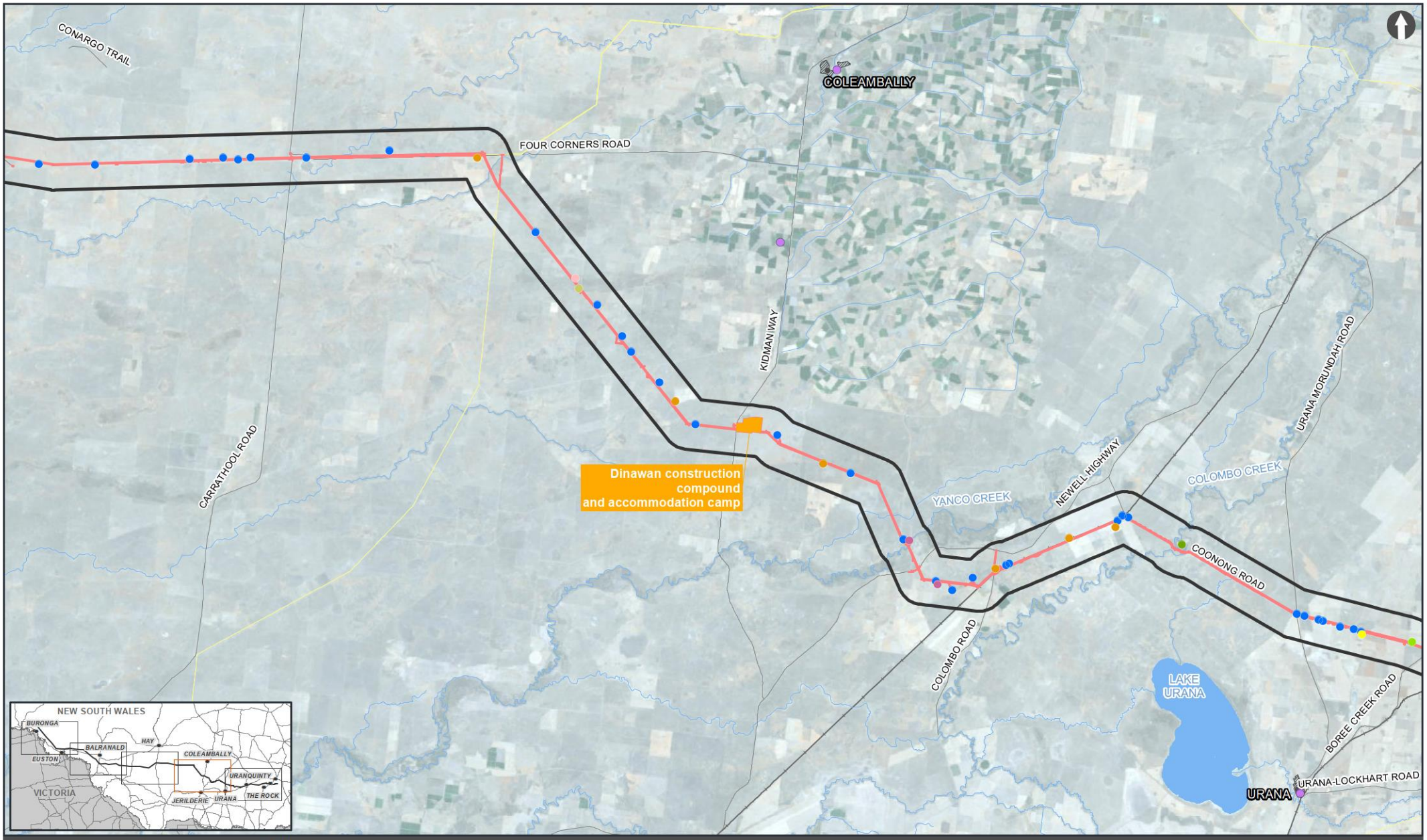
Source: NSWSS, ESRI, Transgrid, WSP



Project Components

- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Access Tracks
- Water Supply Point
- Existing Transmission Line Infrastructure
- Existing Substation
- Existing Railway
- Contamination Study Area
- Built Up Areas

Potential Areas of Contamination

- Agricultural Land (1)
- Cleared Agricultural Land (6)
- Farm Dam (32)
- Potential Agricultural Land (1)
- Residential Property (1)
- Scarring - Potential Quarry (1)
- Scarring - Potential Quarry (old) (1)
- Unknown (residence) (2)

Figure 21-1
Potential Areas of Contamination

Sheet 4 of 5

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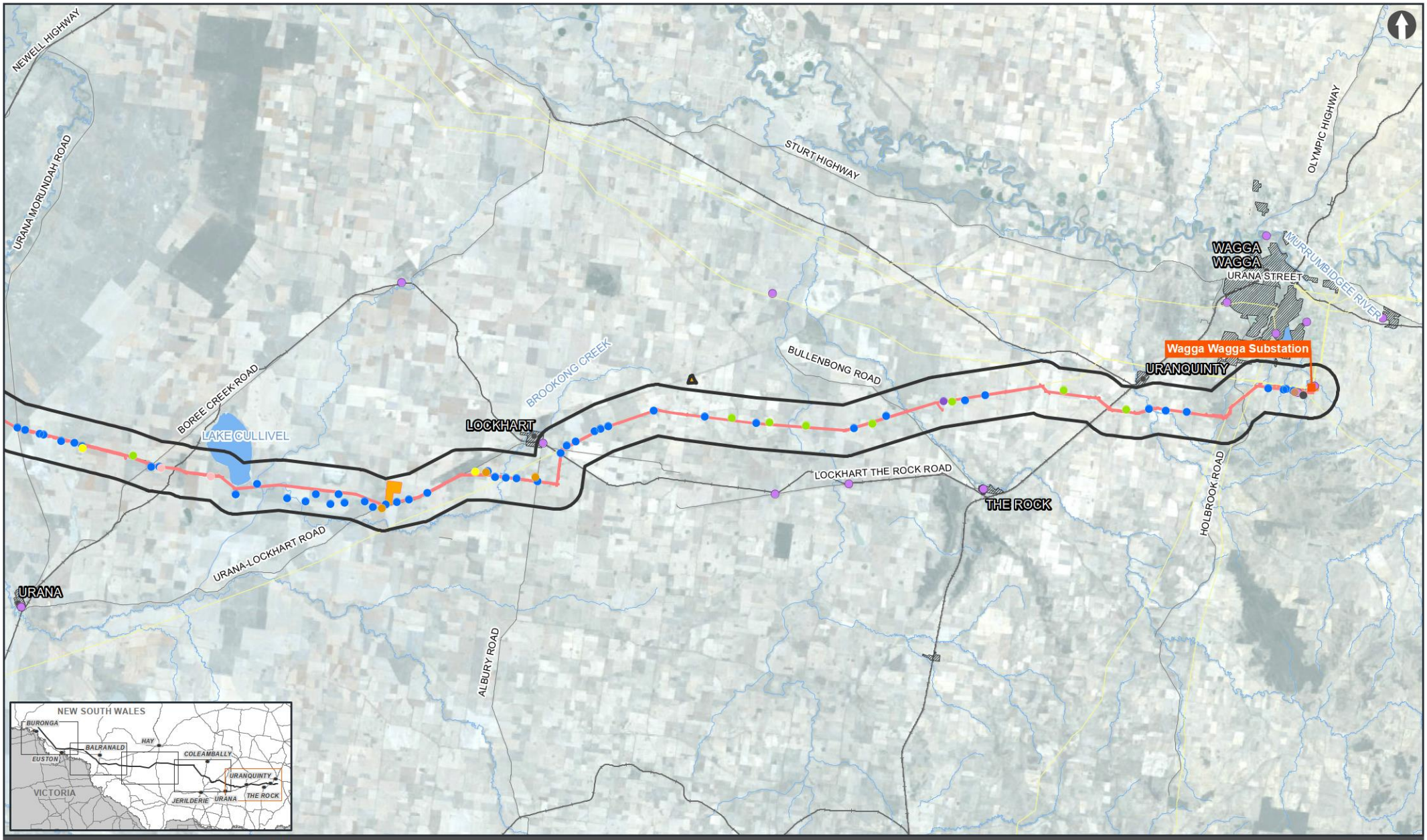
Source: NSWSS, ESRI, Transgrid, WSP



Project Components
- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Access Tracks
- Water Supply Point
- Existing Transmission Line Infrastructure
- Existing Substation
- Existing Railway
- Contamination Study Area
- Built Up Areas

Potential Areas of Contamination
- AEC - SMEC 2020d (1)
- Agricultural Land (8)
- Cleared Agricultural Land (3)
- Construction Site (1)
- Farm Dam (48)
- Residential Property (2)
- Scarring - Potential Quarry (2)
- Waste Management Facility (1)

Figure 21-1
Potential Areas of Contamination

Sheet 5 of 5

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Source: NSWSS, ESRI, Transgrid, WSP

21.3.5. Groundwater

21.3.5.1. Regulated groundwater sources

Groundwater sources within the proposal study area are regulated by three water sharing plans, including:

- Murrumbidgee Alluvial Groundwater Sources 2020
- NSW Murray-Darling Basin Porous Rock Groundwater Sources 2020
- NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2020.

Groundwater regulated by the NSW Murray Darling Basin Porous Rock Groundwater Sources 2020 is located at significant depth, is not anticipated to be intersected by the proposal and therefore has not been discussed further.

21.3.5.2. Hydrogeology

The hydrostratigraphic units (HSUs) within the groundwater study area have been simplified to correspond with groundwater sources listed within the water sharing plans. HSUs are defined as geological material of similar hydrogeological properties. HSUs are generally based on stratigraphic units, although units of similar groundwater storage and transmissive properties are often classified together as a single HSU. Details on the HSUs, taken from the groundwater resource descriptions (DPIE, 2019a, 2019b & 2019c), within the groundwater study area and their relationship to the MDB sediments are provided in Table 21-3.

Table 21-3 Hydrostratigraphic units identified within the proposal study area

Aquifer	Hydrogeological unit	Corresponding MDB Geology	Characteristics	Depth encountered (metres below ground level)
Shallow	Murrumbidgee Alluvium	Shepparton Formation	Typically unconfined aquifer. Recharge occurs through leakage from the Murrumbidgee River and its various tributaries and anabranches, infiltration from rainfall and irrigation activity. Groundwater flow is generally east to west.	0 (surface)
Deep	Murrumbidgee Alluvium	Calivil Formation and Remark Group	Typically confined to semi-confined. Recharge to the system is primarily through connectivity between groundwater sources and leakage from the overlying shallow aquifer. Groundwater flow is generally east to west.	40+

Aquifer	Hydrogeological unit	Corresponding MDB Geology	Characteristics	Depth encountered (metres below ground level)
Shallow	Porous rock	Pliocene sands (Loxton Parilla and Calivil Formation)	Semi-confined aquifer . Groundwater flow is strongly influenced by the degree of weathering of the rock mass. Recharge to the system is primarily through infiltration from rainfall, runoff, surface water within outcropping areas and groundwater flow from connected groundwater sources. Groundwater flow is generally east to west.	Variable, dependent on aeolian cover.
Deep	Porous rock	Renmark Group	Confined aquifer. Recharge to the system is primarily through connectivity between groundwater sources and leakage from the overlying shallow aquifer. Groundwater flow is generally east to west, but influenced by the underlying Lachlan fractured rock topography.	40+
Shallow	Lachlan fractured rock	Pre-Cainozoic Basement	Unconfined to confined aquifer depending on location and overlying geology. Groundwater is stored and moves through fractures, joints, bedding plains, faults and cavities within the rock mass or weathered zone (for the shallow aquifer). Groundwater flow is generally controlled by topography. Hydraulic connectivity between surface water features, other overlying aquifers and between the shallow and deep fractured rock aquifers is limited to the degree of fracturing. The fractured rock aquifers are considered to generally contain low hydraulic connection with overlying aquifers and surface water features.	Can significantly vary

21.3.5.3. Groundwater depth and connectivity

Local groundwater levels vary due to influences from surface water features, climatic conditions and localised geological controls, such as topography and the presence of perched shallow aquitards.

Geotechnical investigations completed for the proposal identified water levels ranging from 4.5 to 18.1 metres below ground level. This water level is inferred to be associated with upper aquifers, including:

- unconfined perched aquifers
- unconfined alluvial aquifers, within a few kilometres of major surface water bodies.

Table 21-4 summarises the available groundwater level records from reviewed registered bore data within the groundwater study area.

Table 21-4 Registered groundwater bores and their groundwater level statistics (WaterNSW, 2021)

Inferred HSU	Aquifer	Groundwater Level (mBTOC)[1]				
		Count[2]	Minimum SWL[3]	Maximum SWL	Average SWL	Median SWL
Murrumbidgee Alluvium	Shallow	28	9.0	24.0	17.4	17.8
	Deep	11	15.8	27.0	22.0	22.7
Porous rock	Shallow	15	7.1	21.9	17.0	17.0
	Deep	6	9.0	30.8	16.7	15.1
Lachlan fractured rock	Shallow	5	2.0	7.6	4.0	3.0
	Deep	17	27.4	61.0	41.0	39.9

1. mBTOC = metres below top of casing (as recorded in WaterNSW (2021))
2. Number of unique groundwater level measurements used to determine statistics
3. SWL = Standing water level

There is limited groundwater connectivity to surface water features within the groundwater study area. The connectivity is predominately limited to recharge via leakage from overlying surface water features. Surface water features (streams, rivers, creeks and lakes) are generally ephemeral, with the main exceptions being the Murrumbidgee River and Colombo Creek, and receive the majority of available water from upstream, particularly within the Murrumbidgee Alluvium and Porous rock HSUs.

On the eastern portion of the outcropping rock, that forms part of the Lake Albert catchment area, groundwater within the shallow Lachlan fractured rock HSU aquifer is anticipated to have limited hydraulic connectivity to Lake Albert. It is estimated that Lake Albert is primarily recharged from surface water flows of Crooked Creek and Stringybark Creek and represents a losing system under normal climatic conditions (Wagga Wagga City Council, 2010). Limited inflows from groundwater may occur when the lake level is low.

Groundwater connectivity to surface water features within the identified HSUs of the groundwater study area are summarised below:

- Murrumbidgee Alluvium: The groundwater table is generally below surface water features including the Murrumbidgee River, Yanco Creek and Colombo Creek resulting in resulting in a 'losing system' for streams, rivers, creeks and lakes (DPIE, 2019a)
- Porous rock: The groundwater table is generally below surface water features resulting in a 'losing system' for streams, rivers, creeks and lakes (DPIE, 2019b)
- Lachlan fractured rock: Connection between groundwater and surface water systems would be limited to the degree of fracturing that propagates from the groundwater source connecting the surface water feature. The degree of connection within the groundwater study area is expected to be low (DPIE, 2019c).

Based on the above, none of the assessed groundwater sources are classified as highly connected to surface water sources.

21.3.5.4. Groundwater quality

The assessment of contamination has not identified any potentially contaminated groundwater within the proposal study area.

The salinity of aquifers within the proposal study area varies depending on the hydrogeological unit the aquifer is contained within. In general salinity levels are as follows:

- unconfined aquifers within 500 metres from fresh surface water – water quality ranges from fresh to brackish in salinity (up to 3,000 microsiemens per centimetre)
- perched aquifers – salinity levels vary, but are generally expected to be high
- unconfined aquifers – generally saline to hypersaline with salinity levels between 30,000 and 150,000 microsiemens per centimetre.

21.3.5.5. Sensitive receivers

Registered groundwater bores

A search of the NGIS (BOM, 2021) and WaterNSW groundwater databases identified a total of 243 registered groundwater bores across the groundwater study area.

Of the 243 bores located within the groundwater study area, the beneficial use of the majority was listed as monitoring or observation (138) followed by water supply (including irrigation, stock and domestic and household water supply) (76), unknown (19), drainage (six) and exploration or mine (four). Of these bores located within the groundwater study area:

- 141 are in an unknown condition
- 92 are functioning or in use
- six are either non-functional, abandoned or removed
- four are proposed.

Groundwater dependent ecosystems

High potential GDEs are listed in Table 21-5, with their location, including low and moderate potential GDEs shown in Figure 21-2. High priority GDEs have been included in the assessment of high potential GDEs as they share the same spatial extent as high potential GDEs.

Table 21-5 GDEs with high potential for groundwater interaction within the groundwater study area (BOM, 2021b)

GDE Type	Name	HSU
Aquatic	Coloboralli Creek	Lachlan fractured rock
Aquatic	Stringybark Creek	Lachlan fractured rock
Aquatic	Boiling Down Creek	Lachlan fractured rock
Aquatic	Crooked Creek	Lachlan fractured rock
Aquatic	Sandy Creek	Lachlan fractured rock
Aquatic	Lake Cullivel	Lachlan fractured rock
Aquatic	Wetlands	Lachlan fractured rock and Murrumbidgee Alluvium
Terrestrial	River Red Gum	Lachlan fractured rock
Terrestrial	Red River Gum and Warrego Grass	Murrumbidgee Alluvium
Terrestrial	Red River Gum and Wallaby Grass	Murrumbidgee Alluvium
Terrestrial	Red River Gum and Lignum	Murrumbidgee Alluvium
Terrestrial	Red River Gum and Black Box	Murrumbidgee Alluvium
Terrestrial	Lignum shrubland	Murrumbidgee Alluvium
Terrestrial	Black box	Murrumbidgee Alluvium
Terrestrial	Canegrass Swamp	Porous rock
Terrestrial	Dillon bush (Nitre bush)	Porous rock
Terrestrial	Nitre Goosefoot shrubland	Porous rock

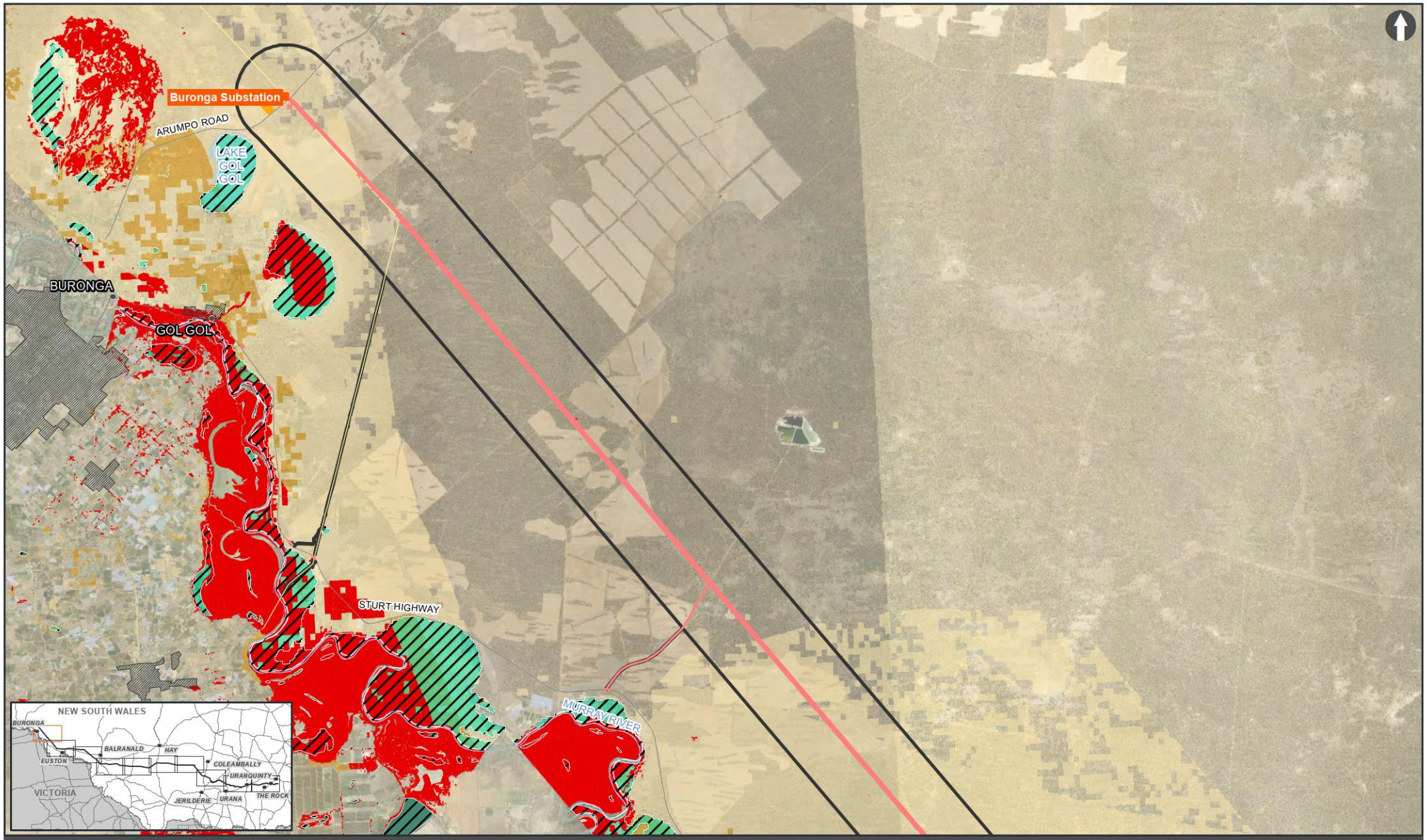
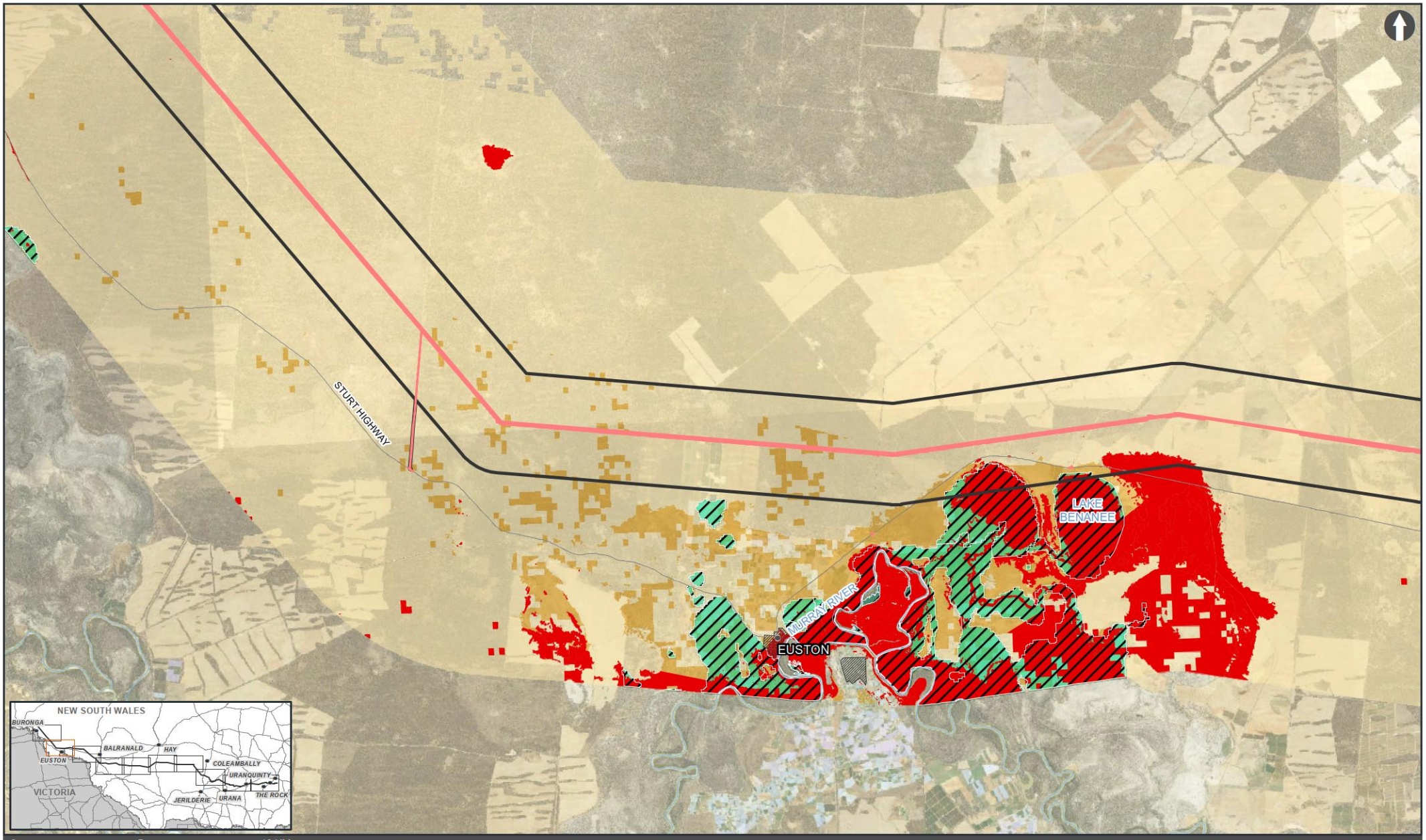


Figure 21-2
Groundwater Dependent Ecosystems

Sheet 1 of 10



Project Components

- Construction Impact Area
- Main Construction Compounds and Accommodation Sites
- Existing Transmission Line Infrastructure
- Existing Railway
- Existing Substation
- Groundwater Study Area
- Built Up Areas

Terrestrial GDE

- High potential GDE
- Moderate potential GDE
- Low potential GDE

Aquatic GDE

- High potential GDE
- Moderate potential GDE
- Low potential GDE
- Unclassified potential GDE

Figure 21-2
Groundwater Dependent Ecosystems

Sheet 2 of 10

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Source: NSWSS, ESRI, Transgrid, WSP

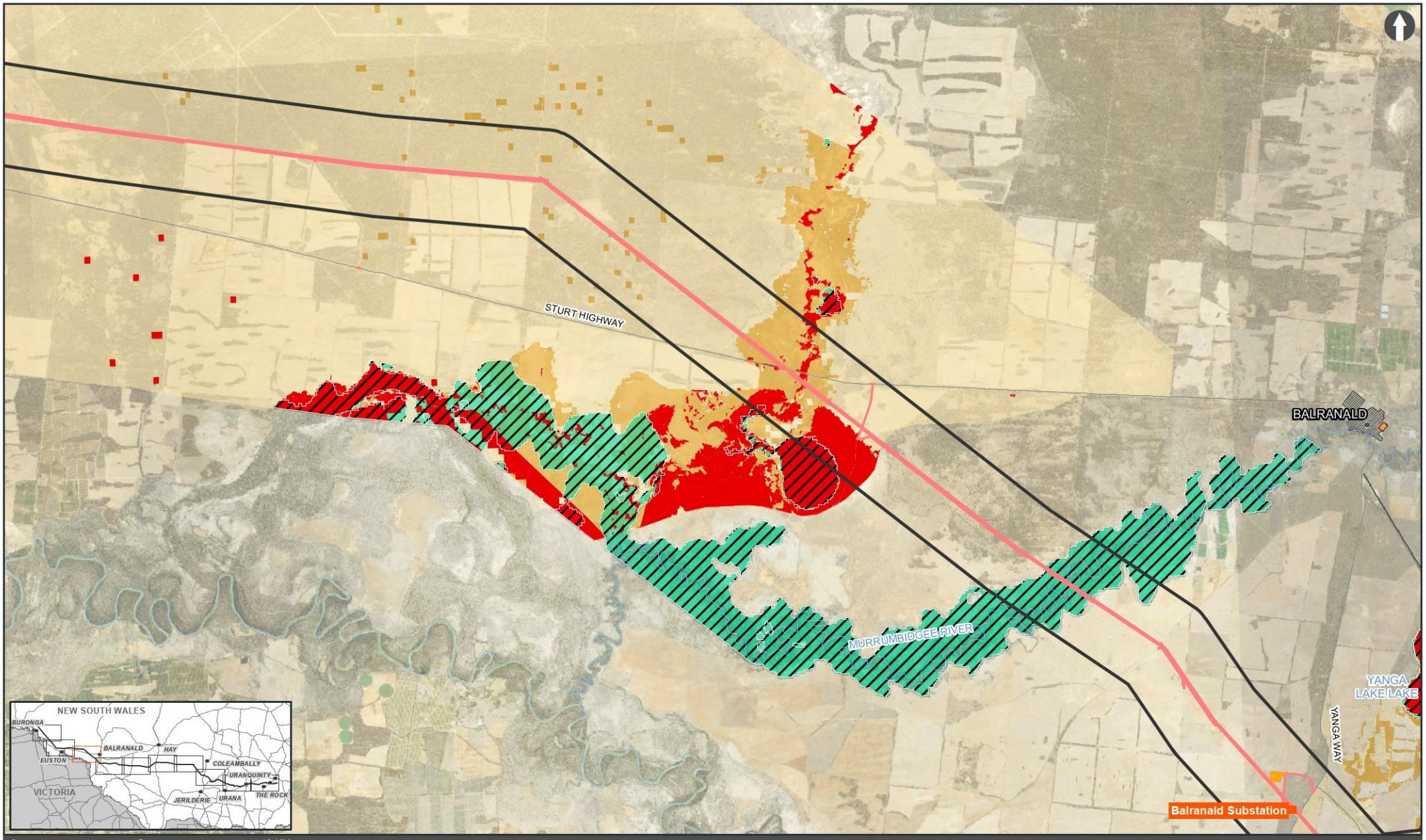

Figure 21-2
Groundwater Dependent Ecosystems

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Source: NSWSS, ESRI, Transgrid, WSP

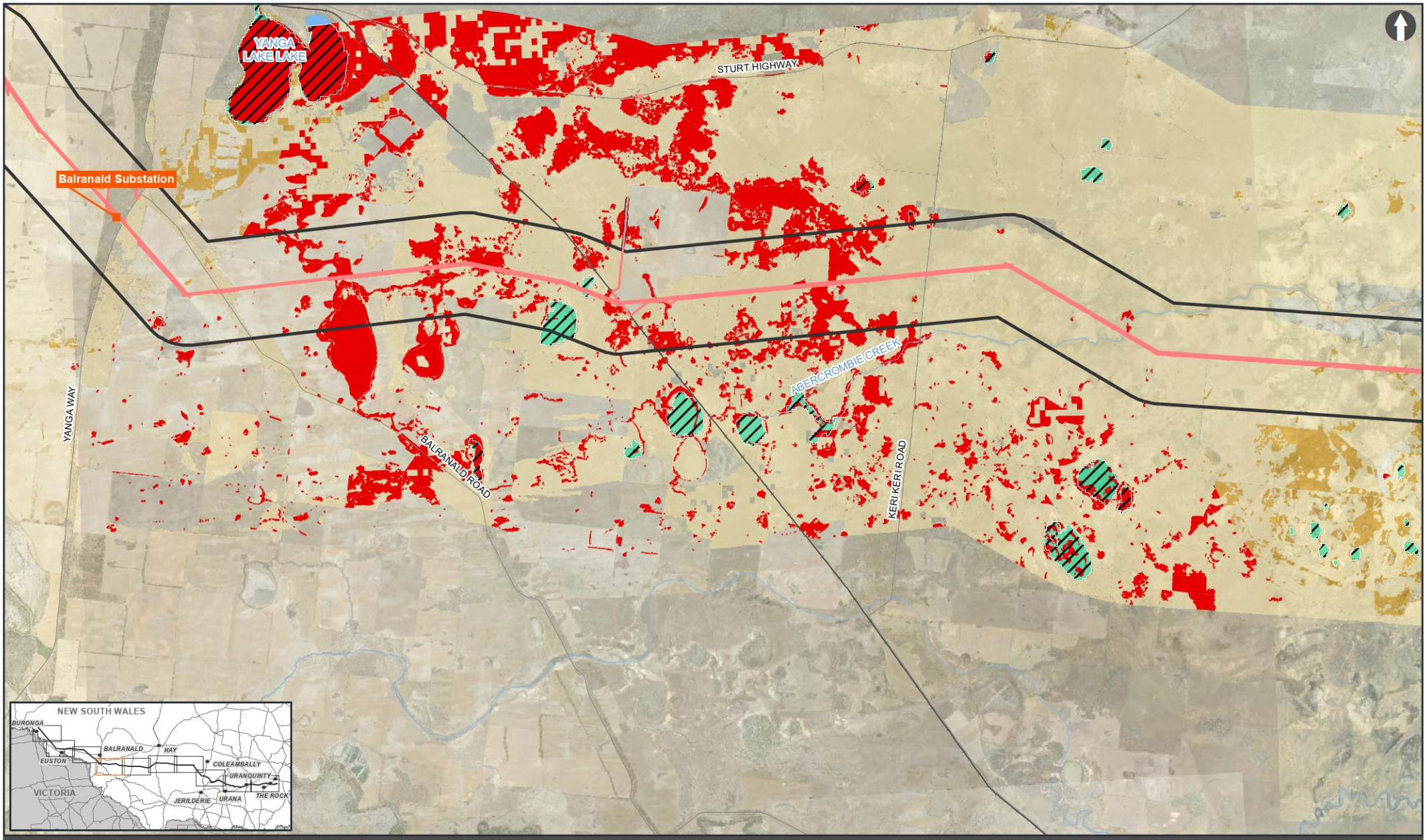

Figure 21-2
Groundwater Dependent Ecosystems

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Source: NSWSS, ESRI, Transgrid, WSP

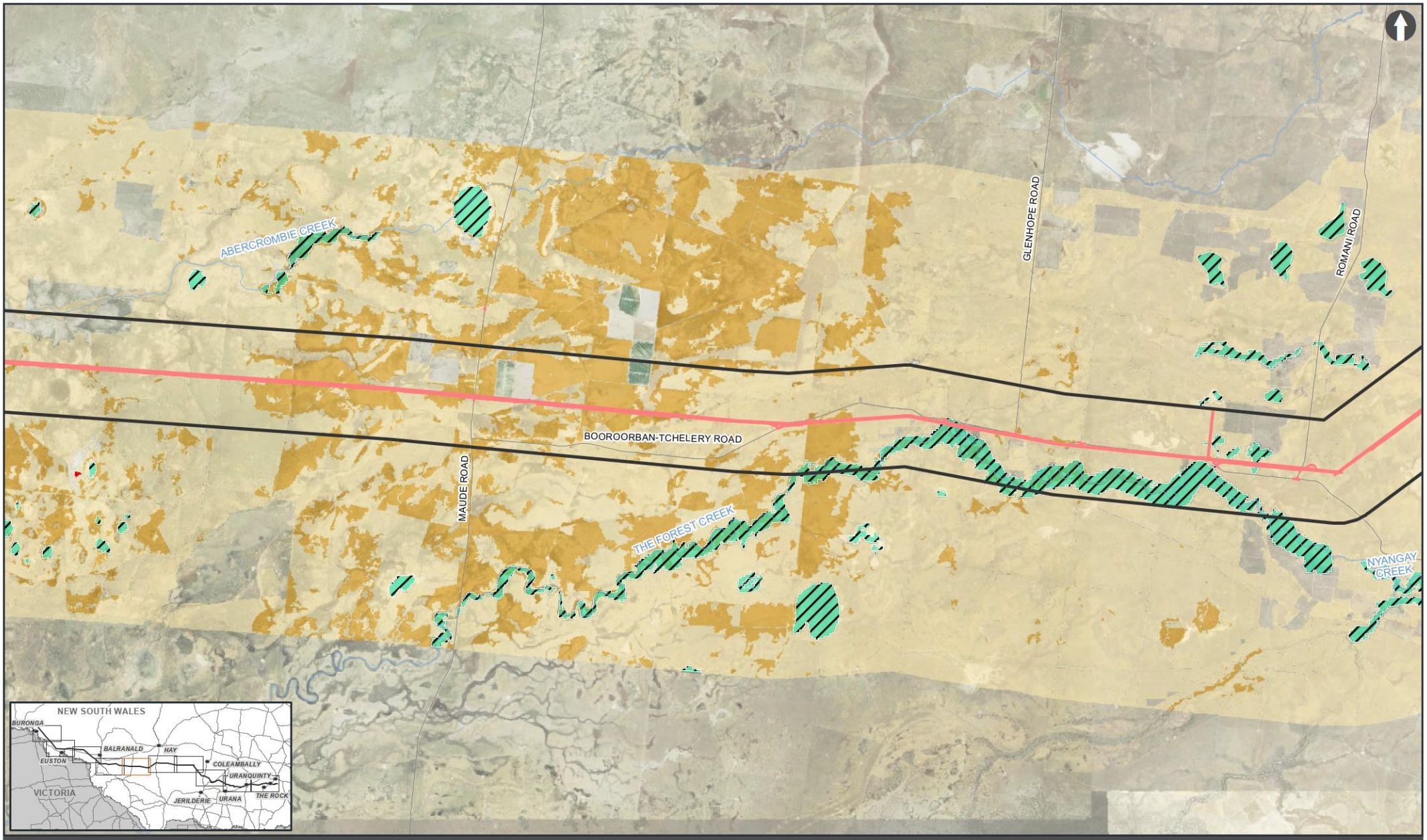

Figure 21-2
Groundwater Dependent Ecosystems

Sheet 5 of 10

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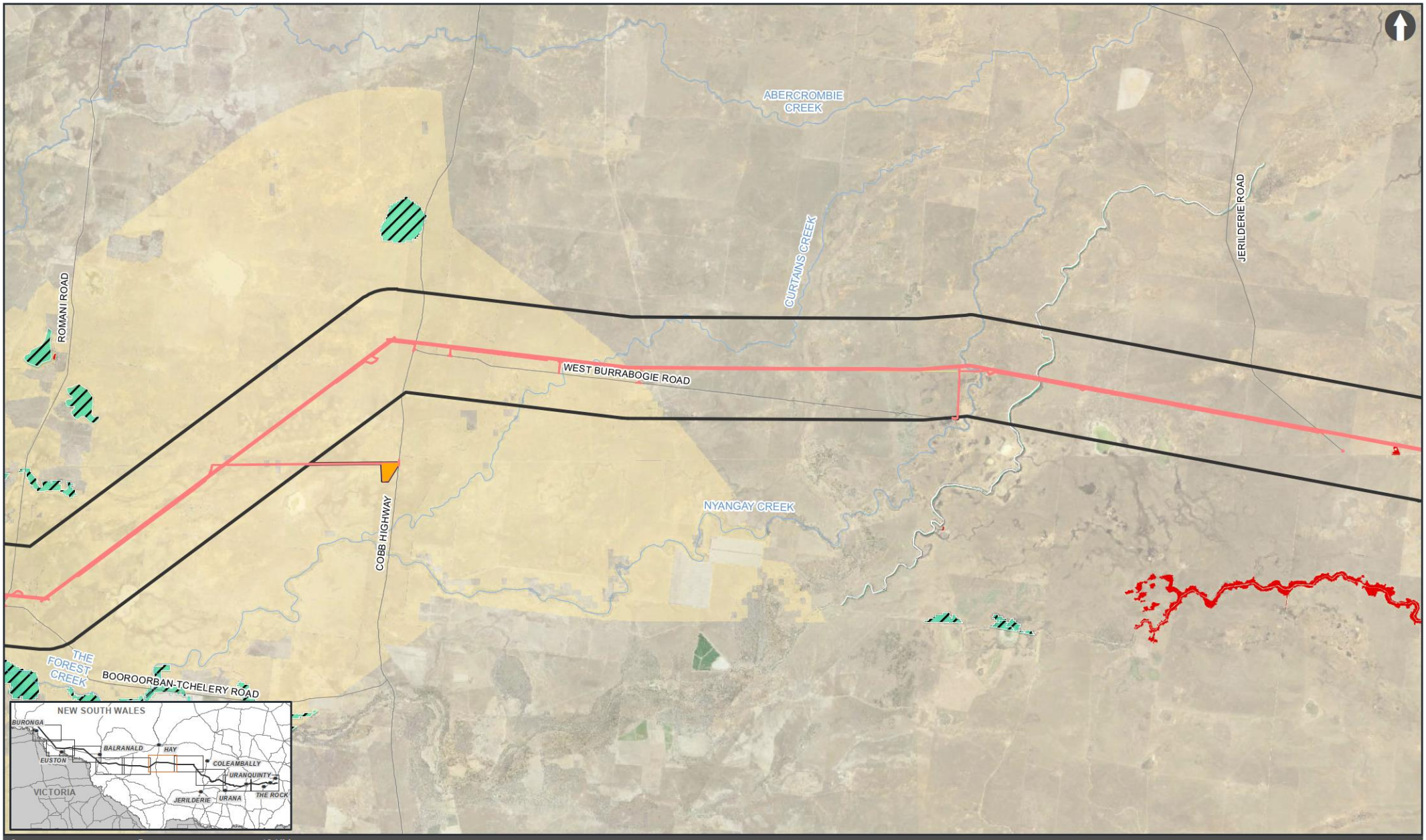
Source: NSWSS, ESRI, Transgrid, WSP



Project Components

- Construction Impact Area
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- Existing Transmission Line Infrastructure
- Existing Railway
- Existing Substation
- Groundwater Study Area
- Built Up Areas

Terrestrial GDE

- High potential GDE
- Low potential GDE

Aquatic GDE

- Low potential GDE

Figure 21-2
Groundwater Dependent Ecosystems

Sheet 6 of 10

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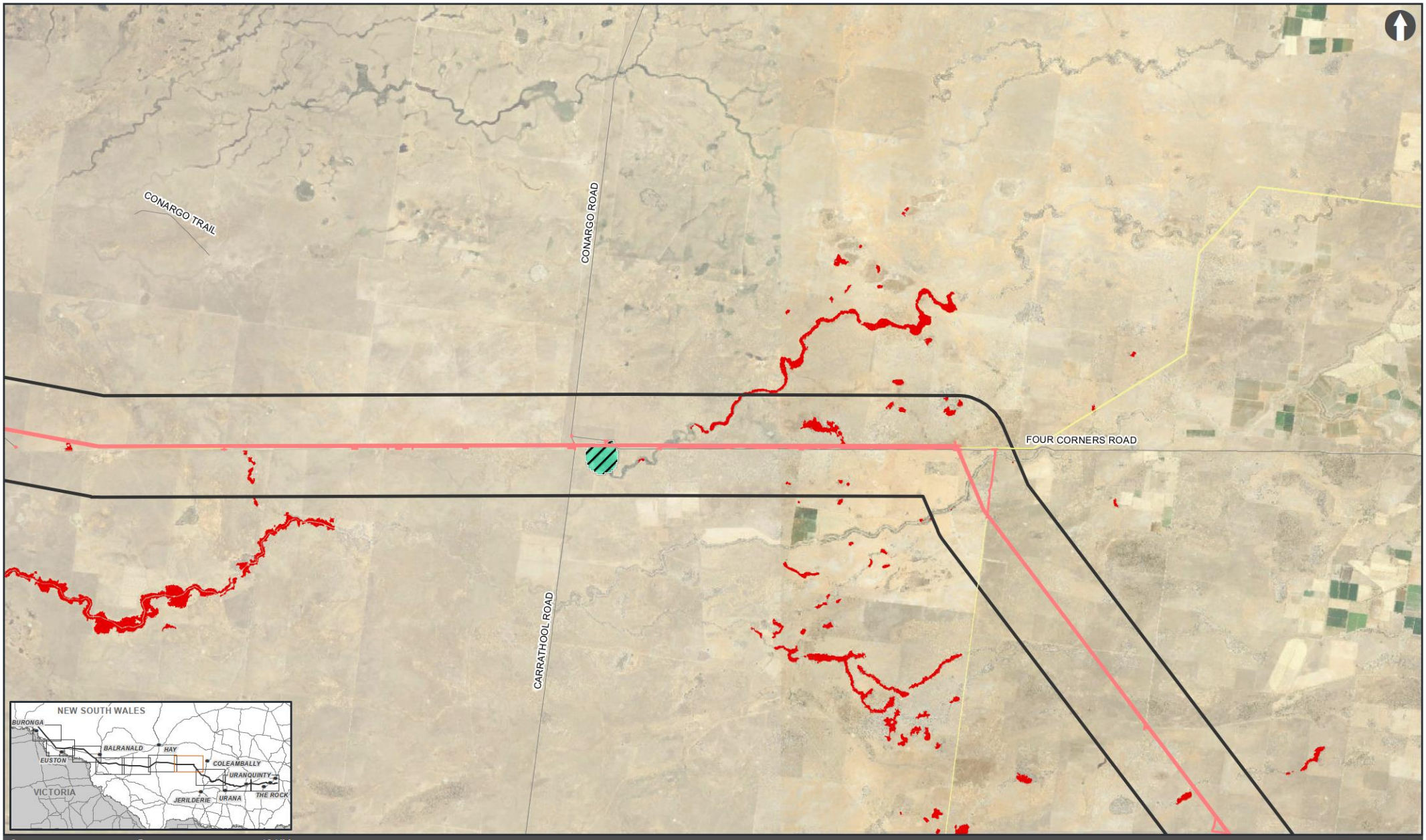

Project Components

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- Built Up Areas

Terrestrial GDE

- High potential GDE

Aquatic GDE

- Low potential GDE

Figure 21-2
Groundwater Dependent Ecosystems

Sheet 7 of 10

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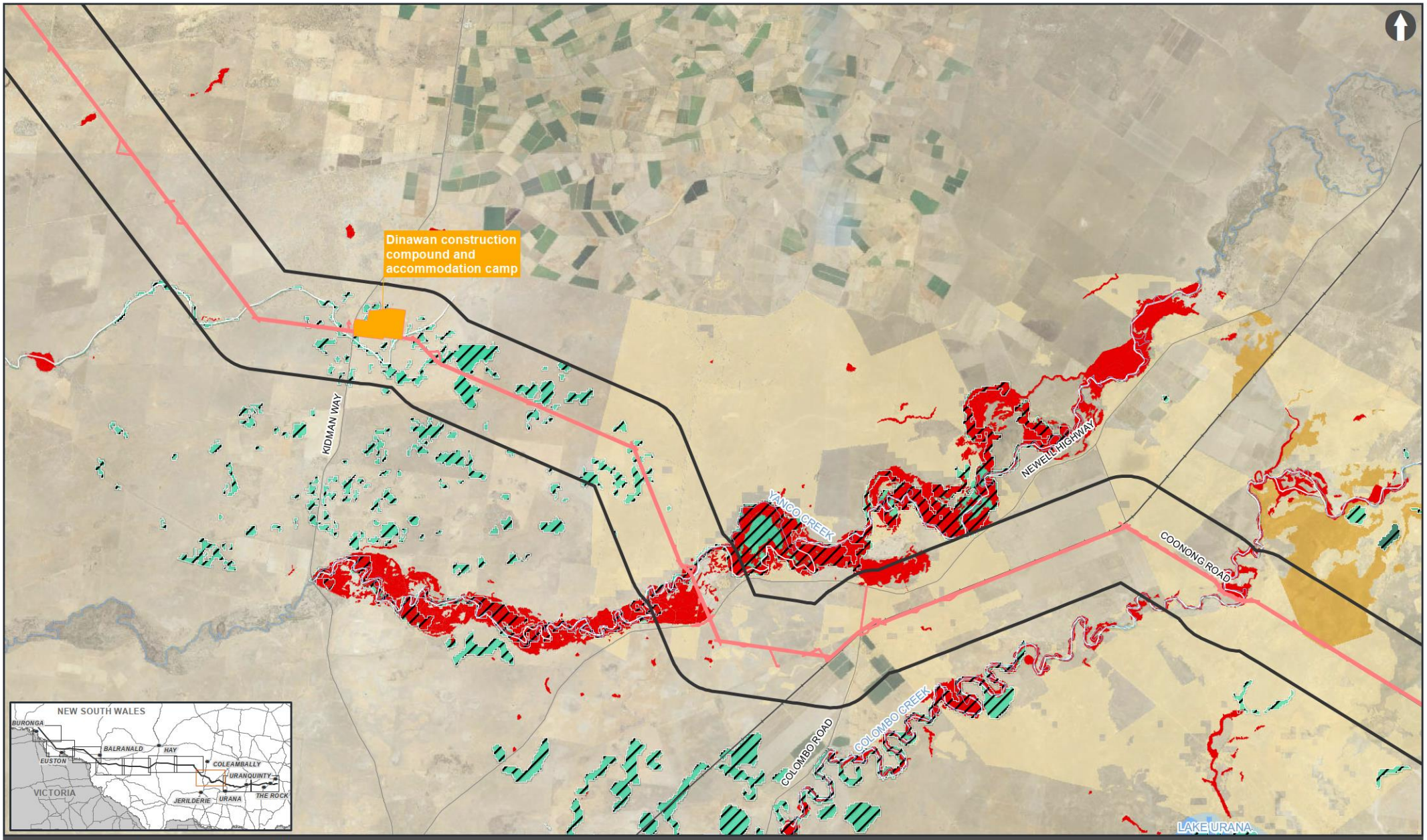

Figure 21-2
Groundwater Dependent Ecosystems

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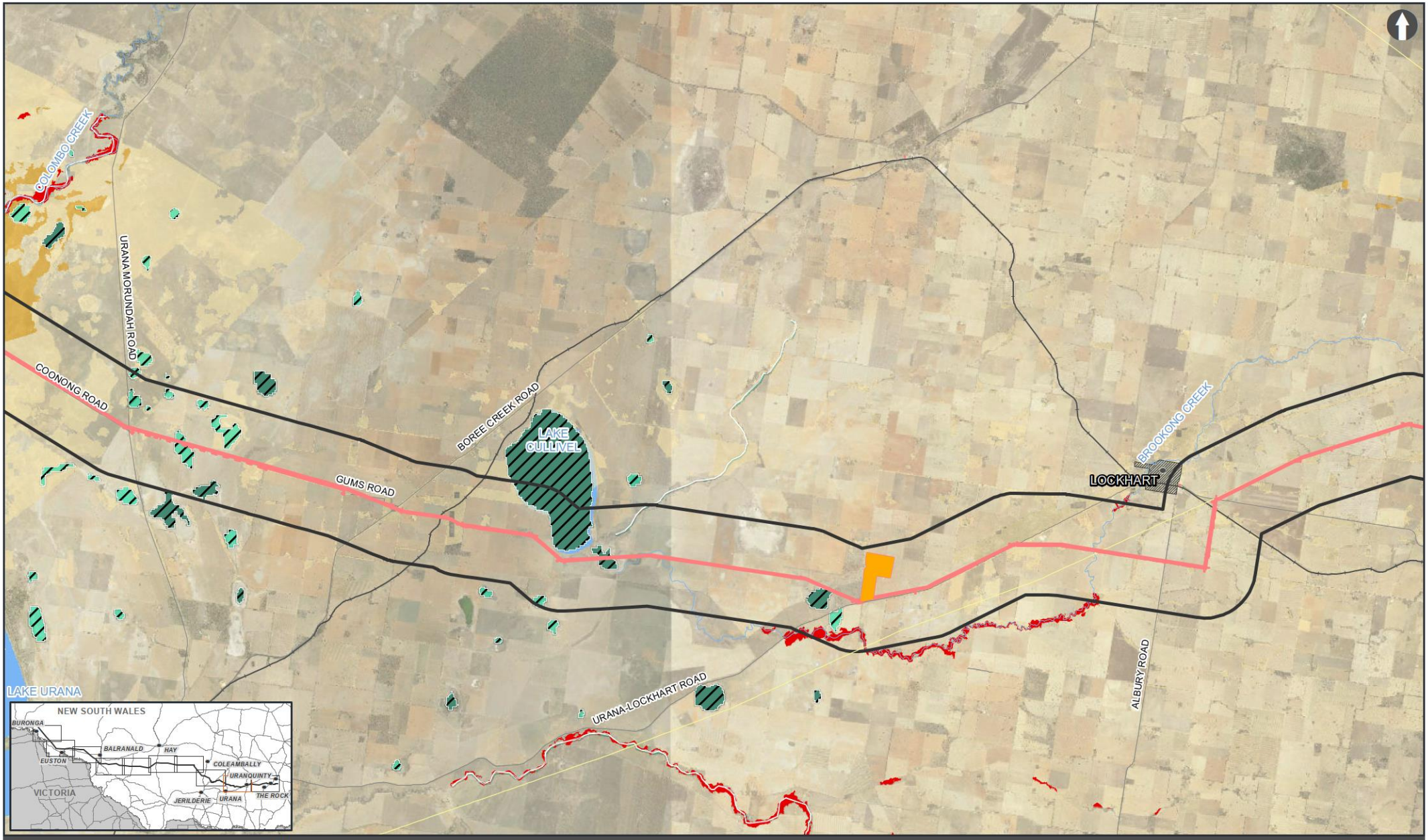

Project Components
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Terrestrial GDE
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- Moderate potential GDE
- Low potential GDE

Aquatic GDE
- High potential GDE
- Moderate potential GDE
- Low potential GDE

Figure 21-2
Groundwater Dependent Ecosystems

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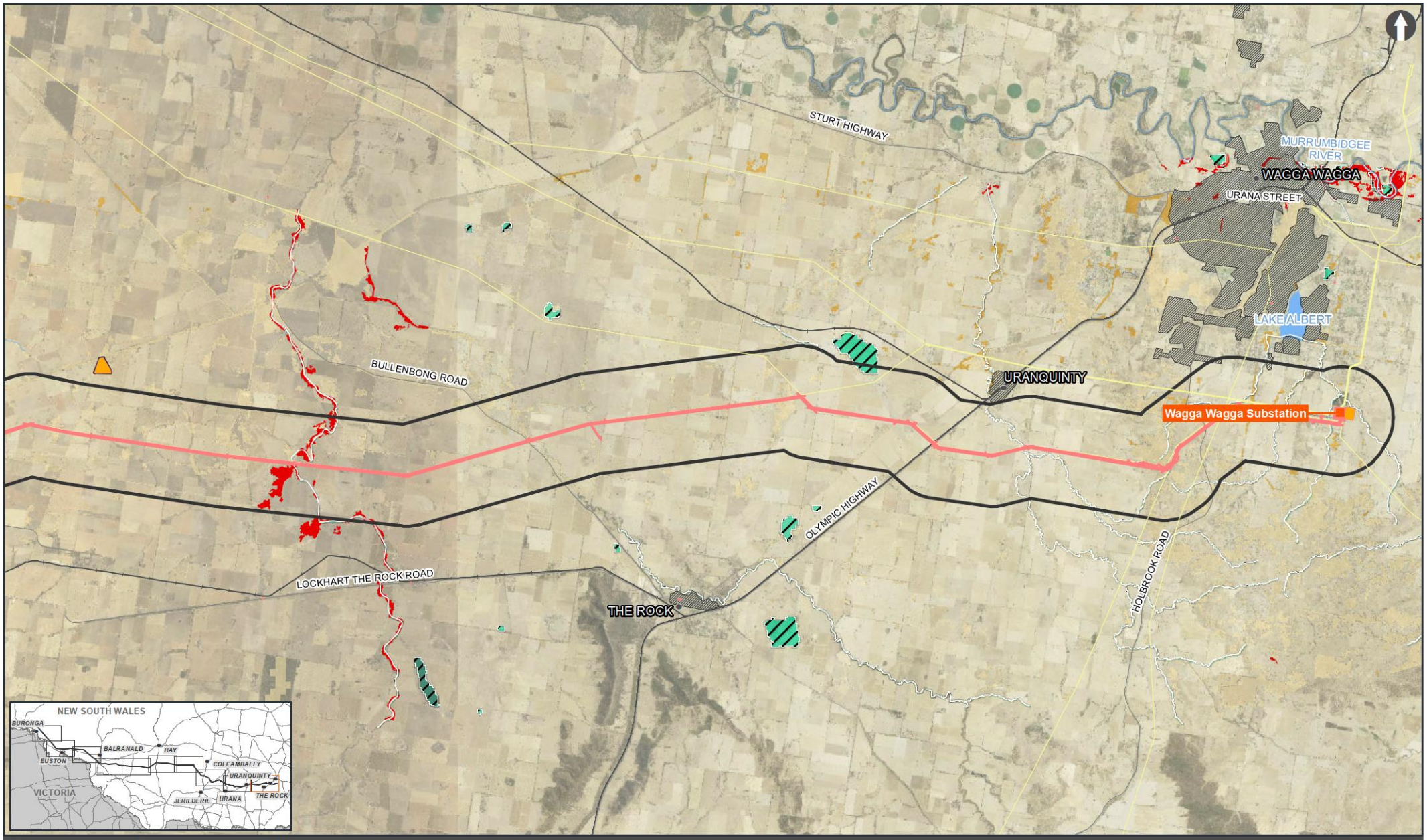

Project Components

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Terrestrial GDE

- High potential GDE
- Moderate potential GDE
- Low potential GDE

Aquatic GDE

- High potential GDE
- Moderate potential GDE
- Low potential GDE

Figure 21-2
Groundwater Dependent Ecosystems

Sheet 10 of 10

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Source: NSWSS, ESRI, Transgrid, WSP

21.4. Potential impacts – construction

21.4.1. Soils

21.4.1.1. Soil erosion and land capability

Construction of the proposal has the potential to result in soil erosion and impacts to land capability in the absence of adequate management measures. Key construction activities that present a risk to soils include excavation and other earth moving activities, vegetation removal and the movement of vehicles, plant and equipment within unsealed areas. The potential impact of these activities may include:

- erosion of exposed soils and stockpiled materials
- dust generation from construction activities
- increased sediment loads entering the surrounding waterways
- compaction of soils leading to impacts on drainage.

The highest potential for soil erosion would be associated with the disturbance of soils on existing slopes during construction. Given the terrain of the construction, the footprint is predominantly flat; however, it includes rolling hills and alluvial floodplains such as areas around Lake Cullivel, Colombo Creek, Yanco Creek and the Murrumbidgee River. Soil disturbance and the associated sediment transportation is a hazard that could occur across the length of the construction impact area. The DP2020a geotechnical report indicates that surface soils have a moderate to high potential for dispersion across the construction impact area.

There is potential for short term impacts on soils and land capability during constriction. Disturbed areas would be progressively rehabilitated as construction work progresses to minimise the duration of disturbance. Land would be reinstated to pre-existing conditions or other condition as agreed with the landholder. No long-term impacts to soils or the land capability of these areas is anticipated.

21.4.1.2. Acid sulfate soils

The majority of the proposal study area is identified as having a low probability of ASS. Low lying areas surrounding lakes and river beds are identified as having a high probability of containing ASS.

If ASS are encountered, it would be managed in accordance with the Acid Sulfate Soil Manual (ASSMAC, 1998). The manual identifies procedures for the investigation, handling, treatment and management of such soils. If encountered and exposed by construction excavation without proper management, it could result in damage to surrounding vegetation and receiving aquatic environments due to the release of sulfuric acid generated from oxidised ASS. The presence of ASS would be confirmed prior to the commencement of construction.

21.4.1.3. Salinity

Potential impacts from salinity can occur due to disruption of the water table (i.e. when saline groundwater rises and deposits salts in upper soil layers). Disruption can result from vegetation removal, physical barriers, or the reuse of saline soils generated by the proposal.

As discussed in Section 21.4.3, the proposal is not anticipated to result in changes to the water table and impacts due to altered groundwater levels are not anticipated. As such, significant impacts on soil salinity is not anticipated. Any localised impacts would be managed by preventing re-use of excavated saline soils in low salinity areas.

21.4.1.4. Naturally occurring asbestos

No areas of known or expected naturally occurring asbestos has been identified within the proposal study area. No impacts from naturally occurring asbestos are anticipated from construction of the proposal.

21.4.2. Contamination

21.4.2.1. Impacts from encountering contamination

Potential impacts from contamination include the risk of encountering existing contamination and spreading it to other areas during earthworks and other construction activities, resulting in exposure to human or environmental receptors.

While areas known to be contaminated have not been identified within the study area (including the existing regulated site near Wagga Wagga), the assessment has identified areas of potential contamination. Construction activities potentially impacting these sites includes vegetation removal, excavation of soils and piling activities. Consideration of these areas, the contamination potentially present, and an evaluation of risk from the proposal is summarised in Table 21-6.

Contaminated soils not previously identified as areas of contamination concern could also be encountered during construction work. However, an unexpected contamination finds protocol would be developed as part of the CEMP.

Table 21-6 Potential areas of contamination and assessed risk of encountering contamination during construction

Potential areas of contamination	Construction activity	Sensitive receiver	Likelihood	Preliminary risk evaluation
Farm dams	Excavation activities	Adjacent residents (including locations where the water is applied) Terrestrial flora/fauna Surface water and groundwater receptors	Medium potential for contaminant build-up within the dam sediments; low likelihood that dam sediments would need to be disturbed during construction. Farm dams present within the contamination study are not anticipated to be impacted and can be avoided during finalisation of the proposal's design and construction.	Low
Farm dams	Pile construction and de-watering	Adjacent residents (including locations where the water is applied) Terrestrial flora/fauna Surface water and groundwater receptors	Low likelihood that dam water would be disturbed during construction. Farm dams present within the contamination study are not anticipated to be impacted and can be avoided during finalisation of the proposal's design and construction.	Low

Potential areas of contamination	Construction activity	Sensitive receiver	Likelihood	Preliminary risk evaluation
Cleared agricultural land	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Current agricultural site users Terrestrial flora/fauna Surface water features, including farm dams	Medium potential for agricultural contaminants to be present.	Medium
Cleared agricultural land	Pile construction and de-watering	Current agricultural site users Terrestrial flora/fauna Surface water features, including farm dams	Groundwater depth anticipated to be >5 mbgl. Low likelihood for groundwater contamination.	Low
Dinawan and Wagga Wagga substations	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Adjacent residents Maintenance/ construction workers Terrestrial flora/fauna Surface water	Low potential for contaminants to be present, however works have the potential to intercept/mobilise any existing contamination at the site.	Low
Dinawan and Wagga Wagga substations	Pile construction and de-watering	Adjacent residents Maintenance/construction workers Terrestrial flora/fauna Surface water	Groundwater depth anticipated to be >5 mbgl. Low likelihood for groundwater contamination	Low
Main transmission line easement	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Terrestrial flora/fauna Surface water features	Low potential for contaminants to be present.	Low
Main transmission line easement	Pile construction and de-watering	Terrestrial flora/fauna Surface water features	Groundwater depth anticipated to be >5 mbgl. Low likelihood for groundwater contamination	Low

Potential areas of contamination	Construction activity	Sensitive receiver	Likelihood	Preliminary risk evaluation
Potential quarries and potential scaring/ earthworks sites	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Adjacent residents Maintenance/construction workers Terrestrial flora/fauna Surface water	Low potential for widespread contaminants to be present.	Low
Potential quarries and potential scaring/ earthworks sites	Pile construction and de-watering	Adjacent residents Maintenance/construction workers Terrestrial flora/fauna Surface water	Groundwater depth anticipated to be >5 mbgl. Low likelihood for groundwater contamination.	Low
PFAS sites (within one kilometre of study area).	Water fill point. Use of potential contaminated water for construction activities (dust suppression, washdown areas). Minor trench excavation for temporary utilities.	Adjacent residents (including locations where the water is applied) Terrestrial flora/fauna Surface water and groundwater receptors	Medium potential for widespread contaminants to be present (no significant impacts expected for sites >500 m). No PFAS sites are located within the area of contamination concern.	Low
Service Stations (within 500m of water fill points 301, 602 and 603, 604).	Water fill point Use of potential contaminated water for construction activities (dust suppression, washdown areas). Minor trench excavation for temporary utilities	Adjacent residents (including locations where the water is applied) Terrestrial flora/fauna Surface water and groundwater receptors	Low potential for widespread contaminants to be present (depth of groundwater likely >5 m). No service station sites are located within the contamination area of concern.	Low

21.4.2.2. Impacts from contamination from the proposal

The proposal has the potential to result in contamination from construction activities. Predominantly this includes accidental leaks and spills from the storage of fuels and chemicals and refuelling and other maintenance activities undertaken on plant and equipment.

The proposal includes construction support facilities including vehicle and equipment storage, maintenance sheds, chemical/ fuel stores and potential stockpile areas. Fuels and other chemicals would be appropriately stored according to Australian standards. While the potential for spills or leaks cannot be discounted, these impacts would be localised and able to be managed and rectified to prevent significant impacts to sensitive receivers.

21.4.2.3. UXO

The soils and contamination study area crosses a UXO area of substantial risk as identified by the DoD. Construction activities, including excavation activities, vegetation clearing, vehicle movement and utility works, have the potential to disturb UXO. Mitigation measures for UXO areas are outlined in Section 21.6.2.

21.4.3. Groundwater

21.4.3.1. Groundwater levels

Potential impacts to groundwater levels can occur where drawdown (or extraction of groundwater) is required, potentially lowering the level of the surrounding groundwater table. Other potential impacts may include groundwater mounding (localised increase in groundwater levels), or a reduction in groundwater recharge from surface infiltration due to an increase in impervious surfaces.

Potential impacts to groundwater levels due to construction may occur where the depth of excavations for transmission line structures intersect the level of groundwater, and dewatering is required. The majority of excavations required for the proposal would be to a maximum depth of two metres. These include excavations associated with the foundation of light structures, such as access tracks, construction camps or pad footings.

However, the likelihood that groundwater may be intercepted would be dependent on a range of factors, including rainfall in the period prior to construction.

Where groundwater may be encountered, a design and construction methodology would be adopted in order to avoid groundwater inflows. This would include the adoption of alternative footing designs (such as boring), if required.

If unexpected groundwater inflows are encountered and dewatering is required during construction of the proposal, it would be limited to discreet locations and likely from perched, non-permanent and localised groundwater that is not connected regionally. The size, depth and duration of the excavation would be limited as far as practicable, reducing the potential impact of the proposal on sensitive receptors due to decreasing groundwater levels resulting as part of the construction phase of the proposal. While approvals under the WM Act would likely not be required (by reason of Section 5.23 of the EP&A Act), if water is encountered and dewatering is required, a water access licence may be needed to be obtained, subject to the applicability of any exemption (refer to Section 21.2.1).

While excavations to deeper depths (between 15 and 25 metres below ground level) would also be required for the installation of piles, the piling method used during construction would not require dewatering, and no impacts to groundwater levels are anticipated. Earthworks associated with the Dinawan and Wagga Wagga substation are not anticipated to intersect groundwater.

Where blasting is undertaken it has the potential to fracture the surrounding rock which increases groundwater connectivity and could potentially alter local groundwater flow paths. This fracturing also increases connectivity to surface water features and potentially increases surface water infiltration. The degree of impact from blasting would be dependent on the charge required, depth to groundwater and the presence of existing defects within the rock. However, it is not anticipated that the blasting halo from an appropriate charge for the embedment of tower footings would extend more than 10 metres.

The proposal includes a relatively small compaction footprint, and small magnitude (shallow depth of compaction), as such significant impacts from groundwater mounding, changes to groundwater flow, or localised increases in groundwater levels are not anticipated for the proposal.

Water supply for construction is to be sourced from existing infrastructure and within existing water allocations, licencing and approvals.

21.4.3.2. Groundwater quality

Potential impacts to groundwater quality from construction activities may include:

- disturbance of previously unidentified contamination in groundwater
- contamination of groundwater from leaks or spills of fuels, oils and other chemicals used during construction
- increases in salinity due to rises in groundwater levels
- removal of saline groundwater (dewatering) and discharge.

Potential impacts from contamination are discussed in Section 21.4.2 and the potential for impacts to groundwater are considered to be low and easily managed.

The proposal is not anticipated to result in increased groundwater levels, and therefore impacts from increases in salinity are not anticipated.

If saline groundwater is encountered during construction potential impacts may include discharge to the surrounding environment and impacts to sensitive receivers. However, management measures would be included in the CEMP for the proposal to manage any impacts.

21.4.3.3. Sensitive receivers

The proposal is not anticipated to impact registered groundwater bores due to changes in groundwater levels or quality.

From the 243 registered bores, 11 registered bores are located within the construction impact area and therefore contain an increased risk of being accidently damaged during construction activities. The 11 registered bores within the construction impact area are listed in Table 21-7.

Table 21-7 Registered bores within the construction impact area

Bore ID	HSU	Status	Purpose	Bore depth (mbtoc)
GW415977	Lachlan fractured rock	Functioning	Monitoring	25.0
GW415978	Lachlan fractured rock	Functioning	Monitoring	10.6
GW415979	Lachlan fractured rock	Functioning	Monitoring	19.0
GW415980	Lachlan fractured rock	Functioning	Monitoring	7.0
GW415982	Lachlan fractured rock	Functioning	Monitoring	22.0
GW049852	Murrumbidgee Alluvium	Proposed	Exploration	152.4
GW084098	Murrumbidgee Alluvium	Functioning	Monitoring	7.0
GW012872	Murrumbidgee Alluvium	Functioning	Monitoring	29.9
GW403762	Murrumbidgee Alluvium	Unknown	Household supply	76.0
GW032607	Murrumbidgee Alluvium	In use	Stock and domestic	51.8
GW087095	Porous rock	Unknown	Monitoring	23.0

Where blasting is undertaken, it has the potential to fracture the surrounding rock, which may result in localised groundwater level decline. This could potentially impact neighbouring GDEs or registered water supply bores, if present, such as Sandy Creek, Stringybark Creek or Coloboralli Creek, which are located proximal to mapped outcropping rock. However, Sandy Creek is currently the only high potential GDE within 50 metres of the potential blasting areas. As discussed earlier, the blasting halo is not expected to extend beyond 10 metres and therefore the risk to Sandy Creek is low.

No registered bores are located within 50 metres of potential blasting areas and subsequently the risk to these receivers is considered low.

21.4.3.4. Aquifer interference policy

There are currently no requirements for aquifer interference approvals under the WM Act. However, the aquifer interference policy is used to guide proponents and DPIE in assessing aquifer interference activities.

An assessment of the proposals impacts on aquifers and GDEs in regard to the minimal impact considerations of the NSW Aquifer Interference Policy was undertaken for groundwater source categories of:

- highly productive groundwater sources, in which the groundwater source has total dissolved solids of less than 1,500 mg/L and contains water supply works that can yield water at a rate greater than five litres per second
- less productive groundwater sources failing to meet the highly productive criteria and are either alluvial, porous rock or fractured rock.

A summary of the assessment against these groundwater sources is provided in Table 21-8.

Table 21-8 Consideration of aquifer interference

Impact	Minimum impact consideration (highly productive and less productive groundwater sources)
Water table	There is a low risk of the proposal causing change to the groundwater table. Any potential change would be minimal due to the expected groundwater depth and selection of appropriate construction methodologies. No groundwater take is anticipated for construction or operation of the proposal.
Water pressure	Pressure heads are not anticipated to be lowered (or raised) due to the expected depth of the confined aquifers in the groundwater study area and selection of appropriate construction methodologies. No groundwater take is anticipated for construction or operation of the proposal.
Water quality	Any potential impact to groundwater is not expected to result in significant change in water quality that results in lowering the beneficial use category beyond 40 metres from the activity.

The assessment concluded the predicted impacts would comply with the Level 1 minimal impact considerations and thus impacts water table, water pressure and water quality would be considered as acceptable (refer to Table 7.1 of Technical paper 15 for the full assessment).

21.5. Potential impacts – operation

21.5.1. Soils

The potential for erosion of soils may be present around infrastructure, particularly around footings for transmission line structures and permanent access tracks located within the floodplain, where erosion and scour from water flow during flood events or high winds is more likely to occur. However, these impacts are anticipated to be minor as the proposal would be designed to manage water flows and the effects of winds, including scour protection (where required). Any areas of erosion would be minor and easily rectified.

Maintenance and repair activities would require use of vehicles on unsealed roads, as well as small scale excavation and ground disturbance. These activities have the potential to result in minor short-term impacts to soils from erosion and sedimentation. However, these impacts would be managed by implementing Transgrid's existing environmental management procedures.

21.5.2. Contamination

Operation of the proposal would not require disturbance to additional areas, as such the potential for exposure to previously unidentified areas of contamination is considered to be negligible.

Potential sources of contamination during the proposal operation would be for potential hydrocarbon (fuels, diesel, oils) contamination of soil, surface water and groundwater arising from incidents involving vehicle accidents, leaks and spills in the transmission line easement or at the proposed substation sites. Spill volumes from such incidents would be expected to be minor; however, the potential for hydrocarbon fuel to migrate off-site cannot be discounted. Spill containment facilities (such as bunded containers, designated fill points, and spill kits) would be used on maintenance work sites and at the proposed Dinawan and Wagga Wagga substations. Furthermore, it is expected that the operator would implement and develop incident response procedures to manage the risk from these occurrences.

21.5.3. Groundwater

21.5.3.1. Groundwater levels and flow

No significant excavations or cuttings would permanently intersect groundwater and no groundwater take is required during the operation of the proposal.

Infrastructure pads and other sites may have the potential to result in localised groundwater mounding resulting from compaction of the aquifers. However, areas of compaction are limited in size, and not considered likely to result in impacts from groundwater mounding or impacts to the flow of groundwater.

In the long-term, compaction from infrastructure pads, or piles intersecting groundwater may present potential risk of disrupting groundwater flows, causing groundwater levels to increase on the up gradient side (relative to groundwater flow direction) and decrease down gradient causing a 'groundwater shadow'. However, the potential impact from infrastructure associated with the proposal is considered minor and not likely to impact to groundwater flow.

Increases in impervious layers can reduce infiltration of rainfall and surface water. However, the proposed impervious areas are small relative to the local catchment area and the net impact on regional recharge and groundwater levels is low.

If blasting was undertaken during the construction of the proposal, the impact would exacerbate fracturing and jointing within the rock which may increase groundwater connectivity and alter local groundwater flow paths. Groundwater impacts from blasting would be limited if undertaken in accordance with the mitigation measures outlined in Section 21.6.2.

21.5.3.2. Groundwater quality

Groundwater quality may be impacted due to degradation of footing materials under aggressive groundwater (and soil) conditions. This could impact GDEs and registered users that are reliant on the underlying groundwater. However, the potential impact is considered low due to the minimal pile footing diameter and localised impact that would unlikely lead to degradation in groundwater quality of the groundwater resource.

Existing groundwater contamination, if present, is not anticipated to be mobilised due to the operation of the proposal as dewatering is not required for its operation and any potential impact from blasting is expected to result in a limited halo and radius of influence.

The operational impact for groundwater quality (contamination) related to the proposal would be potential hydrocarbon (fuels, diesel, oils) contamination of soil, surface water and groundwater arising from incidents involving vehicle accidents, leaks and spills in the transmission line easement or at the proposed substation sites. Spill volumes from such incidents would be expected to be minor; however, the potential for hydrocarbon fuel to migrate off-site cannot be discounted. Spill containment facilities (such as bunded containers, designated fill points, and spill kits) would be used on maintenance work sites and at the proposed Dinawan and Wagga Wagga substations. Furthermore, the operator would implement and develop incident response procedures to manage the risk from these occurrences.

21.5.3.3. Sensitive receivers

No impacts to registered groundwater bores, or GDEs are anticipated during operation of the proposal. Blasting has the potential to exacerbate fracturing of the rock, however given the limited blast halo radius of 10 metres this is not anticipated to impact any sensitive receivers.

While the potential impact to surface water features and their associated groundwater aquifer could cause potential impact during the operation of the proposal, the overall risk is considered to be low.

21.6. Management of impacts

21.6.1. Environmental management

Environmental management for the proposal would be carried out in accordance with the approach as detailed in Chapter 24 (Environmental management).

Measures and procedures to address potential impacts to impacts to soil, contamination and groundwater would be specified in a soil and water management sub-plan. The sub-plan would set out measures to mitigate and manage impacts on soil and water, including water quality and potentially contaminated soils (refer to Chapter 16 for further discussion).

21.6.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to soil, contamination and groundwater are listed in Table 21-9.

Table 21-9 Mitigation measures – soils, contamination and groundwater

Reference	Mitigation measure	Timing	Applicable location(s)
SCG1	Construction materials would be selected to withstand high saline soil and groundwater environment (where applicable).	Pre-construction and construction	Locations mapped as moderate to high-risk salinity
SCG2	Disturbance to areas of medium risk of contamination would be avoided or minimised where practicable during construction. Disturbance to these areas refers to intrusive work, such as excavation. Where disturbance cannot be avoided, potential impacts would be minimised during finalisation of the design and construction methodology where practicable. Areas of medium risk of contamination that would be disturbed by construction activities would be further investigated including completion of a site inspection. Based on the outcome of the site inspection, where considered to be required, a Phase 2 investigation would be completed in accordance with National Environmental Protection Measure 2013. Additional mitigation measures identified through further investigation would also be implemented.	Pre-construction	Cleared agricultural land, potential quarry and PFAS sites

Reference	Mitigation measure	Timing	Applicable location(s)
SCG3	Direct impacts to registered bores would be avoided, where possible. If the bores are: • not required to be removed during construction, then they would be clearly demarcated with a 5 by 5 metre construction exclusion zone • are to be removed during construction or unavoidably damaged, then make good provisions would apply in consultation with the registered bore owner.	Pre-construction and construction	Registered bores (refer Table 21-7)
SCG4	Prior to carrying out any blasting, a desktop assessment would be carried out to identify any high potential GDEs and registered bores in the vicinity that might be affected. Potential impacts to the GDEs and bores would be assessed using the latest available location data. The assessment would identify any necessary measures to mitigate any potential significant impacts. The measures would be implemented during the blasting. Where the assessment identifies potentially significant impacts to high potential GDEs and bores due to blasting that cannot be mitigated, alternative lesser impact construction methodologies or engineering solutions would be investigated and implemented.	Construction (prior to blasting)	Finalised blasting locations if within 50 metres of high potential GDEs
SCG5	Construction materials, spoil and waste would be suitably stored to minimise the potential for soil, groundwater or water quality impacts.	Construction	All
SCG6	Prior to ground disturbance in areas of PASS occurrence (e.g. in low lying areas surrounding former or current lakes and river beds), testing would be carried out to determine the presence of actual and/or potential ASS. If ASS are encountered, they would be managed in accordance with the *Acid Sulfate Soil Manual* (ASSMAC, 1998) and Transgrid's HSE Guideline.	Construction	All areas identified as potential ASS
SCG7	Prior to ground disturbance, a visual inspection would be undertaken for the presence of saline soils. Areas of known or suspected salinity would be subject to further testing as required. If salinity is confirmed, excavated soils would be managed in accordance with *Book 4 Dryland Salinity: Productive use of Saline Land and Water* (NSW Department of Environment and Climate Change, 2008b) and the *Salinity Training Manual* (DPI, 2014) to manage salinity impacts. Erosion controls would be implemented in accordance with *The Blue Book* (Landcom, 2004).	Construction	All

Reference	Mitigation measure	Timing	Applicable location(s)
SCG8	All chemicals, fuels or other hazardous substances would be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of any bunded area shall be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s shall be shown on the site plans.	Construction and operation	All (construction) Dinawan and Wagga substations (operation)
SCG9	The discovery of previously unidentified contaminated material would be managed in accordance with an unexpected contamination finds procedure.	Construction	All
SCG10	A site-specific risk assessment would occur for locations where there is a risk of encountering UXO. The risk assessment would be carried out prior to any activities that could interact with UXO. This would include field verification to validate the historical assessment of UXO contamination and identify appropriate mitigation practices. The risk assessment would occur with input from an appropriate UXO specialist and would identify if and when an explosives engineer is required during site activities. An unexpected finds procedure would be implemented. The procedure would specify the actions that site personnel must take to minimise the risk to and from any UXO encountered. The management actions identified in the risk assessment would be implemented prior to and during all relevant site activities. All personnel conducting intrusive works within an identified UXO area would be provided with appropriate safety and awareness briefing(s) prior to the participating in the intrusive works.	Pre-construction and construction	All
SCG11	If groundwater is encountered during piling or excavations, and dewatering is required, any dewatering volumes would be recorded by the contractor (and made available to the relevant authority – such as DPIE or DPI – upon request).	Construction	All locations
SCG12	Environmental spill kits containing spill response materials suitable for the works being undertaken would be available at the proposed Dinawan and Wagga substations with extras available to be carried in vehicles for use at maintenance work sites.	Operation	Dinawan and Wagga substations

21.6.3. Managing residual impacts or uncertainties

With the implementation of the mitigation measures detailed above, no significant residual impacts for soils, contamination and groundwater are anticipated for the proposal. The assessment includes a level of uncertainty and the potential for previously unidentified impacts such as contamination may occur. These impacts would be able to be managed appropriately through the mitigation measures detailed above.

22. Waste management and resource use

This chapter provides a summary of the assessment of potential waste management and resource use impacts of the proposal and identifies measures to address these matters.

22.1. Environmental assessment requirements

The Secretary's environmental assessment requirements relating to waste management and resource use and where these requirements are addressed in this EIS are outlined in Table 22-1.

Table 22-1 Secretary's environmental assessment requirements – waste management and resource use

Ref.	Secretary's environmental assessment requirements	Where addressed
Land		
Key issues	The EIS must address the following matters: • identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.	Waste management during construction is addressed in Section 22.3. Waste management during operation is addressed in Section 22.4.

22.2. Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment.

22.2.1. Legislative and policy guideline context

The main legislation relevant to the management of waste are the POEO Act, the Protection of the Environment Operations (Waste) Regulation 2014 (the Waste Regulation) made under the POEO Act, and the *Waste Avoidance and Resource Recovery Act 2007* (WARR Act). The POEO Act establishes the procedures for environmental control, and for issuing environmental protection licences regarding matters such as waste, air, water and noise.

The Waste Regulation controls matters such as the obligations of consignors (producers and agents), transporters and receivers of waste in relation to waste transport licensing and tracking requirements. The WARR Act aims to ensure that waste management options are considered against the following waste management hierarchy:

1. avoidance of unnecessary resource consumption
2. resource recovery (including reuse, reprocessing, recycling and energy recovery)
3. disposal.

22.2.1.1. Waste classification

The classifications that apply to waste in NSW and the descriptions of each are provided by the POEO Act, the Waste Regulation and supporting guidelines, including the *Waste Classification Guidelines* (NSW EPA, 2014). Many waste types are pre-classified under the POEO Act and do not require testing. However, if a waste is not pre-classified, it may need to be tested to determine its classification.

22.2.2. Methodology

The assessment involved:

- reviewing the regulatory framework for waste management
- identifying potential waste generating activities
- identifying the likely classification of waste generated by the proposal in accordance with relevant legislation and guidelines
- estimating quantities of waste, where feasible
- identifying available waste management options
- identifying waste management measures for construction and operation.

The waste types and quantities of waste detailed in this EIS are indicative and have been identified for the purpose of determining potential waste impacts and waste management options. Although the quantities of waste actually generated by the proposal may differ from the estimates made, the identified waste management options are variable and would be appropriate to the final waste quantities. Typical management measures, in line with State regulatory frameworks have also been proposed to appropriately manage potential waste and resource use impacts.

22.3. Potential impacts – construction

22.3.1. Waste sources

The anticipated waste streams generated during construction are outlined in Table 22-2.

Table 22-2 Summary of potential waste streams

Activity	Waste type	Comment / anticipated volume (indicative)
Vegetation	Trunks which are more than 200 millimetres in size may be retained and stockpiled within the easement area for potential future reuse Material would generally be mulched and used in the rehabilitation of each site	Assumption of around 550 kilometres of 80 metre wide easement (33 square kilometres) of medium (25 per cent) to high (40 per cent) density vegetation above two metres high that would require removal Around 275,000 cubic metres
Earthworks	Spoil from excavation of towers	67,500 cubic metres
	Spoil from excavation of substations	Dinawan – around 40,000 cubic metres Wagga Wagga – 4,000 cubic metres
	Spoil from excavation of access tracks	15,000 cubic metres
	Potentially contaminated soils	< 16,000 tonnes
Transmission line and substation construction	Metal cable drums/empty OPGW	Total number 2,800
	Concrete waste	1,600 tonnes
	Other scrap metal	400 tonnes
	Wood and other construction waste	1,600 tonnes

Activity	Waste type	Comment / anticipated volume (indicative)
	Ancillary substation waste including empty oil drums, nitrogen and SF_6 bottles	Volumes to be determined following finalisation of proposal construction methodology
Demolition works	Existing tower demolition waste metal	120 tonnes (around 30 tonnes per tower for four towers)
	Existing transmission line removal	2 kilometres
	Demolition wastes from substations	640 tonnes
	Hazardous and contaminated waste	< 1 tonne
Laydown/ workshop/camp/ office establishment	Concrete waste	160 tonnes
	Scrap metal	40 tonnes
	Wood and other construction waste	40 tonnes
Accommodation camp operation	General domestic waste (construction and maintenance personnel)	500 tonnes
Laydowns and workshop operation	Tyres	80 tonnes
	Oils, grease, fuel, chemicals and fluids	16 tonnes
	Batteries	4 tonnes
	Radiator fluid	2 tonnes
	Hydraulic fluid	4 tonnes
Laydown/ workshop/camp/ office demobilisation	Concrete waste	4,800 tonnes
	Scrap metal	160 tonnes
	Gravel and hardstand materials	120,000 tonnes
	Solar panels	Quantity to be confirmed during design (proposed to seek reuse in the local community)
	Wood and other construction waste	160 tonnes

22.3.2. Resource use

22.3.2.1. Materials selection and use

As described in Section 6.9.4, the proposal would require a wide range of materials during construction. Typical construction materials including steel, transmission line cable, concrete, plastics, paints and timber. Key materials and resources would include:

- 18,700 tonnes of steel for transmission line towers
- 7,555 kilometres of conductor cables
- up to 3,700 cubic metres of concrete for substation works and up to around 30,000 cubic metres of concrete for transmission tower footings.
- up to 350 tonnes of reinforcement steel for foundations in substations

- 550 tonnes of steel for support of electrical equipment in substations
- main electrical equipment for substations:
  - 2 Synchronous Condensers
  - 4 Shunt Reactors
  - 2 Capacitor Banks
  - 330kV Switchgear.

The majority of materials required for construction are considered common construction materials. The highest value materials used in the proposal would include large amounts of copper used in the transmission line cabling and transformers housed in the substation. This metal is considered relatively abundant, with the proposal not likely to impact on its availability.

Opportunities to utilise recycled materials in the proposal would be explored during the subsequent phases of the proposal design and construction.

22.3.2.2. Energy and fuel use

Construction of the proposal would require the use of energy and fuels to power plant, equipment and transport vehicles. Fuels would likely include non-renewable sources such as petroleum, diesel, natural gas and liquefied natural gas.

Electricity needs on site would likely be provided by connection of the construction site offices to the local power grid. Generators would be used where it is not possible to obtain power from the local grid or through the use of solar panels at the construction compound and accommodation camp sites.

22.3.2.3. Water

As described in Section 6.9.2, water would be required during construction for:

- dust suppression on the substation construction sites and line structure construction sites, and on access tracks through the use of a water spray attached to a tanker vehicle (including the use of water reduction polymers)
- concrete batching activities for use when mixing with cement, aggregates and water for transmission line structures and substation foundations
- wetting backfill material (if it is too dry for effective compaction)
- general worker facilities at the main construction compound and camp sites.

It is estimated that about 1.1 gigalitres of water would be required for construction, comprising about:

- 728 megalitres for dust suppression
- 203 megalitres for earthworks compaction
- 20 megalitres for concrete batching activities (potable water)
- 11 megalitres for vehicle washdown facilities
- 100 megalitres for camp sites (potable water).

Wastewater would be collected via tanker trucks and disposed of at approved disposal locations in accordance with the NSW EPA waste classification guidelines.

Water would be supplied to the required areas either via water tanker vehicle deliveries or connections to a local town water main (in line with the relevant council and utility provider approval processes). It is estimated that water tanker deliveries would require a number of water truck movements per day across the overall proposal during the peak construction period to maintain appropriate water supplies to the relevant construction work front, compound or camp site as required (refer to Table 6-4 in Section 6.9.2 for details). Transgrid has commenced discussions with a number of water suppliers within the broad region through which the proposal would be located to identify the required volume water (potable and non potable) for the proposal from existing facilities.

22.3.2.4. Waste handling and management

Relevant legislation and policies outline the requirements which would be adopted for construction waste management. The proposed waste handling and management measures for construction waste streams are provided in Table 22-3.

Soil stockpile management would be in accordance with *Managing Urban Stormwater – Soils and Construction* (Landcom, 2004). The size of stockpiles would be determined by material quantity requirements, space availability, stockpile stability and safety.

Table 22-3 Management of construction waste

Waste type	Management of waste
Spoil from excavated materials	Excavated materials would be reused on site where practicable. Where excavated materials cannot be reused (on site or in other projects off site) or reinstated, it would be classified and taken off site to a waste management facility that is lawfully permitted to accept that type of waste for reuse, recycling or disposal.
Contaminated spoil or soils	In situ testing of soils in areas of potential contamination concern would be undertaken to determine the appropriate waste classification. Further details regarding management of any contaminated soils is provided in Chapter 21.
General construction waste	General construction waste would be managed in accordance with the waste hierarchy. Where possible, concrete waste would be subject to onsite recycling and reuse in hardstands or counterweights, or disposed of off-site. Waste would be segregated and stockpiled on site, with materials such as concrete, timber, plastic, and metals separated for reuse or recycling. Electrical waste would be stored for collection by an authorised contractor for recycling off site, where feasible, or disposal at an appropriately licenced facility. All construction waste that cannot be reused or recycled would be classified in accordance with the *Waste Classification Guidelines* and directed to a waste management facility that is lawfully permitted to accept that type of waste or reused in accordance with the requirements of any applicable resource recovery order and exemption.
Liquid waste	Sewage and grey water from construction compounds and camp sites would be disposed of in sewers or transported to an appropriately licenced liquid waste treatment facility.

Waste type	Management of waste
Adhesives, lubricants, waste fuels and oils, engine coolant	Waste from construction vehicle and plant maintenance activities would be collected and stored in designated waste storage areas for collection by an authorised contractor for off-site disposal. Where feasible, containers holding oil, grease and lubricants would be washed prior to disposal or stored separately for disposal as hazardous waste. Waste oil and oil filters would be stored in recycling bins and collected by an authorised contractor and recycled off site, where feasible.
Office waste including kitchen waste, paper, cardboard, plastics, glass	Waste containing food would be stored appropriately (covered), and regularly removed from site for disposal to reduce the likelihood of attracting pests and vermin (including birds). Recyclable materials such as paper, cardboard, plastics, glass, ferrous, and non-ferrous containers would be stored at recycling bins for collection by an authorised contractor and recycled off site. Where recycling is not feasible, waste would be collected and stored in designated waste storage areas for collection by an authorised contractor for off-site disposal at a licenced waste facility.
Green waste	As far as practicable, green waste would be chipped, mulched and reused for vegetation management or dust suppression on site, reused in other projects in accordance with the requirements of any applicable resource recovery order and exemption or collected by an authorised contractor and recycled off site. Noxious weeds would be disposed of in accordance with relevant guidelines/ requirements.
Topsoil	As far as practicable and subject to suitability, topsoil would be reused in rehabilitation/reinstatement work or reused in other projects in accordance with the requirements of any applicable resource recovery order and exemption.

22.3.2.5. Off-site recycling and disposal locations

General waste and recycling would be disposed of off-site and would be sent to the closest local council recycling/transfer centre to the section of the alignment where the waste is generated.

Any additional metals such as steel or aluminium (either from redundant infrastructure or waste from new structures) would also be recycled.

22.4. Potential impacts – operation

Minimal operational waste or resource impacts are anticipated during the operation of the proposal. The wastes generated during operation of the proposal would be related to the following:

- periodic maintenance activities which would have the potential to generate some materials where elements of the proposal are required to be replaced or serviced
- general waste generated by maintenance personnel
- vegetation management activities (which would typically be limited to maintenance of vegetation clearances limits along the proposal easement).

The potential volumes of waste are shown in Table 22-4.

Table 22-4 Operational waste volumes

Frequency	Waste type	Anticipated volume	Proposed disposal / recycling
1 per 50 years	Waste conductors and insulators materials	50 tonnes	Offsite disposal at an approved facility
5 per 20 years	Waste oil from substation transformers	100 tonnes	Offsite disposal at an approved facility
Daily	Sewage waste from facilities	Less than one tonne	Discharge to sewer or approved septic system
Yearly	Domestic waste	Less than five tonnes	Regular waste collection service

No regular waste collection service would be required for the proposal. Waste would be removed from site as required by maintenance personnel. Similarly, no regular/ongoing use of resource use are anticipated during operation of the proposal.

Resource use during operation would include:

- water for onsite staff facilities (toilet and wash basin facilities) and fire-fighting (if required)
- electricity for the proposed Dinawan 330kV substation operation, upgraded and expanded Wagga substation, communications facilities and minimal lighting.

22.5. Management of impacts

22.5.1. Environmental management

Environmental management for the proposal would be carried out in accordance with the approach as detailed in Chapter 24 (Environmental management).

Potential impacts to waste and resource use would be managed throughout each phase of the proposal. As part the design and procurement stage, design optimisation and sustainable procurement elements would be incorporated where practicable, to reduce material inputs and enable reduced energy and fuel inputs throughout the construction phase. A waste management sub-plan would be prepared for the proposal, including (but not limited to):

- targets for the recovery, recycling and re-use of construction waste
- procedures for the assessment, classification, management and disposal of waste
- waste tracking and compliance management.

22.5.2. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to waste and resource use (where not previously identified) are listed in Table 22-5.

Table 22-5 Mitigation measures – waste and resource use

Reference	Mitigation measure	Timing	Applicable location(s)
WM1	The proposal would achieve an Infrastructure Sustainability Council verified 'Design' and 'As-built' rating of Excellent under v1.2 of the IS rating tool.	Pre-construction and construction	All locations
WM2	Measures to minimise excess spoil generation would be investigated at finalisation of the proposal's design and construction methodology. This would include a focus on optimising the design to minimise spoil volumes and the reuse of material on-site.	Pre-construction	All locations
WM3	Opportunities to re-use or recycle construction and demolition waste would be investigated during finalisation of the proposal's design and construction methodology.	Pre-construction	All locations
WM4	All waste would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).	Construction	All locations
WM5	Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities.	Construction	All locations
WM6	All waste generated and surplus spoil to be removed from the construction of the proposal would be transported to appropriately licensed waste disposal or transfer facilities or other facilities lawfully able to accept materials.	Construction	All locations
WM7	Waste during operations would be managed in accordance with Transgrid's existing Environmental Management System and processes for the identification, classification, handling and management of waste.	Operation	All locations
WM8	All waste would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).	Operation	All locations

22.5.3. Managing residual impacts or uncertainties

Through the implementation of the standard mitigations detailed in Table 22-5, residual impacts resulting from waste and resource use are anticipated to be appropriately managed.

23. Cumulative impacts

This chapter provides an assessment of the potential cumulative impacts. It describes other projects in the proposal study area and identifies where there is the potential for cumulative impacts to occur.

23.1. Assessment approach

When a project is assessed in isolation, the environmental impacts (or benefits) may not be considered large. However, when combined with other projects, the resultant cumulative effects may result in a greater extent, magnitude or duration of impact than may otherwise be generated separately by each project. Identifying the potential for cumulative impacts assists in guiding the development of appropriate mitigation measures. The cumulative impact assessment is therefore an assessment of environmental, social, economic and other impacts which result from a project when added to other past, present and reasonably foreseeable future projects. The cumulative assessment undertaken has been predominantly qualitative, due to information available at the time of the assessment for the projects against which the cumulative impacts have been assessed and has been completed with consideration of the recently released *Cumulative Impact Assessment Guidelines for State Significant Projects (CIA Guidelines)* (Department of Planning, Infrastructure and Environment, 2021).

23.1.1. Consideration of projects to be assessed for cumulative impacts

The identification of proposed developments assessed as part of this cumulative impact assessment was based on a number of criteria including the:

- proximity of the additional project(s) to the proposal
- likelihood of the additional project(s) being constructed during a similar time as the proposal
- size of the additional project(s) and the potential to result in substantial changes to identified key issues likely to result in cumulative impacts (such as traffic, noise and vibration, air quality, resource needs, etc.) or substantial changes to the existing land use of the area
- likelihood of the additional project(s) being constructed given their current pre-approval status and support from relevant government planning strategies and local environmental plans (noting for major projects this only included consideration of projects where a formal scoping document or EIS had been lodged with the DPIE).

Consistent with the expectations of the CIA Guidelines (DPIE, 2021), determination of the relevant future projects was determined from by publicly available information (including preliminary environmental assessment, environmental impact statements and relevant environmental information) from the following:

- Australian Government EPBC Public notices list (Department of Environment and Energy, latest search October 2021).
- NSW Major Projects website (NSW Government Department of Planning, Industry and Environment (DPIE), latest search October 2021), focussing on other State Significant Infrastructure or State Significant Developments and division 5.1 of the EP&A Act projects that are likely to significantly affect the environment and require an EIS
- Relevant council websites (latest searches October 2021) focusing on any major greenfield and urban renewal developments that are scheduled for the area.

The projects that were considered as having the potential to result in a cumulative impact with the proposal are listed in Table 23-1 and shown in Figure 23-1.

Table 23-1 Projects with the potential for cumulative impacts

Project/ proponent	Details	Status (as of October 2021)	Construction timeframe (indicative)	Nearest proposal location/relevance for cumulative assessment
EnergyConnect (NSW – Western Section) *Transgrid*	The key components of EnergyConnect (NSW – Western) include: • about 135 kilometres of new 330kV double circuit transmission line and associated infrastructure between the SA/NSW border and the existing Buronga substation • an upgrade of the existing 22 kilometre 220kV single circuit transmission line between the Buronga substation and the NSW/Victoria border at Monak to a 220kV double circuit transmission line • a significant upgrade and expansion of the existing Buronga substation to a combined operating voltage of 220kV/330kV.	The project was approved in September 2021	Construction of the proposal is scheduled to commence in early-2022 (enabling phase). The construction of the transmission lines would take approximately 18 months while the Buronga substation upgrade and expansion would be delivered in two components and be operational by mid-2023. Site decommissioning and remediation is expected to extend approximately one year beyond the commissioning (operational) phases, with estimated completion in mid-2024.	The EnergyConnect – (NSW – Western Section) would occur at the western end of the current proposal and include a section of parallel alignment with the proposal for the first six kilometres.
Buronga Solar Farm *Renew Estate*	The Buronga Solar Farm development includes a 400 MW solar farm with energy storage and associated infrastructure located adjacent to the proposal Buronga substation. The project would also involve the construction of a 220kV or 330kV transmission line for connection to the existing Buronga substation.	SEARs were issued on 3 August 2018. It is assumed an EIS is currently being prepared for the proposal.	The construction schedule for the proposal is identified as being about approximately 18 to 24 months from site establishment to completion (noting commencement subject to approval from DPIE) (Renew Estate, 2018).	The proposed solar farm would be located immediately adjacent to the Buronga substation.

Project/ proponent	Details	Status (as of October 2021)	Construction timeframe (indicative)	Nearest proposal location/relevance for cumulative assessment
Buronga Landfill Expansion *Wentworth Shire Council*	The proposal includes the expansion to the existing Buronga landfill to allow for an increase in the total quantity of waste that can be accommodated from 30,000 tonnes to 100,000 tonnes of general waste per annum.	SEARs were issued on 11 November 2020. It is assumed an EIS is currently being prepared for the proposal.	Subject to approval, the works would be undertaken strategically over the next 30 years (subject to filling requirements).	The existing landfill is located around six kilometres to the south east of the Buronga substation.
Buronga – Gol Gol residential expansion *Wentworth Shire Council*	The Buronga and Gol Gol communities are considered to be the growth area of the Wentworth Shire with new subdivisions proposed to provide approximately 500 new large residential housing allotments. The proposed expansion of residential subdivisions in the Buronga and Gol Gol area is identified in the *2017-2027 Community Strategic Plan* (Wentworth Shire Council, 2017) with areas identified as urban release areas on the Wentworth LEP 2011.	No timeframe on proposed development of the urban release areas has been identified at this time	No timeframe on proposed development of the urban release areas has been identified at this time	Within the township of Buronga and Gol Gol about seven to eight kilometres west of the proposal
Inland Rail – Albury to Illabo *ARTC*	ARTC is proposing to upgrade the Albury to Illabo section, along the 185 kilometres of existing operational narrow-gauge railway from the Victorian/New South Wales border to Illabo in regional NSW. The proposal would provide clearance of the existing 'Main South' corridor to operate 1,800 metres long, 6.5 metres high, double stacked trains and includes the provision of dual track in areas for train passing. The project is made up of discrete sections of proposed upgrade, including upgrades within the existing rail corridor at Uranquinty, The Rock and within the centre of Wagga Wagga.	SEARS were issued on 14 October 2020. It is assumed an EIS is currently being prepared for the proposal.	Subject to planning approval, construction is planned to commence in mid-2023 and complete by late 2024. Operation is estimated to commence in 2025.	Where the proposal crosses the existing railway line and Olympic Highway would be located around 2.5 kilometres south of the nearest enhancement site for the Inland Rail project.

Project/ proponent	Details	Status (as of October 2021)	Construction timeframe (indicative)	Nearest proposal location/relevance for cumulative assessment
Uranquinty Solar Farm *Origin Energy*	Origin Energy is proposing to develop a commercial scale solar photovoltaic site and associated battery storage at Uranquinty. The proposal would have a capacity of up to 200 megawatts (MW) of renewable energy production for the local electricity supply. The site is located north-west of Uranquinty village along Uranquinty Cross Road, around 15 kilometres south-west of Wagga Wagga.	SEARs were issued on 19 February 2021. It is assumed an EIS is currently being prepared for the proposal.	The proponent is seeking to undertake the proposal either in two stages or as one (both stage 1 and 2 at the same time). The land for Stage 1 was reported to be available in January 2021 while the land set aside for Stage 2 would not become available until January 2025. Construction of the proposal is expected to take about 12 months. A construction workforce of about 60 workers on average would be required, however this would peak at about 100 workers during busy periods.	The proposed solar farm would be around 3.5 kilometres north of the proposal alignment at Uranquinty
Gregadoo Solar Farm *Hanwha Energy*	The Gregadoo Solar Farm would be located about 13 kilometres south-east of Wagga Wagga. The project is proposed to comprise construction, operation and decommissioning of a maximum 47 MW solar farm and associated infrastructure.	Approved	Construction was expected to commence mid-2021.	The proposed solar farm would be located just to the north of the proposal alignment and west of the Wagga Wagga substation.

Figure 23-1

Project with potential cumulative impacts

23.2. Assessment of cumulative impacts

This section provides an overview of the cumulative impacts that may occur between (or as a result of) the proposal and other proposed projects during the construction and operation (either through impacts on, or as a result of each development). The projects listed in Table 23-1 are the key project(s) that are considered to potentially result in cumulative impacts due to the proximity of these projects with the current proposal for EnergyConnect (NSW – Eastern Section) and the potential overlap of construction periods (or as outlined in the CIA Guidelines (DPIE, 2021), have been approved but not yet started).

The assessments provided in the following sections have focused on the key matters that could be materially affected by the cumulative impacts of the project and the other identified relevant future projects. It is noted that as outlined in the CIA Guidelines (DPIE, 2021) not every conceivable cumulative impact on every matter associated with each project has been detailed as part of the presented assessment. The assessment has focused on the key matters that are within the immediate geographical area of influence of the project (i.e. within proximity to the project site) and within the relevant strategic context.

In considering the CIA Guidelines (DPIE, 2021), an assessment of the likely overlap of assessment matters for each project was undertaken. A summary this assessment and the potential issue-specific cumulative impacts that may occur with each identified project is provided in Table 23-2. Further detailed discussion of the consideration of these impacts against each project is then provided in the following sections below.

Table 23-2 Summary of potential overlap between project impacts

Project	Potential overlap between impact of project on assessment matter and impact of other project on the same assessment matter										
	Biodiversity	Aboriginal heritage	Historic heritage	Land use and property	Landscape and visual amenity	Social	Hydrology, flooding and water quality	Air quality	Noise and vibration	Traffic and access	Contamination
EnergyConnect (NSW – Western Section)											
Buronga Solar Farm											
Buronga Landfill Expansion											
Buronga – Gol Gol residential expansion											
Inland Rail – Albury to Illabo											
Uranquinty Solar Farm											
Gregadoo Solar Farm											

Key

The project may result in significant impacts on the matter

The project is unlikely to result in significant impacts on the matter

No potential overlap in impacts between a future project

23.2.1. EnergyConnect (NSW – Western Section)

The proposal forms part of the broader EnergyConnect project and would share a direct interface with the approved EnergyConnect (NSW – Western Section) and would also be located geographically within the vicinity of the approved Victorian Section. Key cumulative impacts that may arise as a result of these interfaces would be associated with potential impacts to:

- amenity impacts due to an overall incremental increased level of construction activities within the vicinity of the interfaces, such as construction noise emissions and dust emissions
- traffic impacts, where common haulage routes are proposed to be used resulting in an incremental increase in overall traffic along some roads
- visual amenity and landscape impacts due to construction activities, or construction of new or modified permanent infrastructure
- land use and property impacts, due to temporary changes to land uses or restrictions to activities due to the creation of new easements
- Aboriginal heritage
- social impacts
- biodiversity impacts
- resource impacts, where common water supply points are proposed to be used.

The potential for cumulative impacts would depend on the staging, location and timing of construction activity, the opportunities to avoid and minimise impacts through design and construction methodologies, and proximity to sensitive receivers. However, construction impacts would be readily managed by the contractor (which would be common to both the NSW – Western and NSW – Eastern components of the EnergyConnect project) through staging of works to minimise interruption and impacts to sensitive receivers, where possible.

Potential cumulative impacts that may arise as a result of both projects are summarised in Table 23-3. For a majority of the potential impacts, these are likely to occur as a result of incremental increase in overall impacts between the two projects (such as an overall increase in traffic movements).

Table 23-3 Summary of cumulative impact – the proposal and EnergyConnect (NSW – Western Section)

Environmental aspect/impact	Potential cumulative impact
Biodiversity	Cumulative impacts from the loss of biodiversity has the potential to extend beyond the construction of the proposal, through the combined loss of additional habitat and vegetation. To manage the cumulative biodiversity impacts of EnergyConnect (i.e. the NSW – Western, NSW – Eastern, and Victorian sections), the options development for EnergyConnect has considered routes to avoid and minimise impacts to biodiversity, and opportunities would continue to be explored during further proposal development and based on further field investigations. In addition to environmentally sensitive design responses, biodiversity offsets would be provided for the proposal, and would be expected for the NSW-Western (and Victorian) sections of EnergyConnect, to address cumulative biodiversity impacts where removal of habitat and vegetation is unavoidable. Ecological impacts would be carefully managed between sections of EnergyConnect but would still result in a linear impact to a combined impact, primarily to mallee habitats, similar to those at the western end of the current proposal. Overall, the mitigation measures proposed, when combined, would result in achieving a net increase in conservation and protection of impacted species and Plant Community Types.

Environmental aspect/impact	Potential cumulative impact
Aboriginal heritage	**Construction** – there are 131 previously unidentified and unrecorded Aboriginal sites, as well as 28 PADs, in the EnergyConnect (NSW – Western Section) project area. Of these, 78 sites are expected to be impacted by the project. An additional 45 Aboriginal sites and 39 PADs have also been identified as part of the current proposal. Due to the linear nature of the proposal and impacts being spread across the landscape, cumulative impacts in association with EnergyConnect (NSW – Western Section) are likely to be partial as opposed to total and would not occur in the same location. However, the combination of the two projects would still result in an increased number of overall Aboriginal items impacted, resulting in some cumulative impact. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts on the Aboriginal heritage of the region are assessed as low. **Operation** – Both projects would have no ongoing operational impacts to Aboriginal heritage and as such are not expected to result in additional cumulative impacts during operation.
Historic heritage	**Construction** – EnergyConnect (NSW – Western Section) pass through the property boundary (curtilage) of three listed heritage items and past two unlisted heritage items (survey marker trees). Given the distance of the project from these items the proposal would not have any direct impact to the items associated with the listings. In addition, the proposal would pass through the curtilage of one additional listed heritage item. The linear nature of the proposal, as well as the large spans between tower location impacts (around 500 metres) would result in large areas where no impacts would occur and a very limited impact footprint. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts from the proposal on the Historic heritage of the region are assessed as low. **Operation** – Both projects would have no ongoing operational impacts to historic heritage and as such are not expected to result in additional cumulative impacts during operation.
Land use and property	**Construction** – the proposal may contribute to a cumulative loss of land for agricultural uses when considered in relation to the EnergyConnect (NSW – Western Section) project. However, the magnitude of the impacts of the proposal on agriculture is limited by: • the relatively low productivity of agriculture in the area • the small amount of land removed from agriculture • the continuation of agriculture activity • the low biosecurity risks in the region. The total agricultural area affected by the proposal and EnergyConnect (NSW – Western Section) would be minor, relative to total extent of agricultural land across the nine impacted LGAs through which the proposal passes. Additionally, between both the proposal and EnergyConnect (NSW – Western Section), some agricultural production would be able to continue during construction, limiting the overall impact. Overall, the cumulative impact of the proposal and the EnergyConnect (NSW – Western Section) project is expected to be low. **Operation** – Both projects would have limited additional land use impacts during construction and as such are not expected to result in additional cumulative impacts during operation.

Environmental aspect/impact	Potential cumulative impact
Landscape character and visual amenity	**Construction** – EnergyConnect (NSW – Western Section) would have a cumulative impact from both a landscape character and visual amenity perspective with the proposal. As the proposal and EnergyConnect (NSW – Western Section) would both result in minor landform change, various extents of vegetation removal, and the inclusion of additional infrastructure elements within the existing landscape, it is anticipated that there would be some cumulative visual and landscape impacts. However, given the broad region across which the impacts would occur and the linear nature of both projects with limited physical overlap, the overall cumulative impacts on any one location or receiver would be limited and likely only occur where potential receivers can see construction of both projects at the same time. **Operation** – at the western end of the proposal, the proposed permanent infrastructure (towers and transmission lines) would be located parallel to the eastern extent of works for EnergyConnect (NSW – Western Section). This would occur for a section of transmission line around six kilometres to the east of the existing Buronga station. This would result in a combined increase in the extent of transmission line infrastructure to be developed for this area during operation. The impacts of this cumulative impact are expected to be low given the lack of visual receivers in this region. No additional cumulative impacts during operation with the EnergyConnect (NSW – Western Section) are anticipated.
Social	**Construction** – during concurrent construction activities, potential social cumulative impacts could occur as a result of: • increased project workforces associated with both projects being present in the same local area at the same time • continued potential employment opportunities • increased traffic levels on the regional road network due to construction traffic from both the proposal and the EnergyConnect (NSW – Western Section) occurring at the same time. In relation to use of the Buronga accommodation camp and compound, the full operational capacity and usage was assessed and approved under the EnergyConnect (NSW – Western Section) EIS. Eastern construction workers would utilise some of the assessed capacity during construction resulting in no additional cumulative impacts for this item. **Operation** – Both projects would have limited operational social impacts and as such are not expected to result in additional cumulative impacts during operation.
Hydrology, flooding and water quality	**Construction** – as assessed in the EnergyConnect (NSW – Western Section) *Hydrology and Flooding Impact Assessment* (WSP, 2020) there would be minimal impact from the construction provided correct implementation of soil and water management plans. Similar minimal impacts to geomorphology, water supply or water quality have been identified for the current proposal. As such it is estimated that there would be no cumulative impacts to geomorphology, water supply or water quality as a result of the proposal and EnergyConnect (NSW – Western Section). **Operation** – Both projects would have limited operational hydrology or water quality impact impacts and as such are not expected to result in additional cumulative impacts during operation.

Environmental aspect/impact	Potential cumulative impact
Air quality	**Construction** – there is the potential for minor air quality cumulative impacts to occur during construction depending on the timing and nature of the EnergyConnect (NSW – Western Section) project and the proposal. These impacts would occur as a result of the increase overall level of construction works to be undertaken across the region, in particular where the two projects overlap to the east of the Buronga substation (such as when additional earthworks may occur for both projects within close proximity to each other). However, given the broad region across which the impacts would occur and the linear nature of both projects with limited physical overlap, the overall cumulative impacts on any one location or receiver would be limited. **Operation** – Both projects would have limited operational air quality impacts and as such are not expected to result in additional cumulative air quality impacts during operation.
Noise and vibration	**Construction** – there is the potential for concurrent construction activities occurring in proximity to noise sensitive receivers as a result of the construction of this proposal. Given the broad region across which the impacts would occur and the linear nature of both projects with limited physical overlap, the overall cumulative impacts on any one location or receiver would be limited. The risk of notable construction impacts at the nearest receivers would be low, with concurrent noise levels not exceeding 3 dB above the highest predicted individual impact. **Operation** – the potential for cumulative operational noise impacts would occur where the proposal would be constructed adjacent to high voltage transmission lines (330kV). A six kilometre section of the proposal would be constructed adjacent to a 220kV section of the EnergyConnect (NSW – Western Section) transmission line. As such no cumulative impacts between the proposal and EnergyConnect (NSW – Western Section) are expected to occur.
Traffic and access	**Construction** – the construction traffic generated from EnergyConnect (NSW – Western Section) was identified as equating to a peak hourly movement of around 58 light vehicles per hour, with the proposal adding an additional hourly movement of 26 light vehicles and 20 heavy vehicles from the Buronga construction compound and accommodation camp, which is anticipated to have minimal cumulative impact on the road network performance. **Operation** – Both projects would have limited operational traffic and transport impacts, primarily centred around operational maintenance. Additionally, the two projects would be expected to be maintained as one, limiting cumulative operational traffic impacts.
Contamination	**Construction** – Both the proposal and the EnergyConnect (NSW – Western Section) project would have the potential to impact on areas of potential contamination. Both projects were however assessed to have relatively minor impacts in this respect. Additionally, given the linear nature of both projects and the limited physical overlap, the overall cumulative impacts on any one location of potential contamination being impacted by both project would be limited. **Operation** – Both projects would have limited operational contamination impacts and as such are not expected to result in additional cumulative impacts during operation.

23.2.2. Buronga Solar Farm

Potential cumulative impacts that may arise as a result of both projects are summarised in Table 23-4.

Table 23-4 Summary of cumulative impact – the proposal and Buronga Solar Farm

Environmental aspect/ impact	Potential cumulative impact
Biodiversity	This solar project would primarily occur on cropped lands and is unlikely to result in substantive cumulative impacts during construction or operation.
Aboriginal heritage	**Construction** – five Aboriginal sites are located within the development area for the Buronga Solar Farm, which would potentially be impacted by the project. The combination of the two projects would have the potential to result in an increased number of overall Aboriginal items impacted, resulting in potential of some cumulative impacts. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts on the Aboriginal heritage of the region are assessed as low. **Operation** – both projects would be expected to have no ongoing operational impacts to Aboriginal heritage and as such are not expected to result in additional cumulative impacts during operation.
Historic heritage	**Construction** – no historic heritage items are recorded within five kilometres of the Buronga Solar Farm. Given the distance of the project from any heritage items the proposal would not have any direct impact on heritage items. The current proposal would pass through the curtilage of one additional State listed heritage item. The linear nature of the proposal, as well as the large spans between tower location impacts (around 500 metres) would result in large areas where no impacts would occur and a very limited impact footprint. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts from the proposal on the Historic heritage of the region are assessed as low. **Operation** – Both projects would have no ongoing operational impacts to historic heritage and as such are not expected to result in additional cumulative impacts during operation.
Land use and property	**Construction** – the Buronga Solar Farm, would comprise development of a 400-megawatt solar farm on approximately 1,200 hectares of agricultural land. The total agricultural area affected by the proposal and the Buronga Solar Farm would be minor, relative to the total extent of agricultural land across the nine impacted LGAs through which the proposal passes. Additionally, between both the proposal and the Buronga Solar Farm, some agricultural production would be able to continue during construction and operation, limiting potential impacts. Overall, the cumulative impact of the proposal and the Buronga Solar Farm is expected to be small. **Operation** – both projects would have limited additional land use impacts following construction and as such are not expected to result in additional cumulative impacts during operation.
Landscape character and visual amenity	**Construction** – the Buronga Solar Farm is located directly adjacent to the Buronga substation. As both the proposal and solar farm project would result in some minor landform change, various extents of vegetation removal and addition of energy infrastructure, it is anticipated that there would be some cumulative visual and landscape impacts. However, given the broad region across which the impacts would occur, with limited physical overlap, the overall cumulative impacts on any one location or receiver would be limited. **Operation** – no additional cumulative impacts during operation with the Buronga Solar Farm are anticipated.

Environmental aspect/ impact	Potential cumulative impact
Social	**Construction** – if concurrent construction activities of the proposal and the Buronga Solar Farm occurs, cumulative impacts could result in the following areas: • competition for local resources and labour • increased demand for local service in Wentworth LGA • increased traffic and movement of people along important highways and regional roads in Wentworth LGA • cumulative impacts to agricultural properties affecting regional outputs. **Operation** – no additional impact.
Hydrology, flooding and water quality	**Construction** – With appropriate soil and water control measures in place there would be no expected cumulative impacts to geomorphology, water supply or water quality as a result of the construction of both the Buronga Solar Farm and the proposal. The proposal is not located within a floodplain and hence would not impact local flood risk. **Operation** – Both projects would have limited operational hydrology or water quality impact impacts and as such are not expected to result in additional cumulative impacts during operation.
Air quality	Cumulative impacts during construction and operation of this project and the proposal are not anticipated.
Noise and vibration	**Construction** – the nearest noise sensitive receiver to the Buronga Solar Farm site is closer to the proposal. As the proposal is closer to noise sensitive receivers, it would mask noise levels from works from the Buronga Solar Farm. As a result, it is anticipated that there would be a low risk of cumulative impacts. **Operation** – the proposal has the potential to result in cumulative noise impacts with the proposed Buronga Solar Farm, which would be located next to the Buronga substation and involve operation of noise generating equipment including electrical transformers, inverters, solar panel sun tracking mechanism, and service vehicles. The cumulative noise and vibration impact between the proposal and the solar farm is predicted to be minor.
Traffic and access	**Construction** – if concurrent construction activities of the Buronga Solar Farm and the proposal were to occur, given the substantial residual capacity available on Arumpo Road, the cumulative impact is considered manageable within the existing road network capacity. With mitigation, the cumulative impact during construction is considered minor. **Operation** – both projects would have limited operational traffic and transport impacts, primarily centred around operational maintenance.
Contamination	Cumulative impacts during construction and operation of this project and the proposal are not anticipated.

23.2.3. Buronga Landfill Expansion

Potential cumulative impacts that may arise as a result of both projects are summarised in Table 23-5.

Table 23-5 Summary of cumulative impact – the proposal and Buronga Landfill Expansion

Environmental aspect/impact	Potential cumulative impact
Biodiversity	Impacts from this project would occur in a distinct area and are unlikely to contribute substantially to large regional ecological impacts in combination with the proposal during construction or operation.
Aboriginal heritage	**Construction** – there is one site listed on AHIMS for the Buronga Landfill Expansion project. The combination of the two projects would have the potential to result in an increased number of overall Aboriginal items impacted, resulting in some cumulative impact. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts on the Aboriginal heritage of the region are assessed as low. **Operation** – Both projects would be expected to have no ongoing operational impacts to Aboriginal heritage and as such are not expected to result in additional cumulative impacts during operation.
Historic heritage	**Construction** – no historic assessment was completed for the Buronga Landfill Expansion project due to the historic use of the site as a land fill. As such, there would be limited cumulative historic heritage above and beyond those identified for the current proposal. Therefore, the cumulative impacts from the proposal on the Historic heritage of the region are assessed as minimal. **Operation** – Both projects would have no ongoing operational impacts to historic heritage and as such are not expected to result in additional cumulative impacts during operation.
Land use and property	**Construction** – the Buronga Landfill Expansion site is not currently used for agriculture. Therefore, no cumulative impact on regional agricultural production would be expected between the proposal and the Buronga Landfill Expansion project. **Operation** – No cumulative land use or property impacts would occur during operation.
Landscape character and visual amenity	**Construction** – the Buronga Landfill Expansion is located on the outskirts of Gol Gol where there is an existing landfill site and within an open mallee shrubland setting. The landscape impact of this landfill expansion would not be associated with or viewed from the proposal. Overall, there would not be any cumulative landscape or visual impacts experienced as a result of construction of both the proposal and the Buronga Landfill Expansion project. **Operation** – as the two projects would be visually separated, no cumulative landscape or visual impacts are expected during operation.
Social	**Construction** – If concurrent construction activities of the proposal and the Buronga Landfill Expansion occurs, cumulative impacts could result in the following areas: • competition for local resources and labour • competition for natural resources. The potential effect of these cumulative impacts is expected to be low given the typically different skills and resources required for each project. **Operation** – No cumulative social impacts are expected to occur during operation.

Environmental aspect/impact	Potential cumulative impact
Hydrology, flooding and water quality	**Construction** – given this is an existing operational landfill site, it is anticipated that additional impacts to hydrology and water quality would be managed in line with existing procedures. Additionally, the potential hydrology and water quality impacts anticipated as a result of the proposal during construction would be locationally distant from the impacts of the landfill site. As such, it is considered that that there would be no cumulative impacts to geomorphology, water supply or water quality as a result of the combined construction of the Buronga Landfill Expansion project and the proposal. No cumulative flooding impacts are also anticipated between the two projects during construction. **Operation** – No cumulative hydrology or flooding impacts are expected to occur during operation.
Air quality	**Construction** – there is the potential for minor cumulative air quality impacts to occur where constriction of the Buronga Landfill Expansion project and the proposal are undertaken at the same time. These impacts would occur as a result of the overall increase in level of construction works (in particular earthworks and vehicle movements). However, given the locationally separate nature of the two projects, the overall cumulative impacts on any one location or receiver would be limited. The extent of cumulative impacts from the project and proposal would depend on site management practices and the prevailing wind direction. **Operation** – As the proposal would generate minimal air quality impacts, no cumulative impacts are expected to occur during operation.
Noise and vibration	**Construction** – the Buronga Landfill Expansion site is located more than five kilometres to the south west of the proposal. Two potential noise sensitive receivers are located in between these sites, more than three kilometres from the landfill location. Given the distance between the two projects, cumulative impacts are not expected. **Operation** – as the proposal would generate minimal noticeable noise or vibration impacts at the identified distances between the two projects, no cumulative impacts are expected to occur during operation.
Traffic	**Construction** – if concurrent construction activities of the Buronga Landfill Expansion and the proposal were to occur, there is the potential for cumulative impacts on traffic. Construction traffic generated by the Buronga Landfill Expansion is currently unavailable to determine the magnitude of these potential cumulative impacts. **Operation** - the proposal would have limited operational traffic and transport impacts, primarily centred around operational maintenance and hence limit the potential cumulative impacts during operation.
Contamination	**Construction** – Both the proposal and the Buronga Landfill Expansion project would have the potential to impact on areas of potential contamination. However, the Buronga Landfill Expansion project is expected to be completed progressively, and therefore significant contamination cumulative impacts are not expected. **Operation** – no cumulative contamination impacts are expected to occur during operation.

23.2.4. Buronga – Gol Gol residential expansion

Potential cumulative impacts that may arise as a result of both projects are summarised in Table 23-6.

Table 23-6 Summary of cumulative impact – the proposal and Buronga – Gol Gol residential expansion

Environmental aspect/impact	Potential cumulative impact
Biodiversity	Impacts from the proposed Gol Gol residential expansion are not known at this stage. However, impacts from this project would occur in a distinct area and are unlikely to contribute substantially to large regional ecological impacts in combination with the proposal during construction or operation.
Aboriginal heritage	**Construction** – the proposed land subject to the Buronga – Gol Gol residential expansion sits between 400-1,500 metres from the banks of the Murray River where Aboriginal heritage is predicted to be of moderate to high archaeological sensitivity. The combination of the two projects would have the potential to result in an increased number of overall Aboriginal items impacted, resulting in some cumulative impact. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts on the Aboriginal heritage of the region are assessed as low. **Operation** – both projects would be expected to have no ongoing operational impacts to Aboriginal heritage and as such are not expected to result in additional cumulative impacts during operation.
Historic heritage	**Construction** – there are three locally significant heritage items in Buronga – Gol Gol. In addition, the current proposal would pass through the curtilage of one State listed heritage item. The linear nature of the proposal, as well as the large spans between tower location impacts (around 500 metres) would result in large areas where no impacts would occur and a very limited impact footprint. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts from the proposal on the Historic heritage of the region are assessed as low. **Operation** – both projects would have no ongoing operational impacts to historic heritage and as such are not expected to result in additional cumulative impacts during operation.
Land use and property	**Construction** – the Buronga – Gol Gol residential expansion, would comprise a 240 hectare urban release area on high-value irrigated horticulture land, posing significant potential of impacts to regional agricultural production. However, the proposal would have a very small impact on high-value irrigated horticulture. As a result, there would be minor cumulative impacts from the proposal and Buronga – Gol Gol. **Operation** – no cumulative land use or property impacts would occur during operation.
Landscape character and visual amenity	**Construction** – the Buronga – Gol Gol residential expansion is located on the outskirts of the existing town and has a more intensive agricultural character than the proposal alignment. The landscape impact of this residential expansion would not be associated with the proposal and the proposal would have smaller areas of localised impact along a corridor within a broader scale rural landscape. Overall, there would not be any cumulative landscape or visual impact expected because of the proposal when this expansion occurs. **Operation** – no additional cumulative land use or property impacts would occur during operation.

Environmental aspect/impact	Potential cumulative impact
Social	**Construction** – if concurrent construction activities of the proposal and Buronga-Gol Gol residential expansion occurs, cumulative impacts could result in the following areas: • competition for local resources and labour • competition for natural resources The potential effect of these cumulative impacts is expected to be low given the typically different skills and resources required for each project. **Operation** – no cumulative social impacts are expected to occur during operation.
Hydrology, flooding and water quality	**Construction** – if concurrent construction activities of the proposal and the Buronga – Gol Gol residential expansion were to occur, there would be a cumulative impact on water supply. However, it is not anticipated that there would be any cumulative impacts to geomorphology, water quality or flooding as a result of the combined construction of the Buronga – Gol Gol residential expansion project and the proposal. **Operation** – the Buronga – Gol Gol residential expansion involves a change in land use that would have impacts on the long term water supply and water quality. However, it is not anticipated that the proposal would result in operational hydrology impacts resulting in no cumulative operational impacts.
Air quality	Given the nature of the development and the distance to the proposal, cumulative impacts to air quality during construction and operation are not expected.
Noise and vibration	**Construction** – the Buronga – Gol Gol residential expansion site is located more than seven kilometres to the west of the proposal. Given the distance between the two projects, cumulative impacts are not expected. **Operation** – due to the nature of the Buronga – Gol Gol residential expansion (being for residential use), it is not likely to represent a notable noise generator. Additionally, due to the large separation distance from the Buronga – Gol Gol residential expansion to the proposal, adverse noise impacts from the proposal to the Buronga – Gol Gol residential expansion are not anticipated.
Traffic	**Construction** – construction traffic of the Buronga – Gol Gol residential expansion would be localised to the intersections and road network access to the growth area. Given the well distributed and minor increase in traffic generated over the course of constructing EnergyConnect, the cumulative impact with the proposed Gol Gol residential expansion is considered negligible. **Operation** – the proposal would have limited operational traffic and transport impacts, primarily centred around operational maintenance. As a result, cumulative impacts of traffic are anticipated to be low during operation.
Contamination	Cumulative impacts during construction and operation of this project and the proposal are not anticipated.

23.2.5. Inland Rail – Albury to Illabo

Potential cumulative impacts that may arise as a result of both projects are summarised in Table 23-7.

Table 23-7 Summary of cumulative impact – the proposal and Inland Rail (Albury to Illabo)

Environmental aspect/impact	Potential cumulative impact
Biodiversity	Impacts to biodiversity from this project are comparatively minor as it impacts edge areas along the existing railway. Such impacts are not considered likely to substantially contribute to cumulative impacts in a regional context during construction or operation.
Aboriginal heritage	**Construction** – there are 30 known Aboriginal sites in close proximity to the Inland Rail – Albury to Illabo project that could be potentially impacted by the project, noting the EIS for this project has not been released at the time of this assessment. The combination of the two projects could have the potential to result in an increased number of overall Aboriginal items impacted, resulting in some cumulative impact depending on the impacts of the Inland Rail project. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts on the Aboriginal heritage of the region are assessed as low. **Operation** – no additional impacts.
Historic heritage	**Construction –** there are 102 historic heritage sites within or adjacent to (within 200 metre buffer) the Inland Rail project that could experience impacts noting the EIS for this project has not been released at the time of this assessment. The current proposal would pass through the curtilage of one additional listed heritage item. The linear nature of the proposal, as well as the large spans between tower location impacts (around 500 metres) would result in large areas where no impacts would occur and a very limited impact footprint. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts from the proposal on the historic heritage of the region are assessed as low. **Operation** – both projects would have no further ongoing operational impacts to historic heritage and as such are not expected to result in additional cumulative impacts during operation.
Land use and property	**Construction** – the Inland Rail – Albury to Illabo project is predominantly within the existing rail corridor. Therefore, no cumulative impact on regional agricultural production would be expected between the proposal and the Inland Rail – Albury to Illabo project. **Operation** – no cumulative land use or property impacts would occur during operation.
Landscape character and visual amenity	**Construction** – the Inland Rail project would intensify the character of the rail corridor. As such, the Inland Rail project would not have a similar landscape or visual character and would not be associated with the proposal. Therefore, there are no cumulative impacts on landscape character or visual amenity impacts anticipated. **Operation** – as the two projects would be visually separated, no cumulative landscape or visual impacts are expected during operation.
Social	**Construction** – if concurrent development of the proposal and Inland Rail – Albury to Illabo occurs, potentially minor cumulative impacts could result in the following areas: • competition for local resources and labour • competition for natural resources • increased demand on the road network in Wagga Wagga and Lockhart LGAs • demand for accommodation and social infrastructure Wagga Wagga LGA. **Operation** – no cumulative social impacts are expected to occur during operation.

Environmental aspect/impact	Potential cumulative impact
Hydrology, flooding and water quality	**Construction** – given this is an existing operational rail corridor, it is anticipated that additional impacts to hydrology and water quality would be managed in line with existing procedures. As such, it is considered that that there would be minimal cumulative impacts to geomorphology, water supply or water quality as a result of the combined construction of the Inland Rail project and the proposal. No cumulative flooding impacts are also anticipated between the two projects during construction. **Operation** – no cumulative hydrology or flooding impacts are expected to occur during operation.
Air quality	**Construction** – the nearest enhancement site for the Inland Rail project is located approximately 2.5 kilometres south of the proposal. The main construction works for proposal would be the installation of towers and transmission lines which present a negligible air quality risk. The extent of cumulative impacts from the Inland Rail project and proposal would depend on site management practices and the prevailing wind direction, however any potential impacts are expected to be minimal. **Operation** – as the proposal would generate minimal air quality impacts, no cumulative impacts are expected to occur during operation.
Noise and vibration	Cumulative impacts during construction and operation of this project and the proposal are not anticipated.
Traffic	The proposal includes enhancement works within the Wagga and Lockhart LGAs. As the EIS is yet to be released, the potential for cumulative would need to be considered during detailed construction planning.
Contamination	Cumulative impacts during construction and operation of this project and the proposal are not anticipated.

23.2.6. Uranquinty Solar Farm

Potential cumulative impacts that may arise as a result of both projects are summarised in Table 23-8.

Table 23-8 Summary of cumulative impact – the proposal and Uranquinty Solar Farm

Environmental aspect/impact	Potential cumulative impact
Biodiversity	This solar project would primarily occur on cropped lands and is unlikely to result in substantive cumulative impacts during construction or operation.
Aboriginal heritage	**Construction** – there were 17 sites located within one kilometre of the Uranquinty Solar Farm project. The combination of the two projects would have the potential to result in an increased number of overall Aboriginal items impacted, resulting in some cumulative impact. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts on the Aboriginal heritage of the region are assessed as low. **Operation** – Both projects would be expected to have no ongoing operational impacts to Aboriginal heritage and as such are not expected to result in additional cumulative impacts during operation.
Historic heritage	**Construction** – historic heritage was not considered to be a constraint for the Uranquinty Solar Farm project. As such, there would be limited cumulative historic heritage above and beyond those identified for the current proposal. Therefore, the cumulative impacts from the proposal on the Historic heritage of the region are assessed as minimal. **Operation** – Both projects would have no ongoing operational impacts to historic heritage and as such are not expected to result in additional cumulative impacts during operation.
Land use and property	**Construction** – the Uranquinty Solar Farm would limit agricultural production, but the relatively small size means that the impact would be small on a regional scale. The cumulative impact of the Uranquinty Solar Farm and the proposal on agricultural productivity at a regional scale would also be minor. **Operation** – Both projects have the potential to result in the limiting of certain agricultural uses during operation, however these reductions when considered within the overall availability of agricultural land in the region is considered to be minimal.
Landscape character and visual amenity	**Construction** – the Uranquinty Solar Farm would be located over two kilometres to the north of the proposal in a similar rural landscape. As both the proposal and solar farm project would result in some minor landform change and various extents of vegetation removal and it is anticipated that there would minimal cumulative visual and landscape impacts. **Operation** – both Uranquinty Solar Farm and the proposal would result in a combined increase in the extent of energy infrastructure in this area during operation.
Social	**Construction** – if concurrent development of the proposal and Uranquinty Solar Farm occurs, cumulative impacts could result in minor potential impacts to the following areas: • competition for local resources and labour • competition for natural resources • increased demand on the road network • demand for accommodation and social infrastructure. **Operation** – no cumulative social impacts are expected to occur during operation.

Environmental aspect/impact	Potential cumulative impact
Hydrology, flooding and water quality	**Construction** – With appropriate soil and water control measures in place there would be no expected cumulative impacts to geomorphology, water supply or water quality as a result of the construction of both the Uranquinty Solar Farm and the proposal. The proposal is not located within a floodplain and hence would not impact local flood risk. **Operation** – Both projects would have limited operational hydrology or water quality impact impacts and as such are not expected to result in additional cumulative impacts during operation.
Air quality	Given the distance of the solar farm project to the proposal, cumulative impacts to air quality during both construction and operation are not expected.
Noise and vibration	**Construction** – the Uranquinty Solar Farm development is expected to be very low, particularly as being a solar farm development as well as its rural setting. Due to this, it is anticipated that there would be a low risk of cumulative impacts. **Operation** – the proposal has the potential to result in cumulative noise impacts with the proposed Uranquinty Solar Farm, which would involve operation of noise generating equipment including electrical transformers, inverters, solar panel sun tracking mechanism, and service vehicles. The cumulative noise and vibration impact between the proposal and the solar farm is predicted to be minor.
Traffic	Cumulative impacts of this proposal and the Uranquinty Solar Farm are unknown at this stage. The potential for cumulative would need to be considered during detailed construction planning.
Contamination	**Construction** – both the proposal and the Uranquinty Solar Farm project would have the potential to impact areas of potential contamination. However, contamination impacts during construction are expected to be relatively localised to the project specific proposal disturbance areas, and therefore cumulative impacts are not expected. **Operation** – given the separated nature of the two projects, and the negligible contamination impacts anticipated to result from the operation of the proposal, no cumulative contamination impacts are expected to occur during operation.

23.2.7. Gregadoo Solar Farm

Potential cumulative impacts that may arise as a result of both projects are summarised in Table 23-9.

Table 23-9 Summary of cumulative impact – the proposal and Gregadoo Solar Farm

Environmental aspect/impact	Potential cumulative impact
Biodiversity	This solar project would primarily occur on cropped lands and is unlikely to result in substantive cumulative impacts during construction or operation.
Aboriginal heritage	**Construction** – stone artefacts and a single modified tree are recorded in the Gregadoo Solar Farm project area, with negligible potential for high densities of objects or cultural material within the proposal area. The combination of the two projects would have the potential to result in an increased number of overall Aboriginal items impacted, resulting in some cumulative impact. Given the broad region across which the impacts would occur with limited physical overlap, the overall cumulative impacts on the Aboriginal heritage of the region are assessed as low. **Operation –** no additional impact.
Historic heritage	**Construction –** no historic heritage assessment was completed for the Gregadoo Solar Farm site due to the nearest heritage items being approximately one kilometre away. As such, there would be limited cumulative historic heritage above and beyond those identified for the current proposal. Therefore, the cumulative impacts from the proposal on the historic heritage of the region are assessed as minimal. **Operation –** Both projects would have no ongoing operational impacts to historic heritage and as such are not expected to result in additional cumulative impacts during operation.
Land use and property	**Construction** – the Gregadoo Solar Farm would have little impact on regional agricultural production due to its small size and continued sheep grazing below the arrays. The total agricultural area affected by the proposal and the Buronga Solar Farm would be minor, relative to total extent of agricultural land across the nine impacted LGAs through which the proposal passes. Additionally, between both the proposal and the Buronga Solar Farm, some agricultural production would be able to continue during construction and operation, limiting the overall impact. Overall, the cumulative impact of the proposal and the Gregadoo Solar Farm is expected to be low. **Operation** – Both projects have the potential to result in the limiting of certain agricultural uses during operation, however these reductions when considered within the overall availability of agricultural land in the region is considered to be minimal.
Landscape character and visual amenity	**Construction** – the Gregadoo Solar Farm would introduce energy generation infrastructure and additional transmission lines into the landscape. When viewed together, Gregadoo Solar Farm would result in a combined increase in the extent of energy infrastructure in the landscape. Hence, there would be a cumulative landscape and visual impact associated with this project in combination with the proposal. **Operation** – no additional cumulative impacts during operation with the Gregadoo Solar Farm are anticipated.

Environmental aspect/impact	Potential cumulative impact
Social	**Construction** – in the event of concurrent construction activities of the proposal and the Gregadoo Solar Farm, cumulative impacts could result in the following areas: • competition for local resources and labour • competition for natural resources • increased demand on the road network • demand for accommodation and social infrastructure **Operation** – no cumulative social impacts are expected to occur during operation.
Hydrology, flooding and water quality	**Construction** – With appropriate soil and water control measures in place there would be no expected cumulative impacts to geomorphology, water supply or water quality as a result of the construction of both the Gregadoo Solar Farm and the proposal. The proposal is not located within a floodplain and hence would not impact local flood risk. **Operation** – Both projects would have limited operational hydrology or water quality impact impacts and as such are not expected to result in additional cumulative impacts during operation.
Air quality	Given the distance of the solar far project to the proposal, cumulative impacts to air quality are not expected.
Noise and vibration	**Construction** – the Uranquinty Solar Farm development is expected to be very low, particularly as being a solar farm development as well as its rural setting. Due to this, it is anticipated that there would be a low risk of cumulative impacts. **Operation** – the proposal has the potential to result in cumulative noise impacts with the proposed Uranquinty Solar Farm, which would involve operation of noise generating equipment including electrical transformers, inverters, solar panel sun tracking mechanism, and service vehicles. The cumulative noise and vibration impact between the proposal and the solar farm is predicted to be minor.
Traffic	**Construction –** given minimal vehicle movements during construction of the Gregadoo Solar Farm, as imposed by the consent conditions, cumulative traffic impacts are negligible. **Operation –** both projects would have limited operational traffic and transport impacts, primarily centred around operational maintenance.
Contamination	**Construction** – both the proposal and the Uranquinty Solar Farm project would have the potential to impact areas of potential contamination. However, contamination impacts during construction are expected to be relatively localised to the project specific proposal disturbance areas, and therefore cumulative impacts are not expected. **Operation** – given the separated nature of the two projects, and the negligible contamination impacts anticipated to result from the operation of the proposal, no cumulative contamination impacts are expected to occur during operation.

23.2.8. Summary of cumulative impact

Overall, there is the potential for cumulative impacts between the current proposal and other projects that may be constructed (or operate) in the broader region at the same or similar times. These impacts would generally occur during construction and would typically relate to amenity-type impacts. Cumulative impacts with other major projects in the vicinity of the proposal would primarily include:

- cumulative social impacts (such as an overall increase in worker population across the region which may put increased strain on existing regional resources, facilities and accommodation)
- traffic and transport (including increase overall traffic on local and regional roads)
- noise and vibration impacts (due to increased overall levels of construction, in particular where projects are geographically close to each other).

The interface of construction activities between identified projects and the proposal are considered to be generally low and readily manageable by the construction contractor.

The key potential cumulative impacts that may occur during combined construction and operation would be broader regional impacts with respect to biodiversity and Aboriginal heritage. With respect to biodiversity, an offsets strategy, which is currently being prepared for each NSW component of EnergyConnect, would be implemented and would identify opportunities for offsetting the potential biodiversity impacts of the proposal within the broader region (refer to Section 9.7.4 for details).

With respect to impacts of the proposal on Aboriginal heritage, where direct impacts to sites cannot be avoided during design refinement, mitigation measures (as outlined in Table 10-3) would be implemented to minimise the potential impacts on Aboriginal heritage. This would include surface salvage of artefacts or a program of salvage excavations in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010) (as specified in mitigation measure AH3, AH6 and AH8).

No substantial operational cumulative impacts are expected between the proposal and the other identified projects within the vicinity of the proposal.

23.3. Management of impacts

23.3.1. Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential cumulative impacts are listed in Table 23-10.

Table 23-10 Mitigation measures – Cumulative impacts

Reference	Mitigation measure	Timing	Applicable location(s)
CI1	Consultation with relevant roads authority would occur in relation to road use.	Construction	All locations
CI2	Consultation with relevant local councils and other water supply operators would occur in relation to the proposal's water supply strategy to ensure there is effective management of these demands during construction and operation.	Pre-construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
SE5 (as per Table 14-19)	If proposal construction coincides with the construction of other projects around Wagga Wagga, a workforce accommodation strategy for the proposal would be implemented and would be informed by an additional review of existing housing and accommodation capacity relative to the proposal workforce needs.	Pre-construction	Wagga Wagga LGA
TA11 (as per Table 19-2)	Significant traffic generating developments in the vicinity of the proposal would be identified. Consultation would occur with those developments and the relevant roads authority regarding proposal-related vehicle movements and road works. Measures to address any potentially significant cumulative traffic and access impacts would be identified and implemented.	Construction	All locations

In addition, to manage the potential cumulative impacts identified which are associated with biodiversity, Aboriginal heritage and noise and vibration matters, these would be addressed through a combination of all each of the mitigation measures identified previously in Table 9-6 (biodiversity measures), Section 9.7.4 (biodiversity offset strategy), Table 10-3 (Aboriginal heritage measures) and Table 18-12 (noise and vibration matters) respectively.

Part D – Management and conclusions

24. Environmental management

This chapter describes the environmental management approach for the proposal during design refinement, construction and operation, and identifies the process for inspections, monitoring, auditing and reporting of environmental compliance. This chapter also includes a compilation of the mitigation measures listed throughout the EIS, as well as how sustainability would be considered during design finalisation, and the construction and operational phases of the proposal.

24.1. Approach to environmental management

24.1.1. Overall approach

The approach to environmental management for the proposal would be consistent with:

- the environmental management system (EMS) of the construction contractor and Transgrid during construction and operation respectively
- proposal design – measures to avoid and minimise impacts that have been incorporated into the corridor selection and proposal design
- construction and operational environmental management, as described in the following sections. This would be consistent with Transgrid's *HSE Handbook* (Transgrid, 2020) as relevant, which provides the minimum environmental controls for all construction and maintenance works on the Transgrid network
- mitigation measures – the measures are identified as an outcome of this environmental impact assessment.

24.1.2. Design and construction methodology refinement and uncertainties resolution

As outlined in Chapter 5 (Proposal infrastructure and operation) and Chapter 6 (Proposal construction), the proposal study area and indicative construction impact area have been developed to avoid and minimise environmental impacts wherever possible, while providing some flexibility during finalisation of the design and construction methodology. Aspects of the proposal that may be subject to further refinement include:

- the final transmission line component locations, including the specific location, height and type of transmission line structures, location of some access tracks and associated allocations of the subset disturbance area A, A (centreline) and B categories
- final locations and layouts of the main construction compound and accommodation camp sites - including selection of the final site where location options have been provided at Balranald and Lockhart
- final arrangement of the Dinawan 330kV substation facility within the identified parcel of land
- water supply points and other ancillary construction facilities
- construction methods and staging.

Refinements to optimise the design outcomes and construction method would be carried out to:

- further avoid or minimise environmental impacts. This includes approaches to avoid or minimise native vegetation clearing, impacts to areas of biodiversity value, and areas of moderate to high Aboriginal archaeological potential
- respond to community concerns raised during the exhibition of the EIS
- limit impacts on the community during construction and/or operation
- limit the duration of construction
- improve the operation of the proposal.

Generally refinements would be developed and planned to keep disturbance within areas that have been already subject to heritage survey and ecological assessment. Some refinements might however require changes that could disturb locations outside surveyed or assessed areas. In such circumstances additional heritage survey and ecological assessment would occur as required before confirming the change.

These circumstances would include:

- where impacts to a newly identified environmental constraint of very high significance cannot be avoided by simple refinements (i.e. with movement contained in the current surveyed and assessed areas). In relation to environmental constraints of very high significance this would be defined as:
  - Aboriginal heritage:
    - > burial sites
    - > sites of such significance that the narrative and or understanding of Aboriginal heritage occupation in the region would be substantially changed or enhanced based on its identification and/or its potential for future research
  - Biodiversity:
    - > significant unexpected finds of SAII species and/or populations not previously recorded as part of the BDAR for the EIS
- where an additional access track, water supply point or other construction ancillary facility (i.e. brake and winch site) is identified as being required which:
  - does not substantially adversely impact on environmental matters in addition to those presented this this EIS
  - any associated landholder is supportive of the required use.

The final design would be reviewed for consistency with the approved proposal. If proposal impacts are not consistent with the approval from the Minister for Planning and Public Spaces, approval would be sought from the Minister for any such modifications in accordance with the requirements of Division 5.2 of the EP&A Act.

24.1.3. Construction environmental management approach

The proposed approach to environmental management outlined here is indicative. It is based on the current design and construction methodology, and the types of conditions of approval typically granted in relation to CSSI projects. Depending on the specific conditions of approval, a different approach might be required.

24.1.3.1. Community and stakeholder engagement

A community and stakeholder management plan (CSMP) would be prepared prior to commencement of construction works. The CSMP would be developed in consultation with the relevant stakeholders. The CSMP would detail the approach to communication between Transgrid, the construction contractor, the community, community groups, other stakeholders and government authorities.

The CSMP would:

- identify people, organisations and government authorities to be consulted during the construction works
- set out procedures and mechanisms for the regular distribution of accessible information to keep the community and stakeholders informed of the proposal
- set out the procedures and mechanisms for consulting with relevant councils and government authorities including procedures for nil responses
- describe the method for advertising the telephone line and email address for enquiries relating to the proposal
- set out procedures and mechanisms for response to enquiries and feedback
- include a complaints management system which outlines parameters for recording information on all complaints received during the main construction work
- set out procedures and mechanisms to resolve any issues and disputes that might arise in relation to environmental and stakeholder management associated with the proposal.

24.1.3.2. Enabling works

Enabling works are activities proposed early in the overall construction program for the proposal to facilitate the commencement of substantial construction works and collect information required to finalise aspects of the design and construction methodology. Typical and expected enabling works are described in Section 6.6.1. The construction contractor would confirm the proposed scope and timing of enabling works following confirmation of the conditions of approval for the proposal.

The conditions of approval for CSSI projects typically allow construction staging and require that separate CEMPs are prepared, or existing CEMPs updated as required, to cover each proposed stage. Transgrid anticipates that construction would be staged (refer to Section 6.4), with certain enabling works scheduled to occur ahead of and separate to main construction works. The construction contractor would for confirm the approach to construction staging and preparing the required environmental management documentation for each stage in accordance with the conditions of approval.

Minor/low impact enabling works

The conditions of approval for CSSI projects typically require that all construction activities occur in accordance with an approved CEMP. Typical conditions of approval, however, often exclude certain pre-construction minor works and activities with low potential for environmental and community impacts (minor/low impact activities) from the definition of construction. When this occurs, the minor/low impact activities can occur prior to approval of a CEMP.

Proposed minor/low impact activities for the proposal include:

- investigations (including geotechnical, contamination and other testing/sampling, surveying and the placement of survey pegs/marks)
- installation of fencing, gates, barricades, exclusion zones and other access controls
- installation of environmental controls, mitigation measures and monitoring equipment
- adjustments to roads required to facilitate safe ingress/egress at construction compounds, accommodation camps and laydown areas
- archaeological test excavations carried out in accordance with a test excavation methodology developed in consultation with the relevant Registered Aboriginal Parties in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH, 2010) and in accordance with *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010), and any associated salvage
- clearing of vegetation to establish construction compounds, accommodation camps, laydown areas and excavated material sites, and to facilitate other minor/low impact activities proposed prior to approval of a relevant CEMP
- upgrading existing and creating new access tracks
- excavations and surface preparation required to establish construction compounds, accommodation camps and laydown areas
- establishing excavated material sites
- installation/erection of camp, office and associated welfare facilities
- installation of temporary site sheds, amenities facilities and storage containers to support other minor/low impact activities proposed prior to approval of a relevant CEMP
- batch plant mobilisation, set up and commissioning
- receiving construction plant and equipment on site and materials at laydown areas
- establishing connections at water supply points
- installation of utility service connections to construction locations and ancillary facilities
- protection, adjustment and relocation of utility assets in the vicinity of construction locations, construction compounds and camps, and other ancillary facilities
- other investigations that meet the definition of exempt development provided in *State Environmental Planning Policy (Infrastructure) 2007* could also occur prior to approval of a CEMP.

To be minor/low impact, the activities must:

- not generate noise levels at any noise sensitive receiver above relevant noise management levels developed in accordance with *Interim Construction Noise Guideline* (DECC, 2009) and
- not result in substantial adverse dust impacts at any residences in the vicinity and
- not affect threatened flora species, vegetation that is part of a threatened ecological communities or is critical habitat for a threatened fauna species (other than associated with the implementation of mitigation measures for biodiversity) and
- not involve excavations in PADs (other than the test excavations and salvage referred to above) prior to the completion of required archaeological test excavations at that location and
- not cause soil disturbance within 40 metres of a watercourse (excluding the installation of sediment and erosion controls in accordance with *Managing Urban Stormwater – Soils and Construction*, Volume 1 (Landcom 2004) and Volumes 2A and 2C (DECCW 2008) (commonly referred to as the 'Blue Book')) and
- be carried out (where required) in accordance with Road Occupancy Licences granted by the relevant roads authority.

The conditions of approval might allow other pre-construction minor works.

Minor/low impact activities would still be subject to the relevant mitigation measures and other environmental commitments in the EIS. The contractor would prepare Environmental Work Method Statements (EWMSs) or similar environmental management documents for minor/low impact activities. The environmental management documents would include all mitigation measures and environmental commitments relevant to the activities. The minor/low impact activities would be carried out in accordance with the relevant environmental management documents.

Activities not described above or that are not excluded from the definition of construction or otherwise provided for in the conditions of approval would occur in accordance with an approved CEMP.

Other enabling works

Other enabling works that are construction by definition in the conditions of approval would be covered by a CEMP or CEMPs. Any CEMP(s) prepared for enabling works would guide the approach to environmental management during the works and would consider and address all relevant mitigation measures from the EIS and the conditions of approval that are relevant to the works.

The contractor would confirm the approach to and scope of enabling works and associated timings. Any enabling works CEMP(s) would be reviewed as required by the Environmental Representative, in response to changes such as activities and environmental conditions, to deliver compliance with approved environmental management requirements.

24.1.3.3. Main construction works

Main construction works would occur in accordance with an approved CEMP prepared in accordance with the conditions of approval. Where the construction contractor proposes to construct the proposal in stages, a CEMP would be prepared for each stage or an existing CEMP updated to cover each upcoming stage.

Each CEMP would include:

- a description of the construction contractor's environmental policy and objectives for construction
- a description of the activities to be undertaken during construction
- reference to all relevant statutory and other obligations, including consents, licences, approvals and voluntary agreements required
- environmental targets and measurable performance indicators which compliance would be monitored against
- roles and responsibilities for all personnel and contractors to be employed on site with regards to the planning, implementation, maintenance and monitoring of environmental controls
- specific mitigation measures and controls that would be applied to avoid and minimise environmental impacts
- required sub-plans (as detailed later in this section), which clearly set out the objectives of the sub-plan, relevant conditions of approval and mitigation measures
- processes for managing non-compliance (including corrective and preventative actions)
- procedures for complaints handling and ongoing communication with the community
- inspection, monitoring and auditing requirements, including procedures for regular environmental inspections and monitoring, auditing and review of the performance of environmental controls, and compliance tracking and reporting
- incident and contingency management requirements

- procedures for the control of environmental records
- induction and training requirements for all personnel and contractors.

The CEMP would be adaptive, establishing a continuous cycle of monitoring, assessment, investigation and corrective actions. This process would be used to continuously evaluate and monitor the effectiveness of the environmental management measures proposed in this EIS and identify the corrective actions to be carried out should such measures be identified as being ineffective. The latest version of the approved CEMP (as annotated from time to time), would be available for all personnel and on request for inspection/audit personnel.

A program of independent audits would be developed as part of the CEMP and implemented by the construction contractor. The program would monitor and report on compliance with this EIS, relevant conditions of approval, and licences and permits applicable to the proposal.

Outline of sub-plans

Table 24-1 outlines the sub-plans that would be contained within the CEMP. Sub-plans may be replaced by a procedure where appropriate (i.e. when considering the scale and scope of the works), or merged with another sub-plan to streamline the CEMP. The conditions of approval for the proposal may require different and/or additional matters to be addressed in the CEMP or sub-plans.

Table 24-1 Outline of CEMP sub-plans

Sub-plan	Purpose and requirement
Biodiversity	The sub-plan would set out measures to minimise and manage impacts on biodiversity. It would include (as a minimum): • measures to minimise impacts to biodiversity, including measures to reduce disturbance to sensitive flora and fauna • procedures for clearing of vegetation, including pre-clearing inspections and procedures for the relocation of flora and fauna • procedures for the demarcation and protection of retained vegetation, including vegetation adjacent to construction areas • weed management • rehabilitation strategies including progressive rehabilitation, and measures for the management and maintenance of rehabilitated areas (including duration) • protocols for unexpected EECs or threatened flora and fauna during construction, including stop work procedures • monitoring requirements and compliance management.
Heritage	The sub-plan would set out the measures to manage any impacts on historic and Aboriginal heritage items/sites. It would include (as a minimum): • appropriate heritage mitigation measures, including identification, protection and/or management of heritage items/sites within or adjacent to construction areas (including additional investigations, recordings, or measures to protect items/sites that would not be directly impacted in the vicinity of construction works) • procedures for unexpected finds, including procedures for dealing with human remains • heritage monitoring and compliance management • induction requirements for construction personnel.

Sub-plan	Purpose and requirement
Noise and vibration	The sub-plan would identify procedures and measures that would be implemented to mitigate and manage construction noise and vibration impacts at sensitive receivers. It would include but is not limited to: • examine feasible and reasonable noise mitigation where management levels are exceeded • examine feasible and reasonable noise measures to manage traffic noise impacts on public roads where exceedances above 2 dB are identified • develop associated noise and vibration monitoring programs, as required • develop proactive and reactive strategies for dealing with any noise complaints • outline community consultation measures including notification requirements • include an out of hours works protocol.
Air quality	The sub-plan would include measures to control dust and other emissions during construction. It would include (as a minimum): • measures to minimise the potential for dust emissions, including dust suppression • air quality monitoring requirements and compliance management. This includes monitoring of meteorological conditions in order to implement appropriate responses to changing weather conditions, and regular visual inspections.
Soil and water	The sub-plan would set out measures to mitigate and manage impacts on soil and water, including water quality and potential contaminated soils. It would include (as a minimum): • measures to minimise impacts to soil and water, and to maintain water quality of surrounding surface watercourses. This includes details of erosion and sediment controls, diversion of runoff around disturbed areas and stockpiles, salinity and acid sulfate soils control measures, as well as minimising areas of disturbance and progressive rehabilitation of disturbed areas • stockpile management procedures, including procedures to segregate wastes and contaminated soil • materials tracking and record keeping • unexpected finds protocols for contaminated materials (e.g. soils, building materials and water) and acid sulfate soils • storage of chemicals and other hazardous materials • spill management procedures • measures to minimise water use during construction • a flood emergency management procedure which would provide a series of activities that need to take place should a flood event occur. These activities would focus on the flood emergency and then during the recovery period to assist with starting work again as soon as possible after the flood event.

Sub-plan	Purpose and requirement
Traffic and transport	The sub-plan would be prepared in consultation with relevant local councils and Transport for NSW to identify the key management and response strategies to potential transport network disruptions that may arise due to the proposal. It would include (as a minimum): • measures to minimise disruption to pedestrians, cyclists and motorists • management of safe vehicle access/egress from construction compounds and other construction work areas • measures to manage oversize and overmass vehicle movements during construction, which would consider activities of adjoining land uses and safety of the public, such as entering urban areas from rural highways • management of long-distance travel through driver fatigue management measures • measures to provide safe access to existing properties during construction, or provision of suitable alternatives.
Waste management	The sub-plan would set out waste management strategies that would be implemented in accordance with the waste management hierarchy of avoid, minimise, re-use and dispose. The plan would include but is not limited to: • targets for the recovery, recycling and re-use of construction waste • procedures for the assessment, classification, management and disposal of waste • waste tracking and compliance management.

24.1.4. Operational environmental management approach

The operation of the proposal would be managed through the practices, procedures and processes outlined in this EIS (with this document taking precedence for the implementation requirements should a discrepancy be identified), within Transgrid's EMS, Environmental Assessment Framework (EAF), environmental checklists, as well as its *HSE Handbook* and *Complaints Handling Policy* (Transgrid, November 2019).

Details of the environmental constraints identified as part of this EIS, that are relevant to the ongoing operation and maintenance of the asset, would be included in the appropriate Transgrid Geographical Information Systems (GIS). Due diligence environmental checks, including review of environmental information generated from GIS where relevant, would be undertaken with required protection measures identified and confirmed before any maintenance works are carried out.

24.1.5. Summary of mitigation measures

A summary of the measures proposed to mitigate and manage the potential impacts of the proposal, as detailed in Part C of this EIS is provided in Appendix E. These measures may be revised in response to submissions raised during public exhibition of the EIS or any design changes made following exhibition. The final list of mitigation measures would be provided in the submissions report.

If the proposal is approved, the proposal would be undertaken in accordance with the conditions of approval and the final list of mitigation measures. In the event of any inconsistencies between the mitigation measures presented in Appendix E and the associated Technical papers, the measures presented in Appendix E would take precedence.

24.2. Sustainability

The Infrastructure Sustainability Council (ISC) Infrastructure Sustainability (IS) rating scheme is an industry-compiled, voluntary sustainability performance rating scheme that evaluates planning, design, construction and operation of a project. The IS scheme drives improved sustainability outcomes for infrastructure and includes Planning, Design, As Built and Operation rating tools. Figure 24-1 shows the assessment tools (rating products).

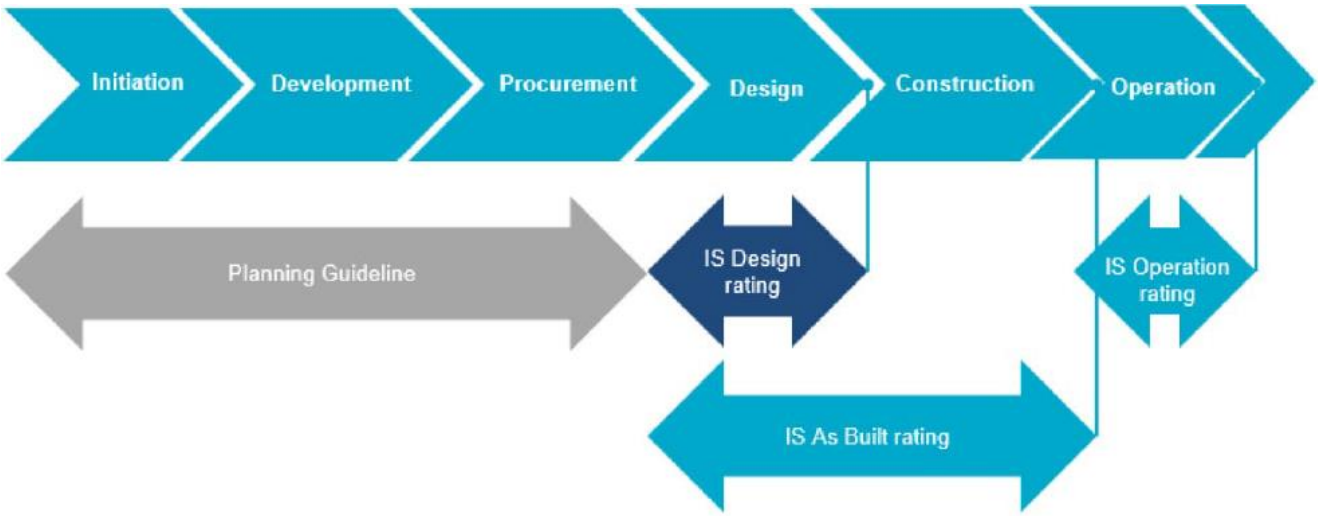

Figure 24-1 ISCA assessment tools across the proposal life cycle (ISCA, 2018)

The proposal, coupled with the EnergyConnect (NSW – Western Section), would achieve an ISC verified 'Design' and 'As-built' rating of Excellent under v1.2 of the IS rating tool.

25. Justification and conclusion

This chapter provides the justification and conclusion to the EIS and an evaluation of the proposal against the principles of ecological sustainable development and the objects of the EP&A Act.

25.1. Proposal justification

Electricity transmission infrastructure improvement is viewed as the critical link to realising the potential of the renewable energy market and providing energy security futures for the National Electricity Market (NEM) as traditional coal fired power stations are retired. The primary objective for EnergyConnect (of which the proposal forms a large component) is to create this critical infrastructure link to reduce the cost of and improve the security of electricity transmission between NSW, SA and Victoria in the near term and facilitate the longer-term transition of the energy sector across the NEM to low emission energy generation sources.

More specifically, the proposal aims to:

- lower power prices
- improve energy security
- increase economic activity
- support the transition to a lower carbon emission energy system
- support a greater mix of renewable energy in the NEM.

The proposal would have benefits that would be realised across the eastern and southern states of Australia, providing the missing link between the SA and NSW transmission networks. EnergyConnect is needed to:

- lower transmission costs, initially in SA, through increased access to electrical supply options across adjoining regions
- facilitate transition to a lower carbon emissions future in the NEM and promote the adoption of new technologies by improving access to high quality renewable resources across all regions of Australia
- enhance the reliability and security of electricity supply in SA and NSW, particularly as coal-fired generators begin to be retired in the near future.

By expanding, and in the case of SA and NSW establishing, power transfer capability between regions, interconnectors can enable the efficient sharing of generation resources within the NEM and can encourage more efficient investment in low-cost generation sources. This can allow overall demand and system reliability requirements to be met at the lowest cost. Allowing for a greater sharing of resources across regions would also help smooth demand and supply fluctuations, which would improve electricity security and reliability within the NEM and alleviate pressure on supply during peak demand periods.

As a result, EnergyConnect would reduce wholesale market electricity costs in SA, as soon as it can be built, by enabling electricity demand in SA to be met using low-cost generating capacity that currently exists on the east coast of Australia. This would also reduce SA's reliance on increasingly expensive gas generation, price volatility and trading risk.

In the longer term, an enhanced ability to import low-cost power from NSW, including significant high-quality renewables, provides market benefits by enabling supply in NSW to be met at a lower overall cost as existing coal-fired plants retire. This is particularly the case for the new interconnection between SA and NSW, as NSW is forecast by AEMO to experience the greatest retirement of coal plant after 2030 and would otherwise rely on higher-cost sources of generation to fill the resulting supply gap (ElectraNet, 2019a).

As discussed in Section 2.2.2, Australia's commitment to reduce carbon emissions has substantial implications for the future operation of the NEM. EnergyConnect would allow renewable energy trade between NSW, SA and Victoria to assist in meeting national carbon emission and renewable energy targets at lowest long-run cost. EnergyConnect will be crucial in meeting the requirements for the connection of the identified REZs and will assist in leveraging large scale private sector investment opportunities, boosting regional economies and building the state's resilience by ensuring there are enough new energy projects coming online to replace the retiring traditional power stations expected over the next two decades.

The environmental impacts of the proposal have been assessed, including impacts to biodiversity, Aboriginal and historic heritage, land use and property, landscape character and visual amenity, social, economic, noise and vibration, traffic and access, hazards and risk (including bushfire, electric and magnetic fields and RFI impacts), soils, contamination, groundwater, hydrology, flooding and water quality, air quality and waste management and resource use.

The EIS identifies that the key impacts associated with the proposal would include:

- *impacts to biodiversity* – while the proposal has been refined to avoid and minimise impacts on biodiversity, there would be direct impacts to a number of threatened species, and threatened ecological communities due to the removal of native vegetation listed under the BC Act. The proposal would also impact EPBC listed species (or their habitat), including potential significant impacts to four threatened ecological communities and three threatened flora species under the EPBC Act. However, the proposal would be unlikely to lead to a significant impact on any threatened fauna species or migratory birds (and their habitat) listed under the EPBC Act. Further opportunities to minimise impacts to biodiversity would be sought as part of finalisation of the proposal design and construction methodology

- *impacts to Aboriginal heritage* – around 45 Aboriginal heritage sites and up to 39 Potential Archaeological Deposits (PADs) would be potentially impacted by the proposal. Other areas of potential impact have been avoided through the selection of the proposed transmission line easement and locations of construction facilities. Further opportunities to minimise these impacts would be investigated as part of the finalisation of the proposal design and construction methodologies

- *visual impacts from private properties during operation* – there would be some high (36 properties) and very high (one property) visual impacts (pre-mitigation) to residential receivers. For these residences, mitigation measures would be considered in consultation with the affected landholder. Subject to consultation with the affected landholder and implementation of visual screening measures these impacts are expected to be reduced to moderate (36 properties) and high (one property) respectively

- *impacts to noise during construction* – during construction, there would be some exceedance of noise levels (the extent of which would be dependent on the stage of construction) for activities including construction of the transmission lines and operation of the construction compound and accommodation camps. These would result in potential amenity impacts to various residential receivers both during standard and out of hours periods (where required). Potential amenity impacts due to noise would be minimised through the implementation of the proposed mitigation measures

- *impacts due to operational noise* – there would be some potential operational noise impacts (pre-mitigation) during wet weather events to a small number of residential receivers as a result of the coronal impact of the transmission lines and the proximity of these existing dwellings to the proposed transmission line. Impacts at these receivers would be addressed in consultation with landholders once the transmission line is operational

- *amenity impacts to nearby residents during construction along construction haulage routes* – dust generated from construction vehicles (particularly on unsealed roads) has the potential to result in amenity impacts particularly under certain conditions (dry surface roads and high winds)

- *potential impacts to road conditions* – *c*onstruction heavy vehicle movements are likely to have minor impact to the condition of the existing sealed road network due to the increase in use of these roads. For unsealed roads, construction traffic is likely to have some impact on existing road condition. The construction contractor would work with asset owners and local councils to make sure unsealed roads remain fit for purpose during, and at the completion of, the construction period

- *social impacts during construction* – there would be some social impacts, primarily relating to construction related amenity impacts (such as noise generated or additional traffic generated impacts) and the potential impacts associated with the temporary increase in the population.

The majority of impacts would occur during construction of the proposal, however some impacts would occur during operation, such as impacts to landscape character and visual amenity and operational noise. These impacts in most instances are considered to be low or moderate, however some occurrences of higher level impacts have been identified pre-mitigation (in particular the potential visual impacts to a number of residences due to the location of proposed transmission towers). A suite of mitigation measures has been identified to guide finalisation of the proposal design and to manage the construction and operational phases of the proposal to mitigate and/or manage the identified environmental, social and economic impacts. These have been consolidated in Appendix E.

25.2. Ecologically sustainable development

The EP&A Act adopts the definition of ecologically sustainable development contained in the *Protection of the Environment Administration Act 1991*. An assessment of the proposal against the principles of ecologically sustainable development as per clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 is provided below.

25.2.1.1. Precautionary principle

The precautionary principle in the context of environmental protection is essentially about the management of scientific risk. It is a fundamental component of the concept of ecologically sustainable development (ESD) and is typically concerned with where a project presents a threat of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

A range of environmental investigations, as described in Part C of the EIS, have been undertaken during the development of the proposal and the environmental assessment process, to make sure that potential impacts are understood with a high degree of certainty. The assessments undertaken are consistent with accepted scientific and assessment methodologies and have taken into account relevant statutory and agency requirements. The assessments have typically applied a conservative approach with regard to construction and operational arrangements, and the modelling used. The assessments indicate that substantial efforts have been made to reduce the potential impact of the proposal to result in serious or irreversible damage to the environment.

The proposal has evolved to avoid impacts where possible and to reflect the findings of the studies undertaken. Where components of the proposal are subject to finalisation of the proposal design, a worst case impact assessment has been carried out, and a number of environmental mitigation measures have been proposed to enable where possible further avoidance and minimise risks to the environment. No safeguards have been postponed as a result of lack of scientific certainty.

25.2.1.2. Intergenerational equity

The concept of intergenerational equity articulates the concept of fairness amongst all generations in the use and conservation of the environment and its natural resources.

The proposal would provide a more secure electricity supply in the near-term and would facilitate the longer-term transition of the energy sector across the NEM to low emission energy generation sources, benefiting current and future generations. It would increase economic activity, regional job opportunities and assist in unlocking the development of large-scale renewable energy generation within the South West NSW, Wagga Wagga, Murray River and Riverland REZs, which are priority areas to assist the NEM transition.

The EIS identifies that the proposal has some degree of environmental, social and economic impacts. A range of mitigation measures have been proposed to further reduce these impacts on the surrounding environment and community. This includes initiatives to deliver benefits to local communities including employment opportunities. No impacts from the proposal have been identified which would be expected to create intergenerational inequity.

25.2.1.3. Conservation of biological diversity and ecological integrity

The development and assessment of the proposal has been carried out with the aim of identifying, avoiding, minimising and mitigating key impacts to biological diversity and ecological integrity. This has been informed by extensive field investigations.

Where potential impacts cannot be avoided, mitigation measures would be implemented to reduce the impact as far as possible, including further avoidance of high value areas. An offsets strategy has also been developed which would enable compensation for the potential biodiversity impact anticipated by the proposal.

25.2.1.4. Improved valuation and pricing of environmental impacts

The design development and construction planning for the proposal has included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process. In addition, the assessment has identified the environmental and other consequences of the proposal, as well as environmental mitigation measures where appropriate to manage potential impacts. If approved, the construction and operation of the proposal would be in accordance with relevant legislation, the conditions of approval and environmental management plans for construction and operation. These requirements would result in an economic cost to the proponent. The application of the environmental mitigation measures, including the biodiversity offsets strategy, would increase both the capital and operating costs of the proposal. This signifies that environmental resources have been given appropriate valuation.

The proposal has been developed with an objective of minimising potential impacts on the surrounding environment and this approach would be continued during finalisation of the proposal design and delivery wherever possible. This approach demonstrates Transgrid's commitment to recognition of the value of protecting environmental resources.

25.3. Objects of the EP&A Act

Table 25-1 summarises the consideration of the proposal against the objects of the EP&A Act.

Table 25-1 Objects of the EP&A Act

Object	Consideration
a. to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The proposal has considered impacts to the community during design development, and social and economic impacts of the proposal have been assessed (refer to Chapter 14 (Social) and Chapter 15 (Economic)). Overall, the operation of the proposal is expected to facilitate enhanced security and reliability of the energy supply with associated social and economic benefits to consumers at the State level across NSW, SA and Victoria. Additionally, the proposal would contribute to the provision of secure and reliable electricity in the near term, while facilitating the longer-term transition across the National Energy Market to low-emission energy sources in conjunction with the identified Renewable Energy Zones proposed for the region. As discussed in Chapter 3 (Proposal design development), the selection of the preferred corridor aimed to minimise impacts on a range of environmental and land use constraints, and to specifically avoid or minimise impacts to ecological and culturally sensitive areas.

Object	Consideration
	Mitigation measures (as consolidated in Chapter 24) would seek to further avoid and minimise environmental social and economic impacts of the proposal where possible.
b. to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment	The principles of ESD have been considered in the planning and development of the proposal as discussed in Section 24.2.
c. to promote the orderly and economic use and development of land,	The proposal would promote the orderly and economic use and development of land by improving the security of electricity transmission between NSW and SA in the near term and facilitating the longer-term transition to low emission energy generation sources. Where possible, the proposal has been designed to use or run adjacent to existing easements, which has minimised impacts on land use and development of land. Where existing easements cannot be used or modified for the proposal, new easements would be created which would assist in promoting the orderly development of land. Additionally, the proposed upgrade and expansion of the Wagga Wagga substation would be contained within the existing site, promoting the efficient use of this site. Substantial land holder engagement has occurred during the proposal alignment selection process enabling their views, operating practices and use of land to be considered The easement for the new transmission line may restrict certain agricultural activities and/or require different farming methodologies to be adopted. However, the overall impact on existing agricultural activities is expected to be relatively minor, particularly as grazing and other agricultural activities would typically be able to continue within the easements. Mitigation measures have been identified that would further minimise impacts to land uses along the transmission line alignment.
d. to promote the delivery and maintenance of affordable housing,	This object is not associated with the aims and objectives of the EnergyConnect. However, the proposal would not seek to prevent the delivery and maintenance of affordable housing in the future.

Object	Consideration
e. to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The selection of the preferred corridor for the proposal considered a range of constraints to avoid and/or minimise the impacts on the environment (refer to Chapter 3), with a particular focus on the avoidance or impact minimisation of tier 1 constraints. These included a range of ecological factors such as National parks, ecological conservation areas, and wetlands. The impacts on biodiversity has been assessed in the EIS (refer to Chapter 9 and the corresponding Technical paper 1) in accordance with the Biodiversity Assessment Method. The assessment found that while the proposal has been refined to avoid and minimise impacts to biodiversity values, direct impacts are expected to a number of threatened species or their habitats under the BC Act and EPBC Act would remain. These impacts would primarily be mostly attributed to the clearing of threatened flora species within the construction impact area a portion of which would not require complete clearing within the easement (due to vegetation with certain potential growth heights being able to be retained in each of the inner and outer maintenance zones of the easement). Only minor impacts associated with other biodiversity impacts are expected (such as impacts to connectivity, water quality and bird strike). Indirect impacts are considered unlikely given the approach to retention of some vegetation within the easement inner and outer maintenance zones providing a buffer to some areas subject to direct and permanent loss of native vegetation. The Australian Department of Agriculture, Water and the Environment determined the proposal to be a controlled action under the EPBC Act. The assessment on the relevant Matters of National Environmental Significance found that the proposal would be unlikely to lead to a significant impact on any threatened species or their habitat, or migratory birds (and their habitat) listed under the EPBC Act. During finalisation of the proposal design, opportunities to further avoid or minimise impacts would be investigated. This would prioritise the avoidance of areas of high value. Further mitigation measures have also been identified to manage any such impacts, and an offsets strategy would be implemented to address the residual impacts of the proposal on biodiversity.
f. to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The impacts on Aboriginal and historic heritage have been assessed in the EIS (refer to Chapter 10 (Aboriginal heritage) and Chapter 11 (Historic heritage), and the corresponding Technical paper 2 and Technical paper 3). The proposal would avoid direct impacts on built components of listed Historic heritage items. The proposal, based on the current construction impact area, has the potential to directly impact 45 Aboriginal sites or artefacts and up to 39 PADs, which include items of generally moderate and low scientific significance. The significance of the PADs would be confirmed as part of the ongoing test excavations which are currently being conducted. Opportunities to avoid or minimise these impacts through micro-siting of the tower and access track locations would be explored during finalisation of the proposal design. Where impacts cannot be avoided, a range of mitigation and management measures would be implemented in consultation with Registered Aboriginal Parties.

Object	Consideration
g. to promote good design and amenity of the built environment,	There would be impacts on the amenity of the built environment as a result of construction and/or operational impacts, including noise, air (dust) and visual amenity. These impacts would be addressed through the mitigation measures summarised in Chapter 24 (Environmental management). Permanent infrastructure would be designed and operated in accordance with Transgrid's public safety and technical requirements.
h. to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The health and safety of workers and occupants of the proposed Dinawan 330kV substation (and existing Buronga and Wagga Wagga substations) would be managed in accordance with Transgrid's existing management systems. No other buildings are proposed as part of this proposal.
i. to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	Transgrid is seeking approval for the proposal under Division 5.2, Part 5 of the EP&A Act. Consultation completed to date is outlined in Chapter 7, which has included engagement with local governments, State agencies and elected government officials.
j. to provide increased opportunity for community participation in environmental planning and assessment.	Community and stakeholder consultation has been carried out through all phases of proposal development to date, and will be ongoing during the next phases of design and delivery. Consultation completed to date is outlined in Chapter 7. The EIS will be placed on public display by DPIE, in which stakeholders and the community will be able to review the EIS and provide submissions on the proposal. Submissions will be responded to by Transgrid within the submissions report. This process provides further opportunity for community participation in the planning and assessment process for this proposal.

25.4. Conclusion

This proposal is a critical and large component of EnergyConnect, which would enhance the energy transmission link between SA and NSW transmission networks, as it would:

- provide a key electricity distribution connection within western NSW option to encourage future renewable energy providers to invest in lower emission electrical generation alternatives within this region.
- deliver positive net market benefits and support the energy market transition to a lower carbon emissions future as soon as it can be built. In particular, it would reduce the cost of providing secure and reliable electricity transmission between NSW and SA in the near term
- be crucial in meeting the requirements for the connection of the identified REZs within south west and western NSW.

The proposal has been designed, to the greatest extent possible to date, to avoid and minimise impacts, and to respond to the issues raised by the community and stakeholders. The finalisation of the proposal design and development of the construction methodology for the proposal would be further developed with the objective of further avoiding and minimising potential impacts on the local and regional environment, and the local community.

Assessments have been based on the current design and construction methodology for the proposal, and some uncertainties remain. At this stage of assessment, a reasonable worst case assessment has been carried out which indicates that no unacceptable significant impacts are anticipated, and that despite efforts to avoid and minimise impacts through design, some residual impacts would remain. These would be addressed through the implementation of the proposed mitigation measures, and the potential residual impacts are considered manageable.

Overall, the proposal is a critical component in delivering long term benefits to SA and NSW electricity consumers, providing security to the NEM and facilitating the transition to a lower carbon emissions future. On balancing the strategic need and benefits of the proposal with the residual impacts, the proposal is justified.

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Appendix A Secretary's environmental assessment requirements cross-reference

Table A-1 Secretary's environmental assessment requirements cross-reference

Requirement	Item	
General Requirements	The Environmental Impact Statement (EIS) for the project must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation). In particular, the EIS must include:	A checklist is provided in Appendix B
	• a stand-alone executive summary;	Executive Summary
	• a summary of the background to the project, including alternatives that were considered to the project;	Chapter 2 (Strategic context and need) and Chapter 3 (Proposal design development)
	• a full description of the project, accompanied by suitable maps and plans, including the: - disturbance area; - physical layout of the project over time, including sections of key components; - key uses and activities to be carried out on site; - likely timing of the project including any stages, the key phases within each stage (site preparation, construction, commissioning, operation, decommissioning and rehabilitation) and the sequencing of these stages and phases;	Chapter 5 (Proposal infrastructure and operation) and Chapter 6 (Proposal construction) Chapter 8 (Approach to impact assessment) for construction impact area (disturbance area)
	• the relevant strategic context for the project, having regard to: - State legislation, policies and guidelines including current initiatives to improve energy security and reliability in the National Electricity Market; - any other existing, approved or proposed projects that could result in cumulative impacts with the project;	Chapter 2 (Strategic context and need) and Chapter 23 (Cumulative impacts)
	• the relevant statutory context for the project, including: - the assessment pathway for the project under the *Environmental Planning and Assessment Act 1979*; - the approvals required before the project may be carried out; - any relevant matters for consideration;	Section 1.4 and Appendix C.

Requirement	Item	
	• a description of the engagement that was carried out during the preparation of the EIS, the key issues raised during this engagement and the proposed engagement strategy for the project if it is approved;	Chapter 7 (Stakeholder and community consultation)
	• an assessment of the likely economic, social and environmental impacts of the project having regard to the requirements in any relevant Government legislation, policies and guidelines (see below), including: - the state of the existing environment; - community views; - the measures that would be implemented to avoid or minimise impacts, including a consolidated summary of the proposed mitigation measures for the project; - the predicted impacts of the project, including any cumulative impacts; - actions proposed to deal with any uncertainties associated with the assessment	Chapters 9 to 22 Chapter 23 (Cumulative impacts)
	• a detailed evaluation of the merits of the project as a whole	Chapter 24 (Justification and conclusion)
	In addition to the matters set out in Schedule 1 of the EP&A Regulation, the EIS must be accompanied by a signed report from a suitably qualified person that includes an accurate estimate of the capital investment value of the project (as defined in Clause 3 of the EP&A Regulation).	This document has been provided as part of the supporting information accompanying the EIS
Key issues		
Biodiversity	• an assessment of the biodiversity impacts of the project, in accordance with the NSW *Biodiversity Conservation Act 2016*, the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR);	Chapter 9 (Biodiversity) and Technical paper 1
	• the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and	Chapter 9 (Biodiversity) and Technical paper 1
	• a strategy to offset any residual impacts of the development;	Chapter 9 (Biodiversity) and Technical paper 1
	• an assessment of the impacts of the project on aquatic ecology including impacts on key fish habitat and threatened species of fish.	Chapter 9 (Biodiversity) and Technical paper 1

Requirement	Item	
Heritage	• an assessment of the Aboriginal and historic heritage (cultural and archaeological) impacts of the project	Chapter 10 (Aboriginal heritage), Chapter 11 (Non-Aboriginal heritage) and Technical paper 2 and Technical paper 3
	• adequate consultation with the local Aboriginal community and other relevant stakeholders, having regard to the Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH, 2010)	Chapter 10 (Aboriginal heritage) and Technical paper 2
Water quality	• an assessment of the impacts of the project on the quantity and quality of the region's surface water resources, including the Murray River, Darling River, Murrumbidgee River, having regard to NSW Water Quality Objectives.	Chapter 16 (Hydrology, flooding and water quality) and Technical paper 8
	• details of water requirements, supply arrangements and wastewater disposal arrangements for construction and operation.	Chapter 16 (Hydrology, flooding and water quality), Chapter 21 (Soils, contamination and groundwater), Technical paper 8 and Technical paper 15
	• an assessment of the impacts of the project on groundwater aquifers and groundwater dependent ecosystems having regard to the *NSW Aquifer Interference Policy* and *relevant Water Sharing Plans*.	Chapter 21 (Soils, contamination and groundwater) and Technical paper 15
	• an assessment of the potential flooding impacts and risks of the project.	Chapter 16 (Hydrology, flooding and water quality) and Technical paper 8
Land	• an assessment of impacts of the project on soils and land capability of the site and surrounds	Chapter 12 (Land use and property), Chapter 21 (Soils, contamination and groundwater) and Technical paper 4
	• an assessment of the risk of soil contamination and disturbance of land (including associated with naturally occurring asbestos in the vicinity of the site)	Chapter 21 (Soils, contamination and groundwater) and Technical paper 14
	• assessment of impact of the project on agricultural land, Crown lands, travelling stock reserves, mineral resources and exploration licenses, rail reserves and pipeline corridors	Chapter 12 (Land use and property) and Technical paper 4

Requirement	Item	
Transport	• an assessment of the transport impacts of the project on the capacity, condition, safety and efficiency of the local and State road network	Chapter 19 (Traffic and access) and Technical paper 11
	• details of the ongoing maintenance works required to service assets, outlining the measures to maintain the road	Chapter 19 (Traffic and access) and Technical paper 11
Amenity	• an assessment of the likely visual impacts of the project on surrounding residences, scenic or significant vistas, night lighting, air traffic and road corridors in the public domain.	Chapter 13 (Landscape character and visual amenity) and Technical paper 5
	• an assessment of the construction, operational and road noise and vibration impacts of the project	Chapter 18 (Noise and vibration) and Technical paper 10
Air	• an assessment of the air quality impacts of the project	Chapter 17 (Air quality) and Technical paper 9
Hazards	• an assessment of potential hazards and risks associated with electric and magnetic fields (EMF) having regard to the latest advice of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA);	Chapter 20 (Hazards and risk) and Technical paper 13
	• an assessment of impacts and risks to Department of Defence's Morundah Receive Station and measures required to avoid and / or minimise impacts;	Chapters 13 (Land use and property) and 20 (Hazards and risk)
	• an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, the handling and use of any dangerous goods and potential impacts to high pressure gas pipelines	Chapter 20 (Hazards and risk) and Technical paper 12
Waste	• identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste	Chapter 22 (Waste management and resource use)
Social and Economic	• including an assessment of the social and economic impacts and benefits of the project (including the workers accommodation facility) for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services.	Chapters 14 (Social) and Chapter 15 (Economic), Technical paper 6 and Technical paper 7

Requirement	Item	
Consultation	• during the preparation of the EIS, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups, affected landowners, Native Title holders, exploration licence holders, quarry operators and mineral title holders.	Chapter 7 (Stakeholder and community consultation) and Appendix D – Consultation outcomes report
	• if you do not lodge the EIS for the project within 2 years of the issue date of these requirements, you must seek revised requirements for the EIS for the project	The requirements were issued on 30 July 2020. The 2 year period has not expired.

A.1 Appendix A of the Secretary's environmental assessment requirements cross-reference

Guidelines for preparing assessment documentation relevant to the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) for proposals being assessed under the NSW Assessment Bilateral.

Project EnergyConnect (NSW – Eastern Section) (EPBC 2020/8766)

Table A-2 details the response to requirements detailed in Appendix A of the SEARs, which commences from Paragraph 5 onwards. Paragraphs 1 to 4 outlines an introduction to the controlled action.

Table A-2 Appendix A of the Secretary's environmental assessment requirements cross-reference

Requirement	Item	Where addressed in EIS
Relevant regulations	5. The Environmental Impact Statement (EIS) must address all matters outlined in Schedule 4 of the EPBC Regulations and all matters outlined below in relation to the controlling provisions.	The below provides a checklist against the matters outlined in Appendix A of the SEARs. Appendix A of the SEARs duplicates, in part, some provisions of Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) (the EPBC Regulations). This checklist identifies the provisions of that Regulation not covered by the matters specifically identified in Appendix A of the SEARs.
Project description	6. The title of the action, background to the action and current status.	The title of the action (being EnergyConnect (NSW – Eastern Section)) and details of the proponent are available in the Certification page of the EIS. This EIS seeks approval for the action. The objectives of the proposal are outlined in Section 1.1.1 of the EIS. The consequences of not proceeding with the proposal is outlined in Section 2.7 of the EIS.

Requirement	Item	Where addressed in EIS
	7. The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on Matters of Nationally Environmental Significance (MNES).	A description of the proposal is provided in Chapter 5 and Chapter 6 of the EIS. The assessment considers an indicative disturbance area as described in Chapter 8 of the EIS. Further description is provided in sections 1.6, 7, 9.9 and Appendix E of Technical paper 1.
	8. How the action relates to any other actions that have been, or are being taken in the region affected by the action.	The proposal is part of EnergyConnect, which would be constructed in progressive sections. A description of the South Australian Section, the Victorian Section and the NSW – Western Section is provided in Chapter 1 of the EIS. The South Australian Section (referral reference no 2019/6468) and the NSW – Western Section (referral reference no 2020/8673) were determined to be separate controlled actions. The NSW – Western Section was determined (approval) in September 2021. This action (being the proposal) is a standalone action which would have distinct potential impacts that would not change due to development of any subsequent sections of EnergyConnect. Further: • EnergyConnect has been divided by it's different jurisdictions, except in NSW. The proposal is able to operate independently of the NSW – Western Section, and subsequent sections of EnergyConnect would be geographically distinct to the proposal (the action). • The other components of EnergyConnect are subject to separate assessments and approvals. Assessing both sections of EnergyConnect in NSW or any other sections as a combined project would not change the assessment on relevant MNES compared to assessing as separate projects. Relevant MNES for subsequent sections of EnergyConnect are expected to be different and not of a cumulative nature to the MNES relevant to the currently proposed action.

Requirement	Item	Where addressed in EIS
	9. How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES	A description of the proposal is provided in Chapter 5 and Chapter 6 of the EIS. The assessment considers an indicative disturbance area as described in Chapter 8 of the EIS. Further description is provided in Sections 7, 9.5 and Appendix D of Technical paper 1 (the BDAR).
Impacts	10. The EIS must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: - a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts; - a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible; - analysis of the significance of the relevant impacts; and - any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Section 9.5 of Technical paper 1 provides the impact assessment of matters of NES.

Requirement	Item	Where addressed in EIS
Avoidance, mitigation and offsetting	11. For each of the relevant matters protected that are likely to be significantly impacted by the action, the EIS must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including: - a description, and an assessment of the expected or predicted effectiveness of the mitigation measures; - any statutory policy basis for the mitigation measures; - the cost of the mitigation measures; - an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing; - the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	As documented in Technical paper 1, the proposal is predicted to have a significant impact on four ecological communities and three threatened flora species. Avoidance measures are discussed in Section 8 of Technical paper 1. Section 10 of Technical paper 1 summarises the mitigation measures specific to the biodiversity assessment. A consolidated list of mitigation measures is provided in Appendix E of the EIS.
	12. Where a significant residual adverse impact to a relevant protected matter is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	As documented in Technical paper 1, the proposal is predicted to have a significant impact on four ecological communities and three threatened flora species. All impacts of the proposal would be offset via the application of the Biodiversity Assessment Method (BAM) for the recorded MNES. The BAM is the approved method required to be implemented under the bilateral process.

Requirement	Item	Where addressed in EIS
	13. For each of the relevant matters likely to be impacted by the action the EIS must provide reference to, and consideration of, relevant Commonwealth guidelines and policy statements including any: - conservation advice or recovery plan for the species or community; - relevant threat abatement plan for the species or community; - wildlife conservation plan for the species; and - any strategic assessment. Note: the relevant guidelines and policy statements for each species and community are available from the Department of Agriculture, Water and the Environment's Species Profiles and Threats Database. http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl	Refer to Section 9.5 and Appendix D of Technical paper 1.
Biodiversity	14. The EIS must identify each EPBC Act listed threatened species and community and migratory species likely to be impacted by the action. For any species and communities that are likely to be impacted, the proponent must provide a description of the nature, quantum and consequences of the impacts. For species and communities potentially located in the project area or in the vicinity that are not likely to be impacted, provide evidence why they are not likely to be impacted.	Refer to Sections 1.5.1, 7, and 9.5 and Appendix D of Technical paper 1 in relation to these factors.

Requirement	Item	Where addressed in EIS
	15. For each of the EPBC Act listed threatened species and communities and migratory species likely to be impacted by the action the EIS must provide a separate: - description of the habitat (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plan - details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements - description of the relevant impacts of the action having regard to the full national extent of the species or community's range - description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action - identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account - a description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established - details of how the current published NSW Biodiversity Assessment Method (BAM) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts	These factors have specifically been considered in Appendix D of Technical paper 1.

Requirement	Item	Where addressed in EIS
	- details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the action in accordance with the BAM and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites	
	16. Note: For the purposes of approval under the EPBC Act, it is a requirement that offsets directly contribute to the ongoing viability of the specific protected matter impacted by a proposed action and deliver an overall conservation outcome that improves or maintains the viability of the MNES i.e. 'like for like'. Any significant residual impacts not addressed by the BAM may need to be addressed in accordance with the EPBC Act 1999 Environmental Offset Policy. http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy	As documented in Technical paper 1, the proposal is predicted to have a significant impact on four ecological communities and three threatened flora species. All impacts of the project will be offset via the application of the Biodiversity Assessment Method (BAM) for the recorded MNES. The BAM is the approved method required to be implemented under the bilateral process. Any biodiversity offsets will be provided in accordance with the EPBC Act 1999 Environmental Offset Policy.
Other approvals and conditions	17. Information in relation to any other approvals or conditions required must include the information prescribed in Schedule 4 Clause 5 (a) (b) (c) and (d) of the EPBC Regulations 2000.	This EIS presents the environmental impact assessment to support the application for the proposal under Division 5.2, Part 5 of the EP&A Act. The status of the NSW planning approval process is summarised in Section 1.4 of the EIS. A determination from the NSW Minister for Planning and Public Spaces will be required in addition to an approval under the EPBC Act. Other approvals, licences or permits required under NSW legislation is summarised in Appendix C of this EIS. Other than the EIS, no other environmental assessment has been, or is being carried out for the project for the purpose of any local or state plan or policy.
Environmental record of person proposing to take the action	18. Information in relation to the environmental record of a person proposing to take the action must include details as prescribed in Schedule 4 Clause 6 of the EPBC Regulations 2000.	Refer to the detail provided below this table.

Requirement	Item	Where addressed in EIS
Information sources	19. For information given in an EIS, the EIS must state the source of the information, how recent the information is, how the reliability of the information was tested; and what uncertainties (if any) are in the information.	Technical paper 1 was prepared by suitably qualified and accredited ecologists based on extensive seasonal targeted field surveys, application of Government ecological mapping layers and reviews of relevant publicly available desktop sources. As such, the level of reliability is high and relatively conservative. Internal reviews by experienced ecologists were undertaken to confirm the reliability of the information and no uncertainties exist. It should be noted that in areas where land access was not permitted, the conservative accepted practice was adopted. This resulted in the adoption of state based vegetation mapping and/or application of the precautionary principle to these areas. Additional survey would be undertaken when access is available, including pre-construction to confirm the data adopted. A table presenting the information sources and the associated required details is presented in Technical paper 1 (References section).

A.2 Environmental record of person proposing to take the action

Transgrid has a consistent record of proactively seeking environmental approvals where required and ensuring that any commitments or conditions placed on activities as a result of these approval processes are adhered to.

In 2001, Transgrid was subject to proceedings under State Environmental laws for clearing vegetation in the vicinity of transmission lines. Transgrid subsequently invested $5 million toward site rehabilitation. Since the 2001 incident, Transgrid has not been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources.

Transgrid is committed to conducting its activities and services in a manner that minimises pollution and complies with relevant environmental legislation, industry standards and codes of practice. Transgrid implores all employees and contractors to stop and consider the potential impact to the environment from their activities.

Transgrid aim to enhance their systems and processes in a manner that promotes continuous improvement in environmental management and which will lead to the achievement of industry best practice.

In meeting these commitments, Transgrid:

- maintains an Environmental Management System (EMS) that provides the framework for setting and reviewing our environmental objectives and targets, including the implementation, monitoring and review of these objectives and targets, as well as facilitating continuous improvement in environmental performance
- continues to develop systems that recognise sensitive environmental and cultural sites on or near our infrastructure, and provides processes to manage and our activities with the aim of preventing environment harm or adversely impacting the environment
- integrates environmental management considerations into the planning, design, siting, construction, maintenance, operation, decommissioning and disposal of all Transgrid assets
- provides environmental training, assessment and authorisation under our Environmental Management System to employees and contractors to enable them to perform their duties in an environmentally sensitive manner
- engages with the community, customers, employees, government and other stakeholders regarding potential environmental or cultural impacts associated with our plans and activities
- pursues opportunities to maximise resource efficiencies and reduce the generation of waste through avoidance, reduction, reuse and recycling programs
- identifies, sets and monitors realistic environmental measures and communicates them to all employees and stakeholders.

The proposal (the action) would be undertaken in accordance with Transgrid's environmental policy and planning framework Transgrid Environment Policy is available on their web site, and the construction contractor's EMS. Both EMS' are accredited under ISO 14001:2015.

Transgrid's Environmental Policy commits to protecting and enhancing the natural environmental and social values in all Transgrid's activities. Transgrid's planning framework allows for early identification of environment and social values and methods for avoiding, minimising and mitigating impacts caused as a result of their developments via preliminary detailed screening and risk assessments within the development envelope and finally subsequent footprint selection.

Transgrid's EMS is independently certified and covers all of their processes and activities that have the potential to impact on the environment. The EMS enables compliance with Transgrid's environment and heritage compliance obligations, providing the framework for driving environmental requirements throughout leadership, planning, support, operation, performance evaluation and continuous improvement actions. The proposed action, therefore, will be undertaken, monitored and measured in accordance with the Transgrid's EMS.

Appendix B Environmental Planning and Assessment Regulation 2000 checklist

Table B-1 Requirements of Schedule 2 (Part 3) of the Environmental Planning and Assessment Regulation 2000

Requirement	EIS Reference
6. Form of environmental impact statement	
An environmental impact statement must contain the following information	
a. the name, address and professional qualifications of the person by whom the statement is prepared,	Certification page
b. the name and address of the responsible person,	Certification page
c. the address of the land:	Certification page
i. in respect of which the development application is to be made, or	Certification page
ii. on which the activity or infrastructure to which the statement relates is to be carried out,	Certification page
d. a description of the development, activity or infrastructure to which the statement relates	Certification page, Chapter 5 (Proposal infrastructure and operation) and Chapter 6 (Proposal construction)
e. an assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule	Certification page
f. a declaration by the person by whom the statement is prepared to the effect that: i. the statement has been prepared in accordance with this Schedule, and ii. the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and iii. that the information contained in the statement is neither false nor misleading.	Certification page
7. Contents of the environmental impact statement	
An environmental impact statement must also include each of the following:	
g. a summary of the environmental impact statement,	Executive summary
h. a statement of the objectives of the development, activity or infrastructure,	Section 1.2.1
i. an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,	Chapter 3

Requirement		EIS Reference
j.	an analysis of the development, activity or infrastructure, including:	
i.	a full description of the development, activity or infrastructure, and	Chapter 5 (Proposal infrastructure and operation) and Chapter 6 (Proposal construction)
ii.	a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and	Chapter 4 (Proposal setting) and Chapters 9 to 23
iii.	the likely impact on the environment of the development, activity or infrastructure, and	Chapters 9 to 23
iv.	a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and	Chapters 9 to 23, and Technical papers 1 to 15
v.	a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out,	Chapter 1 and Appendix C
k.	a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),	Chapter 24 (Environmental management)
l.	the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).	Chapter 25

Appendix C Statutory planning assessment

C.1 NSW Statutory planning requirements

This appendix outlines the statutory requirements and explains the environmental impact assessment and planning approval process for the proposal. This appendix also outlines the environmental planning instruments applicable to the proposal.

Environmental planning approval for the proposal is required in accordance with the (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act) and Environmental Planning and Assessment Regulation 2000 (EP&A Regulation). Consideration of the NSW environmental planning legislation and approvals requirements is provided in Section C.1.1. A referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was also submitted for the proposal which determined the proposal to be a controlled action. Commonwealth assessment and approval under the EPBC Act is considered in Section C.2.1.

A summary of the overall assessment and approval process for the proposal is shown in Figure C-1 and described in greater detail in the following sections.

C.1.1 NSW Environmental planning legislation and approvals

The EP&A Act and the EP&A Regulation are the primary pieces of legislation regulating land use planning and development assessment in NSW. This legislation is supported by a range of environmental planning instruments including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs). Part 5, Division 5.2 of the EP&A Act establishes the assessment and approval regime for SSI and CSSI.

The requirements of Clause 192 of the EP&A Regulation for applications seeking approval of the Minister for Planning and Public Spaces to carry out SSI are also addressed in the following sections.

C.1.2 Permissibility

The proposal is permissible without development consent under clause 41 of *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) being 'development for the purpose of an electricity transmission or distribution network, carried out by, or on behalf of, an electricity supply authority or public authority without consent on any land'.

The proposal is characterised as an electricity transmission network under the Infrastructure SEPP which defines an 'electricity transmission or distribution network' to include:

- above or below ground electricity transmission or distribution lines (and related bridges, cables, conductors, conduits, poles, towers, trenches, tunnels, ventilation and access structures)
- above or below ground electricity kiosks or electricity substations, feeder pillars or transformer housing, substation yards or substation buildings.

Transgrid is defined as an electricity supply authority under clause 40 of the Infrastructure SEPP being a transmission operator under the *Electricity Supply Act 1995*. Therefore, the proposed electricity transmission and distribution works is permissible without consent pursuant to clause 41 of the Infrastructure SEPP.

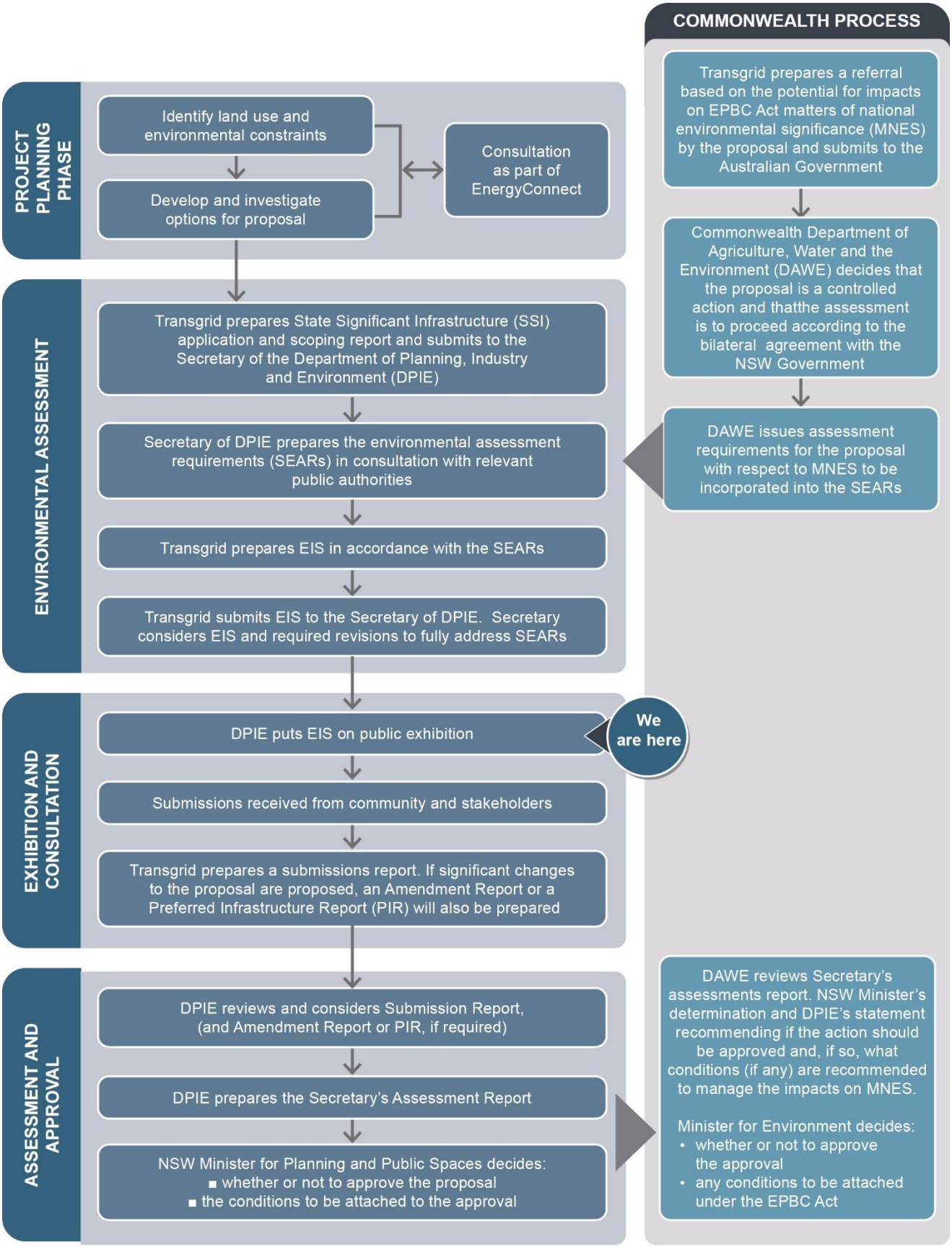


Figure C-1 Assessment and approval process for the proposal

C.1.3 NSW State Significant Infrastructure

As stated above, Clause 41 of the Infrastructure SEPP permits development for the purpose of an electricity transmission or distribution network to be carried out by, or on behalf of, an electricity supply authority or a public authority without con sent, provided that the project is not carried out on land reserved under the NSW *National Parks and Wildlife Act 1974* (NP&W Act). The proposal study area would cross one area of land reserved under the NP&W Act being the Murrumbidgee Valley Nature Reserve. In the absence of the Order made by the Minister for Planning and Public Spaces, the proposal would not be able to be assessed under Part 5 of the EP&A Act.

However, the effect of the Order in respect of EnergyConnect (which includes the proposal) means that it has been declared a SSI and CSSI project under Section 5.13 of the EP&A Act. Schedule 5 the SRD SEPP has been amended to include the project as CSSI (Section 15). Importantly, Clause 16 of the SRD SEPP provides that development specified in Schedule 5 (which includes the land reserved under the NP&W Act) may be carried out without development consent under Part 4 of the Act, and is also declared to be SSI for the purposes of the EP&A Act, if it is not otherwise so declared.

In respect of the land reserved under the NP&W Act, Transgrid will need to obtain an easement from the Minister Administering the NP&W Act under section 153 of that Act.

On this basis, the entire proposal is to be assessed as a CSSI project and this EIS has been prepared to support the application under Division 5.2 of the EP&A Act.

C.1.4 Planning approval process under Part 5 of the EP&A Act

C.1.4.1 SSI and supporting document

An SSI application was submitted to the Secretary of the NSW Department of Planning, Industry and Environment (DPIE) on 4 September 2020 seeking the Secretary's environmental assessment requirements for the preparation of the EIS for EnergyConnect (NSW – Eastern Section) (the proposal). The application was accompanied by a supporting document, the *Environmental Scoping Report, EnergyConnect (NSW – Eastern Section)* (Transgrid, September 2020).

The supporting document provided an overview of the proposal, outlined the key likely environmental impacts during the construction and operation of the proposal, and proposed an indicative scope for the EIS.

C.1.4.2 Secretary environmental assessment requirements

After consultation with the relevant State and local government authorities, and using information provided in the supporting document, the Secretary issued his SEARs for the proposal on 2 October 2020 – SSI Application SSI-9172452.

A copy of the SEARS and where they are addressed in this EIS is provided as Appendix A.

C.1.4.3 Preparation of the EIS

This EIS documents the description of the proposal, identification of the existing environment, assessment of the likely environmental impacts, and outlines the proposed mitigation measures to minimise the likely impacts of the proposal.

C.1.4.4 Form and content of the EIS

The form and content of this EIS has been prepared to address the SEARs and the requirements of Schedule 2, Part 3 of the (NSW) EP&A Regulation (as per section 5.16 of the EP&A Act). The SEARs also require compliance with Schedule 2, Part 3 of the EP&A Regulation. Consideration of the EP&A Regulation is provided in Appendix B of the EIS.

C.1.4.5 Public exhibition and invitation to make submissions

Pursuant to Section 5.17 of the EP&A Act, the EIS is to be made available for public review for a period of no less than 28 days. During the exhibition period, the community, affected landowners, local businesses, public authorities and other stakeholders are invited to make submissions to the DPIE in response to the proposal.

Further details regarding the proposed activities and public exhibition of the proposal is provided in Chapter 7 of this EIS.

C.1.4.6 Consideration of submissions

Copies of all submissions received by DPIE during the exhibition period would be provided to Transgrid and any relevant public authorities. All submissions regarding the EIS would be treated as public information unless the submission specifically requests that certain details are not made public. Following the exhibition period, Transgrid would prepare and submit the following to the Secretary:

- a submissions report providing responses to issues raised in submissions made to DPIE during the exhibition period
- if required, an Amendment Report (or Preferred Infrastructure Report (PIR) if directed to by DPIE) outlining any proposed changes to the proposal, including any to reduce environmental impacts, in response to issues raised in submissions during the exhibition period. If the changes to the proposal are considered to be significant, the Amendment Report (or PIR) may also be made available to the public, at the discretion of the Secretary, for comment prior to determination.

C.1.4.7 Determination

As a CSSI project, the Minister for Planning and Public Spaces will be the decision maker for the proposal.

Following the exhibition period and Transgrid's response to any issues raised in submissions, the Secretary will prepare a report to the Minister for Planning and Public Spaces in accordance with the provisions of section 5.18 of the EP&A Act. The Secretary's assessment report must be considered by the Minister's in determining whether or not to approve the carrying out of the proposal. The Minister's approval may be subject to conditions of approval, in accordance with section 5.19 of the EP&A Act.

C.1.5 Applicable NSW environmental planning instruments

Section 5.22 of the EP&A Act provides that environmental planning instruments (such as LEPs and SEPPs) other than the Infrastructure SEPP and the SRD SEPP, do not apply to SSI and CSSI projects. Notwithstanding that EPIs do not apply, the key environmental planning instruments have been considered with respect to the proposal for consistency.

These instruments are discussed in Table C-1.

Table C-1 Environmental Planning Instruments of potential relevance to the proposal

Environmental planning instruments	Relationship to EnergyConnect
State Environmental Planning Policy (State and Regional Development) 2011	Amongst other provisions, *State Environmental Planning Policy (State and Regional Development) 2011* identifies development that is SSI. The *Environmental Planning and Assessment Amendment (Project EnergyConnect (SA to NSW Electricity Interconnector)) Order 2019* was made by the Minister for Planning and Public Spaces on 30 August 2019. The order amended Schedule 5 of the SRD SEPP to include the proposal (as part of the broader EnergyConnect project) as a Critical SSI project (note that clause 16 of the SRD SEPP provides that proposals listed under Schedule 5 as Critical SSI are also deemed SSI).
State Environmental Planning Policy (Koala Habitat Protection) 2021	The *State Environmental Planning Policy (Koala Habitat Protection) 2021* was made and commenced on 17 March 2021 and replaced the former SEPP (Koala Habitat Protection) 2019. This SEPP aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline. The policy applies to a number of LGAs across NSW, including the following LGAs within which the proposal would be located: • Wentworth Shire • Murray River • Edward River • Federation • Lockhart Shire. While the requirements of this SEPP would not apply to the proposal (as it would not be subject to council consent), Transgrid have considered potential impacts to koala populations as part of the EIS process and biodiversity impact assessment for the proposal (refer to Chapter 9 and Technical Paper 1).
State Environmental Planning Policy No. 55 – Remediation of Land	This SEPP provides a State-wide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. In accordance with Clause 7(1) of SEPP 55, a consent authority must not consent to the carrying out of development on any land unless: • it has considered whether the land is contaminated • if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or would be suitable, after remediation) for the purpose for which the development is proposed to be carried out • if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land would be remediated before the land is used for that purpose. A Phase 1 contamination investigation has been undertaken for the proposal to inform the design and EIS process. The outcomes of the contamination investigations concluded that based on the available data, the proposal study area is considered suitable for the proposal subject to implementation standard measures and management controls during site development. Operational phase contamination risk management is also considered to be manageable with standard controls and procedures. Further consideration of contamination is addressed in Chapter 21 of this EIS.

Environmental planning instruments	Relationship to EnergyConnect
State Environmental Planning Policy (Primary Production and Rural Development) 2019	This SEPP aims to facilitate the orderly economic use and development of land for primary production and reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources. The SEPP is also intended to identify land which has been declared to be State Significant agricultural land (currently no land identified by the SEPP). Overall, the proposal would not adversely affect the objectives of this SEPP. As discussed in Chapter 3 (Proposal design development), the proposal has been designed to minimise impacts on important agricultural lands, and where possible, utilise previously disturbed corridors such as existing electrical easements or road corridors. Further condition of impacts to agricultural land is provided in Chapter 12 of this EIS.

C.1.6 Local Environmental Plans

The proposal would be located across a range of LGAs. The relevant LGAs and LEPs affected by the proposal are as follows:

- Wentworth Shire (*Wentworth Local Environmental Plan 2011*)
- Balranald Shire (*Balranald Local Environmental Plan 2010*)
- Murray River (*Murray Local Environmental Plan 2011*)
- Edward River (currently still operating under the former Conargo *Local Environmental Plan 2013*)
- Hay Shire (*Hay Local Environmental Plan 2011*)
- Murrumbidgee (operating under both the *Murrumbidgee Local Environmental Plan 2013* and *Jerilderie Local Environmental Plan 2012*)
- Federation (currently still operating under the former *Urana Local Environmental Plan 2011)*
- Lockhart Shire (*Lockhart Local Environmental Plan 2012*)
- Wagga Wagga (*Wagga Wagga Local Environmental Plan 2010*).

The relevant LEPs provides for a range of development standards, zoning and planning controls for development in each LGA. The zoning which is applicable to the proposal includes the following:

- RU1 Primary Production (consisting of a majority of the land on which the proposal would be located)
- RU3 Forestry (east of Yanga Way, just east of the existing Balranald Substation and Brookong State Forest near Lockhart)
- SP1 Special Activities (Wagga waste facility to the south of the Wagga substation)
- SP2 Infrastructure (at the crossing points of the Cobb Highway, Kidman Way, Newell Highway, Olympic Highway, Holbrook Road, the freight rail lines at Lockhart and parallel to the Olympic Highway)
- E1 National Parks and Nature Reserve (east of the existing Balranald Substation associated with the Yanga State Conservation Area)
- E2 Environmental Conservation (small area to the south east of the Buronga substation).

As previously stated, the EP&A Act expressly provides that LEPs do not apply to SSI or CSSI projects. Therefore, the remaining provisions of the relevant LEPs have not been considered further in this EIS. However, the assessment has considered heritage items listed under each LEP in Chapter 11 (Non-Aboriginal heritage) and has considered potential impacts to land use in Chapter 12 (Land use and property).

C.1.7 Other NSW Legislation

Table C-2 discusses other NSW legislation that would be, or may be, applicable to the proposal regardless of the proposal being declared CSSI.

Table C-2 Other NSW planning legislation of potential relevance to the Proposal

Legislation	Requirement
Aboriginal Land Rights Act (NSW) 1983	The purpose of the *Aboriginal Land Rights Act (NSW) 1983* includes providing land rights for Aboriginal persons and representative Aboriginal Land Councils in the State. This Act applies to Crown lands that are not lawfully needed for an essential public purpose; referred to as claimable Crown land. No claimable Crown lands have been identified that would be affected by the proposal.
Biodiversity Conservation Act 2016 (BC Act)	The BC Act aims to conserve threatened species, populations and ecological communities through ensuring appropriate assessment, management and regulation of actions that may damage critical or other habitat for a listed threatened species, or may otherwise significantly affect a threatened species, population or ecological community. Under this Act, SSI projects are required to prepare a biodiversity development assessment report (BDAR) to identify and assess biodiversity impacts under the provisions of the BC Act and offset those impacts by retiring biodiversity credits, determined using the Biodiversity Assessment Methodology (BAM). Biodiversity impacts associated with the proposal have been assessed in accordance with the *Biodiversity Conservation Act 2016*. The results of this assessment are presented in the BDAR for the proposal (Technical paper 1) and summarised in Chapter 9.
Biosecurity Act 2015	The *Biosecurity Act 2015* provides for the prevention, elimination, minimisation and management of biosecurity risks in NSW posed by biosecurity matter, which is defined in section 10 of the Bio Act. It replaces the former *Noxious Weeds Act*. Under the Act, weeds are defined as a plant that is a pest and a biosecurity risk exists where invasive weeds, now termed priority weeds under the *Biosecurity Act 2015*, have the potential to negatively impact on the environment. The Act introduces a responsibility for landowners or land managers to control and prevent the introduction and spread of these priority weeds, which is to be known as a General Biosecurity Duty. As discussed above, the EIS for the proposal has included an assessment of biodiversity impacts including consideration of noxious weeds (refer to Chapter 9 and Technical paper 1).

Legislation	Requirement
Contaminated Land Management Act 1997 (CLM Act)	The CLM Act outlines the circumstances in which notification of the NSW Environment Protection Authority (EPA) is required in relation to the contamination of land. A Phase 1 contamination investigation (Technical paper 14) has been undertaken for the proposal to inform the design and EIS process. The outcomes of the contamination investigations concluded that based on the available data, the proposal study area is considered suitable for the construction and operation of the proposal. Further consideration of contamination is summarised in Chapter 21 of this EIS.
Crown Land Management Act 2016	This Act sets out the requirements for the management of Crown land in NSW, including where councils and other organisations can deal with Crown land. The proposal would pass through a number of areas of Crown Land that would be affected by the proposal. Impacts to Crown Land have been discussed in greater detail in Chapter 12 of this EIS.
Forestry Act 2012 (Forestry Act)	The Forestry Act provides for the dedication, management and use of State forests and other Crown-timber land for forestry and other uses. This Act also allows for the constitution of the Forestry Corporation of New South Wales as a statutory State owned corporation. The proposal study area would cross two areas of land reserved under the Forestry Act being Cullivel State Forest and the Brookong State Forest. Section 34(1) of the Forestry Act provides that *the Minister may, on such terms and conditions as the Minister thinks fit, grant an easement or right of way through or over land within a State forest or flora reserve*. This section would empower the Minister administering the Forestry Act to exercise a discretion to grant an easement to Transgrid though these forests.
Heritage Act 1977	The Heritage Council must be notified if a relic is uncovered during construction and if it is reasonable to believe that the Heritage Council is unaware of the location of the relic. The Heritage Council must also be notified if an item listed on a Government Agency's Section 170 Heritage Register is demolished. Section 139 specifies that a person must not disturb or excavate land knowing, or suspecting, that the action may result in the discovery, exposure, movement, damage or destruction of a relic, unless the work is undertaken in accordance with an excavation permit. Additionally, section 146 requires that the discovery or location of a relic must be notified to the Heritage Council unless the Heritage Council is aware of the relic's location. Under the SSI provisions for the proposal, exemptions and permits that would otherwise be required under Part 4 and section 139 of the Heritage Act are not required for approved SSI projects by reason of section 5.23 of the EP&A Act. Notwithstanding, heritage impacts associated with the proposal have been assessed in accordance with the Heritage Act 1977. The results of this assessment are presented in the *Aboriginal Cultural Heritage Assessment* (Technical paper 2), the *Historic Heritage Impact Assessment* (Technical paper 3) and summarised in Chapter 10 (Aboriginal heritage) and Chapter 11 (Non-Aboriginal heritage).

Legislation	Requirement
Land Acquisition (Just Terms Compensation) Act 1991 (Land Acquisition Act)	The Land Acquisition Act controls the acquisition of land on just terms by authorities of the State with the objective of simplifying and expediting the compulsory acquisition process while ensuring compensation on just terms for the owners of land that is acquired by an authority of the State when the land is not available for public sale. Transgrid is an authority of the State for the purposes of the Land Acquisition Act and the Act applies to the proposal. Further discussion of potential land acquisition associated with the proposal is discussed in Chapter 5, Chapter 12 and Appendix E of the EIS.
National Parks and Wildlife Act 1974 (NP&W Act)	The NP&W Act establishes statutory provisions for the preservation and management of national parks, historic sites and certain other areas, as well as the protection of certain Aboriginal objects. The NP&W Act provides for the conservation of elements of the natural environment, as well as the conservation of objects, places or features of cultural value to Aboriginal people and the people of NSW. Under the provisions of section 86 of the NP&W Act, a person must not harm or desecrate a known Aboriginal object unless authorised by an Aboriginal heritage impact permit issued under section 90 of that Act. The proposal has been declared to be CSSI. Under the provisions of Section 5.23(1) of the EP&A Act, a permit that would otherwise be required under section 90 of the NP&W Act is not required for approved SSI projects. Notwithstanding, a detailed assessment of potential impacts to Aboriginal heritage associated with the proposal has been undertaken. The results of this assessment are presented in the *Aboriginal Cultural Heritage Assessment* (Technical paper 2) and summarised in Chapter 10. Additionally, as noted in section C.1.3, the proposal study area would cross one area of land reserved under the NP&W Act being the Yanga State Conservation Area. However, by reason of the Critical SSI declaration, the proposal (including the land which is the subject of the Yanga State Conservation Area) is being assessed under Part 5 Division 5.2 of the EP&A Act. Section 47I of the NP&W Act also relevantly provides that '*despite anything in this or any other Act, land within a state conservation area is not to be dealt with except as provided under this Act.*'. Importantly, the words 'except as provided in this Act' enlivens section 153, which empowers the Minister administering the NP&W Act to exercise a discretion to grant an easement to Transgrid.
Native Title (NSW) Act 1994	This Act provides for native title in relation to land or waters. The *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010) stipulates that where relevant, consultation must be conducted with Native title holders or registered native title claimants in accordance with the *Native Title Act 1994*. The EIS for the proposal has included an assessment of native title and Aboriginal heritage impacts (refer to Chapter 10 and Technical paper 2).

Legislation	Requirement
Pipelines Act 1967	High pressure pipelines are designed, constructed, tested, operated and maintained in accordance with the *Standard for Gas and Liquid Petroleum Pipelines - AS 2885-2008* (Standards Australia, 2008) and licenced under the *Pipelines Act 1967*. The Pipelines Regulation 2013 also ensures that licensed pipeline are designed, constructed, maintained and operated in a safe and reliable manner. The proposal would cross over an existing high pressure gas main to the west of Uranquinty. Development along such a pipeline poses a risk to pipeline integrity and, equally, may present a risk to the proposal should a failure of the pipeline occur. In line with Clause 66C of the Infrastructure SEPP, Transgrid has considered the impacts of the potential impacts of the proposal's development. These considerations have included: Undertaking an initial identification assessment using Dial Before You Dig requirement. Additional, detailed DBYD checks would be undertaken as part of the finalisation of the proposal's design Operator consultation – consultation with the relevant pipeline operator has commenced. The EIS has included the potential impact to the pipeline as part of the Hazard and Risk assessment presented in Chapter 20 of this EIS.
Protection of the Environment Operations Act 1997 (POEO Act)	The PoEO Act establishes, amongst other things, the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. An environment protection licence (EPL) is required under Chapter 3 of the POEO Act to undertake a scheduled activity or scheduled development work. The proposal would include a proposed screening plant as part of the earthworks to occur at the proposed Dinawan 330kV substation site. Crushing, grinding or separating is listed as scheduled activity 16 under the Schedule 1 of the POEO Act: *16 Crushing, grinding or separating* *(1) This clause applies to crushing, grinding or separating, meaning the processing of materials (including sand, gravel, rock or minerals, but not including waste of any description) by crushing, grinding or separating them into different sizes.* *(1A) However, this clause does not apply to the processing of materials by crushing, grinding or separating that occurs as part of an activity that is declared to be a scheduled activity by—* *(a) clause 33 (Railway activities—railway infrastructure construction), or* *(b) clause 35 (Road construction).* *(2) The activity to which this clause applies is declared to be a scheduled activity if it has a capacity to process more than 150 tonnes of materials per day or 30,000 tonnes of materials per year.* Based on the currently proposed screening daily rates (Up to around 150,000 to 200,000 cubic metres of total volume), criteria (2) would be exceeded and the proposed screening activities would trigger the need for an EPL.

Legislation	Requirement
	Section 5.24(e) of the EP&A Act identifies approvals or authorisations that cannot be refused if they are necessary for carrying out approved SSI (or critical SSI) and are substantially consistent with the Part 5.2 approval, including the need for: • an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act). Additionally, with respect to other components of the proposal, based on the proposed capacity of the wastewater treatment facilities at each camp site, it is not expected that an environment protection licence would be required under the PoEO Act (clause 36 of Schedule 1) for this proposal element.
Rail Safety Act 2008 (Rail Safety Act)	The principal object of the Rail Safety Act of relevance to the proposal is the regulation of the carrying out of various activities within in railway corridors. The proposal crosses rail corridors at five locations with only two being operational railway lines. Activities associated with the proposal that would occur across these rail corridors would predominantly be related to stringing conductors over the rail corridors. As part of the ongoing refinement of the proposal construction methodology, Transgrid and the contractor would consult with the relevant rail authority for each of the required crossings (including Australian Rail Track Corporation, Country Regional Network (John Holland) and VicTrack).
Roads Act 1993 (Roads Act)	The principal object of the Roads Act of relevance to the proposal is the regulation of the carrying out of various activities on public roads. Part 9 of the Roads Act nominates the requirements for undertaking works within a public road, including the requirement to obtain consent under section 138 for carrying out works in, on or over a public road (this includes the erection of structures), and the digging up or disturbance of the surface of a public road. The proposal would potentially require temporary/partial closure of classified and unclassified roads for the construction of the proposal, and may require works to connect new access points. By reason of clause 5(1) of Schedule 2 of the Roads Act, Transgrid is not required to obtain consent to carry out work on unclassified roads. Transgrid will however require consent to undertake work where this occurs on or over classified roads.
Rural Fires Act 1997 (RF Act)	The objects of the RF Act are focused on the prevention, mitigation and suppression of bush and other fires in rural fire districts, and the co-ordination of firefighting and prevention across the State. Section 100B applies to bush fire prone land and empowers the Commissioner of the NSW Rural Fire Service to issue a bush fire safety authority. The bush fire authority authorises certain types of development, subject to compliance with matters considered by the Commissioner to be necessary to protect persons, property or the environment. Potential hazards associated with bush fire risk to the proposal (including during construction), have been considered as part of a *Bushfire Impact Assessment* (Technical paper 12) and summarised in Chapter 20.
Waste Avoidance and Resource Recovery Act 2001 (WARR Act)	The WARR Act aims to encourage the most efficient use of resources to reduce environmental harm in accordance with the principles of ESD. The proposal would consume some natural resources and would produce waste. Waste and resource impacts associated with the proposal have been considered in Chapter 22 of this EIS.

Legislation	Requirement
Water Management Act 2000 (WM Act)	The overarching objective of the WM Act is to provide for the sustainable and integrated management of the water resources of the State and including the application of the principles of ESD. Water use approvals, which authorise and confer a right on the holder of the approval to use water for a particular purpose at a particular location, are dealt with in section 89 of the WM Act. Section 90 of the WM Act identifies three kinds of water management works approvals, being a water supply work approval, a drainage work approval and a flood works approval, with all three of these approvals conferring a right on the holder of the approval to construct and use the specified works at a specified location. There are two kinds of activity approvals that are dealt with in section 91 being a controlled activity and aquifer interference, both of which confer a right on the holder to carry out the specified activity at the specified location. The proposal is CSSI. Under the provisions of section 5.23(1) of the EP&A Act, a water use approval pursuant to section 89 of the WM Act, a water management work approval pursuant to section 90 of the WM Act, and an activity approval (other than an aquifer interference approval) pursuant to section 91 of the WM Act are not required and accordingly, do not apply to approved SSI projects. As discussed in Chapter 16 of the EIS, water would be sourced from existing regulated sources, purchased from the existing water market or council facilities and accessed via existing, licensed water extraction infrastructure only. Additionally, the *NSW Aquifer Interference Policy* (DPI, 2012c) documents the NSW Government's intention to implement the requirement for approval of 'aquifer interference activities' under the WM Act, however, the provisions for aquifer interference approvals have not been enacted. It is not anticipated that the proposal would interfere with any aquifers as the proposal would not likely require excavation to a sufficient depth to intercept an aquifer or result in drawdown. Consideration of the NSW *Aquifer Interference Policy* has been included in Chapter 21 and Technical paper 15.

C.1.8 Approvals or Authorisations that are not required or cannot be refused

In accordance with Section 5.23 of the EP&A Act some planning legislation does not apply to SSI/CSSI or must be applied consistently with an approved SSI/CSSI project.

Approvals of potential relevance to the proposal which are not required under section 5.23(1), include:

- permits under Sections 201, 205 and 219 of the *Fisheries Management Act 1994* (FM Act)
- approvals under Part 4, or an excavation permit under Section 139 of the *Heritage Act 1977*
- Aboriginal heritage impact permits under Section 90 of the NP&W Act
- various approvals under the WM Act, including water use approvals under Section 89, water management work approvals under Section 90, and activity approvals (other than aquifer interference approvals) under Section 91.

Section 5.23 of the EP&A Act also specifies directions, orders or notices cannot be made or given so as to prevent or interfere with the carrying out of approved CSSI. Of relevance to the proposal would be:

- an interim protection order under (within the meaning of the NP&W Act or the *Biodiversity Conservation Act 2016*)
- an order under Division 1 (Stop work orders) of Part 6A of the NP&W Act or Division 7 (Stop work orders) of Part 7A of the FM Act
- an environment protection notice under Chapter 4 of the POEO Act
- an order under section 124 of the *Local Government Act 1993*.

Section 5.24 of the EP&A Act identifies approvals or authorisations that cannot be refused if they are necessary for carrying out approved SSI/CSSI and must be issued substantially consistent with the Part 5.2 approval, including:

- environment protection licences (EPLs) under Chapter 3 of the POEO Act
- consent (Road Occupancy Licence) under Section 138 of the *Roads Act 1993* from the relevant roads authority for the erection of a structure, or the carrying out of work in, on or over a public road, or the digging up or disturbance of the surface of a road.

With respect to EPLs, Schedule 1 of the POEO Act, does not define electrical transmissions lines or substations as a scheduled activity requiring an EPL.

With respect to Road Occupancy Licences, the proposal would potentially require temporary/partial closure of classified and unclassified roads for the construction of the proposal. Transgrid would require consent to undertake work on classified roads. The contractor would be responsible for this. However, by reason of clause 5(1) of Schedule 2 of the Roads Act, Transgrid is not required to obtain consent to carry out work on unclassified roads.

C.1.9 Ecologically sustainable development

Part 3,Schedule 2 (clause 7(4)) of the EP&A Regulation and section 6(2) of the *Protection of the Environment Administration Act 1991* outlines the four principles of ecologically sustainable development (ESD). The four ESD principles comprise the precautionary principle; intergenerational equity; conservation of biological diversity and ecological integrity; and improved valuation, pricing and incentive mechanisms.

Transgrid has considered the principles of ESD in the design development of the proposal. A discussion of how the proposal has considered ESD principles is included in Section 25.2 of the EIS. Section 24.2 of the EIS identifies how sustainability will be incorporated into the proposal.

C.2 Commonwealth legislation

The EPBC Act is the Commonwealth Government's key piece of environmental legislation. The EPBC Act focuses Commonwealth Government interests for the protection of matters of national environmental significance, with the states and territories having responsibility for all matters concerning the environment.

Key parts of the EPBC Act that are relevant to the proposal are:

- Part 3 – requirements for environmental approvals
- Part 5 – bilateral agreements
- Part 7 – whether an approval is needed
- Part 8 – assessing the impacts of a controlled action
- Part 9 – the approval of actions.

Part 3 of the EPBC Act provides for the referral to the Commonwealth Minister for the Environment and Energy a proposal that is likely to have a significant impact on the following:

- Matters of National Environmental Significance (NES) (refer to Section C.2.1 below)
- an action by the Commonwealth or a Commonwealth agency which has, will have or is likely to have a significant impact on the environment
- an action which has, will have or is likely to have a significant impact on the environment on Commonwealth land, no matter where it is to be carried out.

Transgrid is not a Commonwealth agency and current assessment of the proposal indicates no Commonwealth land would be affected. As such, these potential triggers were not considered further.

C.2.1 Matters of National Environmental Significance

Under the EPBC Act, a proposal is required to be referred to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) for activities that have the potential to significantly impact on matters of NES. If the proposal is considered likely to significantly affect matters of NES, the Minister can deem the proposal a controlled action, and their approval is required prior to proceeding to construction. A controlled action may comprise a project, development, undertaking, activity or series of activities.

A summary of the potential impacts to matters of NES as a result of the proposal is presented in Table C-3. As detailed in Chapter 9 and Appendix A of this EIS, the proposal would have a significant impact on EPBC three listed threatened flora species and four ecological communities. No significant impact on threatened fauna species or EPBC listed migratory species.

Table C-3 Matters of NES under the EPBC Act

Matters of NES	Matters which may be affected by the proposal
World heritage properties	The proposal would not impact on any items of world heritage.
National heritage places	The proposal would not impact on any items of national heritage or national heritage places.
Wetlands of international importance	The proposal would not impact on any wetlands of national or international importance.

Matters of NES	Matters which may be affected by the proposal
Great Barrier Reef Marine Park	The proposal would not impact on the Great Barrier Reef Marine Park.
Commonwealth listed threatened species and ecological communities	Based on broad scale state vegetation mapping and database searches a total of seven candidate threatened ecological communities listed under the EPBC Act were considered likely to occur. These are: • Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions – Endangered • Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia – Endangered • Natural Grasslands of the Murray Valley Plains – Critically Endangered • Plains mallee box woodland of the Murray Darling Depression, Riverina and Naracoorte Coastal Plains bioregions • Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains – Critically Endangered • Weeping Myall Woodlands – Endangered • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered. Twenty threatened flora species have a moderate likelihood of occurrence within the proposal study area. Of these, four were identified as being potentially impacted which are: • *Brachyscome papillosa* (Mossgiel Daisy) – Vulnerable • *Lepidium monoplocoides* (Winged Peppercress) – Endangered • *Maireana cheelii* (Chariot Wheels) - Vulnerable • *Swainsona murrayana* (Slender Darling Pea) – Vulnerable. Thirty three threatened fauna species have a moderate likelihood of occurrence within the proposal study area. This comprises one invertebrate, two reptiles, three amphibian, five fish, six mammal and 16 birds species. As documented in Technical paper 1 (where further detail is provided), the proposal is predicted to have a significant impact on four of the ecological communities and three of the threatened flora species, as follows: TECs: • Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • Natural Grasslands of the Murray Valley Plains • Weeping Myall Woodlands • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Threatened flora species: • Mossgiel Daisy - *Brachyscome papillosa* • Chariot Wheels - *Maireana cheelii* • Slender Darling Pea - *Swainsona murrayana*. In relation to the other species and ecological communities the proposal would have some impact on these, however overall the proposal is unlikely to lead to a significant impact on them.

Matters of NES	Matters which may be affected by the proposal
Commonwealth listed migratory species	Database searches identified a total of 19 migratory species listed under the EPBC Act, that are predicted or known to occur within the proposal locality. The results of the likelihood of occurrence assessments identified an additional 17 migratory species listed under the EPBC Act, with moderate or higher potential to occur within the proposal study area. As documented in Technical paper 1 (where further detail is provided), the proposal is considered unlikely to substantially modify, destroy or isolate an area of important habitat for any EPBC Act listed migratory species and is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.
Nuclear action	The proposal would not result in any nuclear action nor would any nuclear activity need to be undertaken.
Commonwealth marine area	The proposal would not result in any impacts to Commonwealth marine areas. Database searches identified 29 listed marine bird species as occurring, possibly occurring or likely to occur within the proposal locality. Two were recorded within the proposal study area during preliminary field surveys, being: • Rainbow Bee-eater • White-bellied Sea-eagle. Listed Marine Species under the EPBC Act are only afforded protection in Commonwealth Marine areas including water, air and seabed that are NOT in state or territory waters, hence consideration of these species was not relevant to this proposal.
Water resources, in relation to a coal seam gas development and large coal mining development	The proposal is not related to a coal seam gas development and large coal mining development.

C.2.1.1 Bilateral agreement

Based on the potential impacts to the listed threatened species identified in Table C-3, a referral under the EPBC Act was submitted on 25 August 2020. Determination by the DAWE on 30 September 2020 confirmed the proposal to be a controlled action and would be subject to the bilateral assessment agreement under Part 9 of the EPBC Act.

Part 5 provides for a written agreement between the Commonwealth and a State that is aimed at minimising duplication in the environmental assessment process through the accreditation of that State's processes. However, an EPBC Act approval is still required.

In February 2015, the Commonwealth and NSW entered into a bilateral agreement under Part 9 of the EPBC Act. Since entering into that agreement, NSW has amended the accredited process through the repealing of the *Threatened Species Conservation Act 1995* and the commencement of the BC Act and the *Environmental Planning and Assessment Amendment Act 2017*. The current agreement provides for certain actions that are State significant development or SSI within the meaning of the EP&A Act to be accredited for the purposes of meeting the requirements for assessment and public exhibition of an action under the provisions of the EPBC Act.

The requirements to meet this bilateral process have been included within the SEARs provided by the DPIE for the proposal (refer to Appendix A).

C.2.2 Airports Act 1996

Part 12 of the *Airports Act 1996* (Airports Act) and the Airports (Protection of Airspace) Regulations 1996 (the Airspace Regulations) establish a framework for the protection of airspace at, and around airports.

Section 181(1) of the Airports Act defines the prescribed airspace as '…an airspace specified in, or ascertained in accordance with, the regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected under this Part'. The Airspace Regulations define the 'prescribed airspace' around Wagga Wagga Airport.

The prescribed airspace consists of the obstacle limitation surface (OLS) and the Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surface. The OLS provides a protected space that is free of obstructions for aircraft flying into and out of the airport. It defines the lower limits of an airport's airspace, which should be kept free of obstacles during the initial and final stages of flight or manoeuvring. Intrusions into the OLS require approval under the Airports Act.

The PANS-OPS protects aircraft flying into and out of the airport when the flight is guided solely by instruments in conditions of poor visibility. The PANS-OPS surface is generally situated above the OLS. Intrusions into the PANS-OPS surface are prohibited.

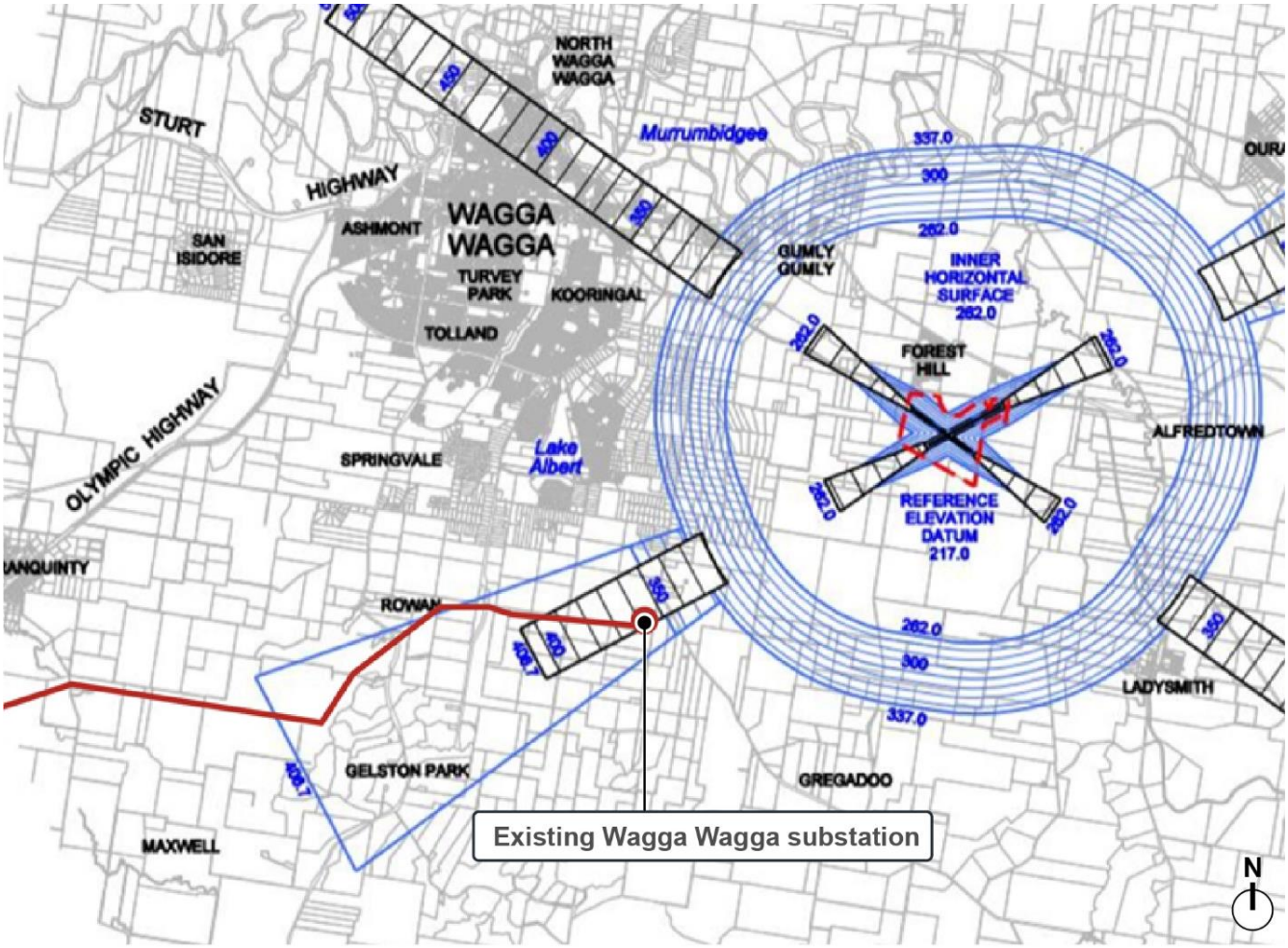
The Airports Act (section 183) defines any activity that intrudes into an airport's prescribed airspace to be a 'controlled activity', which requires approval. Controlled activities include:

- permanent structures, such as buildings, intruding into the protected airspace;
- temporary structures such as cranes intruding into the protected airspace; or
- any activities causing intrusions into the protected airspace through glare from artificial light or reflected sunlight, air turbulence from stacks or vents, smoke, dust, steam or other gases or particulate matter.

Carrying out a controlled activity without approval is an offence under Section 183 of the Airports Act.

While the far eastern portion of the proposal is located below the east-west approach/take-off angle for the airport, given the distance from the runway, the proposal would not encroach into the OLS for Wagga Wagga Airport (refer to Figure C-2). The proposed additional infrastructure below the approach angle would generally be consistent with the existing infrastructure.

As such no further approval under the Airports Act is considered to be required.



Note: Indicative alignment shown in red

Figure C-2 Interaction between the proposal and the Wagga Wagga obstacle limitation surface contours

Appendix D Consultation outcomes report

Transgrid

People. Power. Possibilities.

EnergyConnect (NSW-Eastern Section)

Consultation outcomes report

December 2021

Document purpose

This report has been prepared to support the Environmental Impact Statement (EIS) of the NSW-Eastern Section of EnergyConnect, which is submitted to the NSW Minister for Planning under Part 4 of the *Environmental Planning and Assessment Act 1979*.

The Department of Planning, Industry and Environment issued the Secretary's Environmental Assessment Requirements (SEARs), which outlines key elements that must be considered and reported on within the EIS. This report has been prepared in accordance with the relevant SEARs demonstrating how the *General* and *Consultation* requirements have been achieved. In addition, evidence of complimentary consultation undertaken to inform the wider community and provide opportunities for feedback has also been included.

The consultation requirements of the SEARs and where they have been addressed in this report are outlined below.

Relevant Secretary's Environmental Assessment Requirements

Reference	Secretary's Environmental Assessment Requirements
General requirements	The EIS must include: • a description of the engagement that was carried out during the preparation of the EIS, the key issues raised during this engagement and the proposed engagement strategy for the project if it is approved.
Consultation	During the preparation of the EIS, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups, affected landowners and lease holders, exploration licence holders and mineral title holders.

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1. Executive summary

Transgrid has undertaken a program of community and stakeholder engagement activities to support the lodgement of an Environmental Impact Statement (EIS) for the NSW-Eastern section of EnergyConnect. The NSW-Eastern section includes the construction of new transmission infrastructure from Buronga to Wagga Wagga in the Murray and Riverina regions of New South Wales.

In its entirety, EnergyConnect will deliver the infrastructure to connect the state grids of New South Wales, South Australia and Victoria and support the strategic transition to renewable energy generation. EnergyConnect will ultimately result in increased reliability and security of electricity supply, lower power bills and a cleaner future.

In recognition of the importance of the project, EnergyConnect has been declared Critical State Significant Infrastructure (CSSI) by the NSW Government, and is listed as a priority transmission project in the NSW Government's *NSW Transmission Infrastructure Strategy* and the Australian Energy Market Operator's *Integrated System Plan*.

Engagement drivers

As part of EnergyConnect, Transgrid has been working with stakeholders and the community since November 2018. This report outlines the outcomes of over 7,550 stakeholder and community engagement activities undertaken to address the Secretary's Environmental Assessment Requirements (SEARs) in support of the EIS process.

A diverse range of engagement activities and supporting materials were developed to meet the needs of specific stakeholder groups and in light of contemporary matters, such as NSW Government health guidelines surrounding the COVID-19 pandemic. Key engagement drivers have been broadly grouped into three categories:

1. building project awareness
2. providing accessible communication channels and materials
3. implementing community consultation.

This approach created broad awareness of the project across South-West New South Wales, and included opportunities for stakeholders to contribute to the project decision making process. The development of tailored communication materials providing a project overview and specific subject matter information, supported informed discussions enabling community members and stakeholders to provide meaningful input and feedback on areas of interest or issues of concern.

The specific outcomes of these activities are detailed below.

1. Building project awareness

Print advertisements

97 advertisements across **10** media publications, with an estimated readership of **153,000+**

Online advertisements

9 online advertising campaigns undertaken with **195,356** views

Social media posts

72 posts across **25** local community Facebook pages, with **63,500+** combined followers

Introductory letters

404 letters sent to local stakeholders from Buronga to Wagga Wagga

Flyers and poster displays

600 flyers and poster displays circulated to **25** businesses across **9** towns and an additional **2,100** flyers delivered to local residences

2. Providing accessible communication channels & materials

Project communication channels

124 community calls and emails responded to via the project phone line and email address

Project webpage

9,500+ visits to the project webpage

Subscription newsletter

~400 recipients to a monthly e-newsletter, with an average open rate **2.7x** higher than industry average

Guides and factsheets

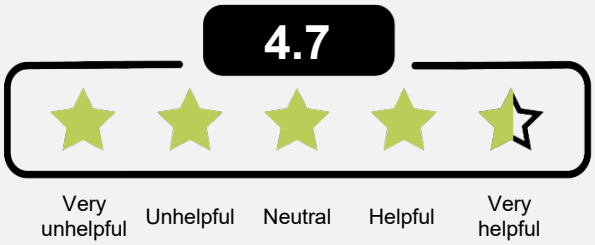
11 guides and factsheets developed specifically for EnergyConnect

3. Implementing consultation activities

In-person community drop-in information sessions

26 face to face drop-in sessions held across **15** local towns and community centres.

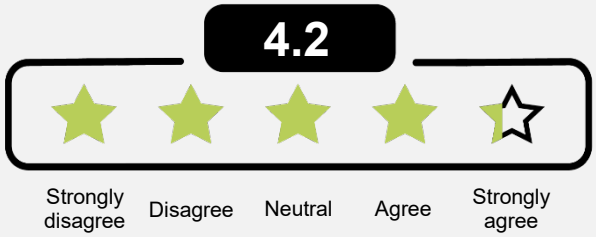
How informative did you find the community information session?



Online community information sessions

3 online community information sessions held, with **171** interested stakeholders and **82** attendees

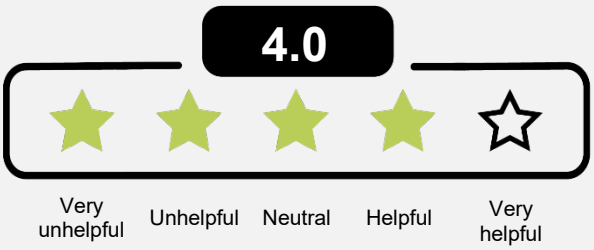
I would recommend others to participate in these online community information sessions



Facilitated landowner Q&A sessions

34 landowners and other community members attended a Q&A session, representing **42** landholdings

How informative did you find the Q&A session?



Property-specific meetings

643 property-specific meetings held as part of the NSW-Eastern Section consultation activities

Interactive map

~9,500 views of the online map, with **319** local insights and feedback provided and considered as part of the route refinement process

Stakeholder briefings

270 collaborative briefings held with key stakeholders

Stakeholder queries and feedback

From the engagement activities undertaken, significant feedback was received from a broad spectrum of stakeholders. The key stakeholders engaged and who provided feedback include:

- Local Members of Parliament
- Commonwealth and State government departments and agencies
- Local governments
- Aboriginal groups and representatives
- Industry and interest groups
- Landholders and community members.

Stakeholders explored and provided feedback on matters ranging from general comments about the consultation process through to detailed questions about longer-term considerations such as operations and maintenance. The overarching themes of discussion included:

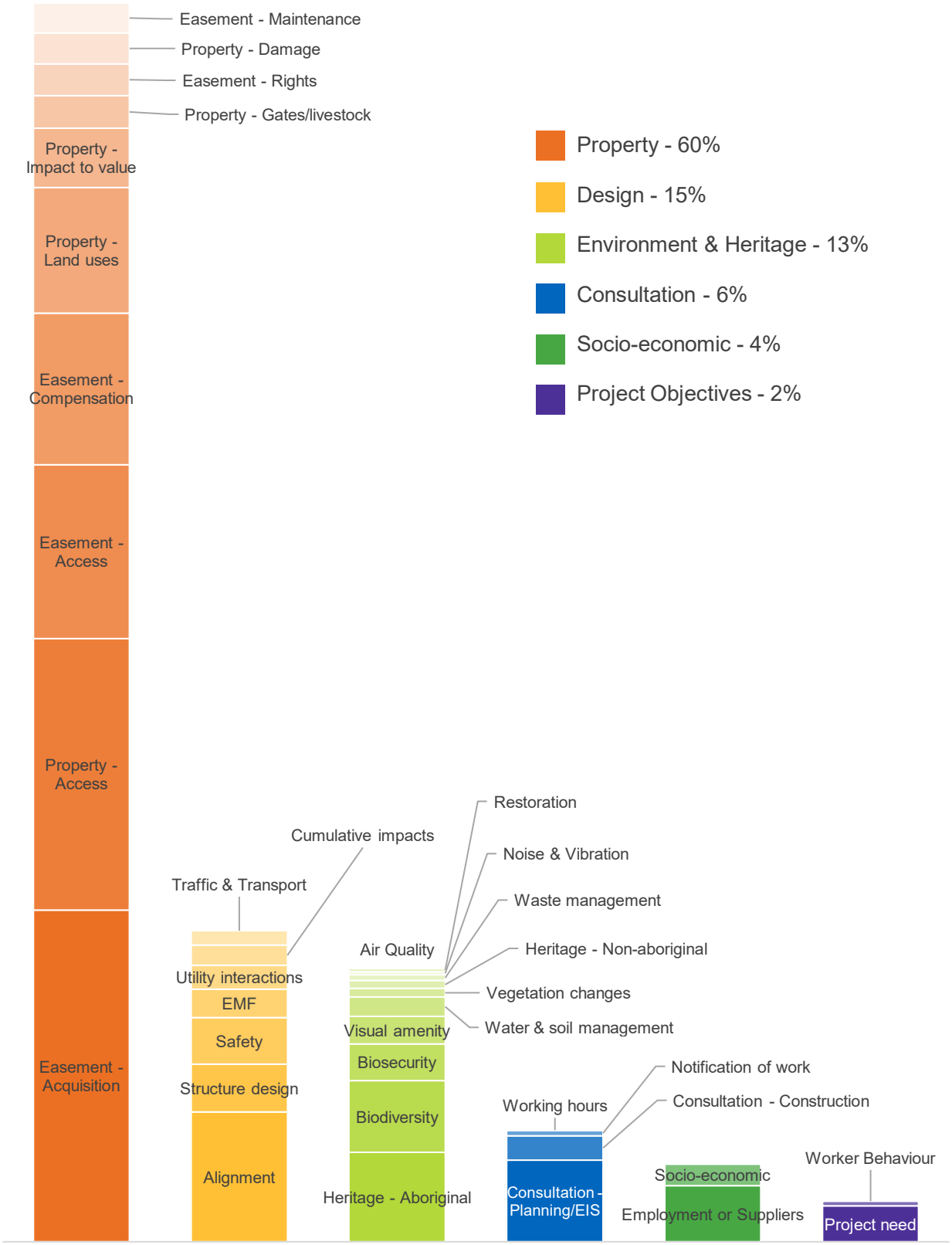
- **Consultation**: the engagement process during the planning phase of EnergyConnect and the potential engagement process during future construction activities
- **Design**: the route refinement process, planning decisions and the design of the physical and structural elements of EnergyConnect
- **Environment & heritage**: Aboriginal and non-Aboriginal cultural heritage, artefacts and sites of significance, bio-diversity (flora and fauna) and bio-security
- **Project objective**: the scope, justification and benefits of EnergyConnect
- **Property**: land management activities associated with private and public lands, including property and easement access, current and future land use and easement acquisition and compensation
- **Socio-economic**: the opportunities and constraints regarding economic development, employment and procurement.

Cumulatively, the most discussed topics of engagement were property related matters. This is reflective of the extensive engagements with local landholders that provided detailed information about their property's current and future land use, which were then factored into the route refinement process to minimise potential impacts.

To date, the vast majority of stakeholders have demonstrated a willingness to work with Transgrid, shown interest in identifying a preferred route and indicated a desire to remain informed and engaged on the progress of EnergyConnect.

Transgrid and project representatives will build on the success of engagements to date to continue building trust and a positive legacy for local communities in south-west NSW.

Detailed topics of discussion across all stakeholders



2. Background

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, like wind and solar. Several factors are driving this transition, including:

- government commitments to reduce carbon emissions
- the potential for renewable generation to lower energy prices
- demand for a more reliable energy supply.

At the same time, consumers are demanding lower power bills and more secure and reliable service.

Reducing carbon emissions

The National Energy Market (NEM), which connects the southern and eastern states in Australia and accounts for around 80 per cent of Australia's electricity consumption, has a system dominated by coal-fired generation.

In Australia, electricity generation is the largest source of greenhouse gas emissions, accounting for 34 per cent of the country's total emissions.

Initiatives to transition to renewable energy generation and supply are an opportunity to honour the Commonwealth Government's emissions policy commitments and achieve the NSW Government's Net Zero Plan of net zero emissions by 2050.

Transition to renewable energy for lower energy prices and more reliable energy supply

As coal-fired generators get older, they become more fragile and susceptible to outages, making the electricity system less reliable. With four of the State's five remaining coal-fired generators set to reach the end of their technical lives and close by 2035, the retirement of coal generation is predicted to be particularly rapid in NSW. The Liddell Power Station, for example, originally commissioned in 1971 and once considered the backbone of the NSW electricity system, is forecast to close in April 2023.

In response and to facilitate a strategic transition, the NSW Government developed the *Electricity Strategy* and *Electricity Infrastructure Roadmap*. These documents set out the plan to help replace the State's aging power stations with Renewable Energy Zones (REZs) leveraging locations with high renewable energy potential, including South-West NSW.

REZs will play a vital role in connecting multiple renewable energy generators and storage in the same location, capitalising on economies of scale to deliver cheap, reliable and clean electricity for homes and businesses in NSW.

The *Electricity Strategy* and *Electricity Infrastructure Roadmap* build on the *NSW Transmission Infrastructure Strategy* and supports the implementation of the Australian Energy Market Operator's (AEMO) *Integrated System Plan*.

> EnergyConnect has been identified as a priority project in both AEMO's *Integrated System Plan* and the NSW Government's *Transmission Infrastructure Strategy*

Role of EnergyConnect in supporting the transition

Connecting the energy grids of NSW, SA and Victoria, will expand the wholesale electricity market across the three states, contributing to increased reliability, security of electricity supply and lower power bills.

EnergyConnect will be crucial to the development of the South-West REZ providing the infrastructure to encourage future renewable energy providers to invest in the region. This in turn will boost regional economies and build the state's resilience by enabling a sufficient volume of new energy projects to replace the aging traditional power stations expected to close over the next two decades.

3. Project overview

3.1. EnergyConnect

Transgrid and ElectraNet are seeking regulatory and environmental planning approval for the construction and operation of a new 900 km interconnector between NSW and SA, with an added connection to north west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect comprises several sections as outlined below.

Section	Location	Responsible	Current status
South Australian Section	From Robertstown, SA to the SA/NSW border (near Chowilla, SA)	ElectraNet	South Australian Govt. planning approval pending
NSW-Western Section	From the SA/NSW border (near Chowilla, SA) to Buronga, NSW and from Buronga to the NSW/Victorian border at Monak (near Red Cliffs, Victoria)	Transgrid	NSW Govt. planning approval received September 2021
NSW-Eastern Section	From Buronga, NSW to Wagga Wagga, NSW	Transgrid	NSW Govt. planning approval being sought
Victorian Section	From the NSW/Victorian border to Red Cliffs	Transgrid	Victorian Govt. planning approval received November 2021

Overview of EnergyConnect sections

3.2. NSW-Eastern Section

The key features of the NSW-Eastern Section includes:

- approximately 537 kilometres of new double circuit transmission line and associated infrastructure between Buronga and Wagga Wagga, which includes:
  - approximately 375 kilometres of new 330 kV double circuit transmission line between the Buronga substation and the proposed Dinawan substation
  - approximately 162 kilometres of new 500 kV double circuit transmission line between the proposed Dinawan substation and the existing Wagga Wagga substation
- construction of a new substation around 30 kilometres south of Coleambally, referred to as the proposed Dinawan substation
- upgrade and expansion of the Wagga Wagga substation
- ancillary works, including access tracks, laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps.

4. Engagement overview and objectives

Transgrid is committed to an engagement process that is proactive, transparent and represents a genuine desire to work with stakeholders. Transgrid recognises that a two-way feedback process is fundamental to understanding the needs and views of stakeholders and communities directly and indirectly affected by its operations.

To date, the scope for community and stakeholder engagement on the NSW-Eastern Section of the EnergyConnect project has focussed on early and detailed engagement work to support the route selection process.

To meet the requirements of the SEARs the methodology for engagement was coordinated across three key areas and associated stakeholder groups:

Engagement with relevant interest groups, agencies and authorities to address specific requirements of the SEARs

Targeted engagement with community members and stakeholders, particularly those with a direct interest in the proposal, such as landowners, neighbours and other identified community stakeholders

Broad communication and consultation with stakeholders in the region.

Objectives

To support a comprehensive and transparent consultation process throughout the preparation of the EIS, Transgrid implemented an engagement program that focussed on:

- identifying and engaging early with community members and stakeholders in a genuine, honest and transparent way
- providing tailored, timely and meaningful information on the proposal, underlying project need and relevant/potential impacts
- conducting the engagement and facilitating a communication process in a manner that addresses regulatory requirements but also provides stakeholders with many genuine opportunities to participate
- encouraging stakeholders to provide informed feedback and actively participate in the route selection process
- consulting on the potential environmental and social impacts of the proposal
- developing and maintaining respectful working relationships with stakeholders.

5. Engagement activities

Transgrid's consultation process placed an emphasis on building awareness of EnergyConnect, providing accessible information, and promoting mechanisms for community members and broader stakeholders to provide feedback.

As such, the key engagement drivers creating opportunities for stakeholder participation in EnergyConnect, have been broadly grouped into the three categories outlined below.

Building project awarness

- Print advertisements
- Online advertisements
- Social media posts
- Introductory letters
- Flyers and poster displays

Communication channels and materials

- Project 1800 number
- Project email address
- Project webpage
- Subscription newsletter
- Guides and factsheets

Consultation activities

- Stakeholder briefings
- Interactive map
- In-person informations sessions
- Online information sessions
- Property specific meetings
- Facilitated Q&A sessions

5.1. Building project awareness

Building awareness of EnergyConnect and promoting opportunities for the community and stakeholders to provide feedback was an integral aspect of the engagement approach. This was achieved through a variety of mechanisms, as detailed below.

Samples of advertisements and other promotional materials are provided in Appendix C.1.

Print advertisements

In addition to extensive editorial coverage in local, state and national media covering topics such as project need, milestone events and benefits, Transgrid planned and implemented significant local advertising campaigns to build awareness.

97 advertisements across 10 media publications, with a total circulation of ~51,000 and an estimated readership of 153,237

Advertisements were included in local newspapers, such as:

- Mildura Weekly
- Southern Riverina News
- Sunraysia Daily
- The Border Mail (Albury)
- The Irrigator (Leeton)
- The Riverine Grazier (Hay)
- The Area News (Griffith)
- The Daily Advertiser (Wagga Wagga)
- The New South Western Standard Bulletin
- The Verandah Post (Lockhart).

These advertisements promoted upcoming project activities and opportunities for stakeholders to provide feedback. This included in-person and online community information sessions, project contact details, community partnership application periods and ways for stakeholder to actively participate in the process.

Circulation area of print advertisements

Print advertisements were also published in Council newsletters, including:

- Lockhart Shire Newsletter
- Wentworth Shire Council What's On.
- Balranald Shire Council Newsletter

Online advertisements

Digital advertising campaigns were implemented to broaden and supplement the reach of the print advertising campaigns. These online advertisements were placed with three major newspapers servicing south-west NSW, being:

9 online advertising campaigns undertaken with 195,356 views

- The Area News (Griffith)
- The Border Mail (Albury)
- The Daily Advertiser (Wagga).

The advertisement included a click through to the EnergyConnect webpage. This contained comprehensive information about dates, times and locations of community information sessions, and connected the audience to additional channels for project feedback.

Social media posts

Social media was used to reach non-consumers of traditional media, and those in smaller communities who learn about local activities through online groups and pages.

73 posts across 25 local community Facebook pages, with more than 63,500 combined followers

Project information featured on four of the smaller print publications' Facebook pages to complement print advertising in the:

- Mildura Weekly
- Southern Riverina News
- Sunraysia Daily
- Riverine Grazier.

Local councils have been instrumental in helping raise awareness of engagement opportunities and feedback mechanisms through posting on their Facebook pages. In addition, Councils have supported Transgrid's Community Partnerships Program by promoting the application rounds on their Facebook pages and encouraging eligible community groups to apply. Council Facebook pages included:

- Balranald Shire Council
- Federation Council
- Lockhart Shire Council
- Murrumbidgee Council
- Edward River Council
- Hay Shire Council
- Murray River Council
- Wentworth Shire Council.

Local community Facebook groups also helped raise awareness of the project and engagement opportunities. They included:

- Balranald Link
- I'm From Urana
- Lockhart Local
- Robinvale Country Market
- Urana Bowling Club
- Uranquinty Progress Association.
- Balranald Local
- Lockhart IGA
- Moulamein Bowling Club
- The Rock NSW Community Noticeboard
- Urana District Communities

Introductory letters

Initial letters were sent to a variety of stakeholders providing an overview of the project and opportunities to engage further.

***404** letters sent to local stakeholders from Buronga to Wagga Wagga*

This included introductory letters sent to landowners within the initial area of investigation from Buronga to Wagga Wagga. These letters initiated the engagement process to support the identification of a proposed transmission route through the sharing of local insights, such as potential constraints and opportunities to minimise impact to the local environment and community.

With opportunities and constraints considered and the route refined, follow up letters were issued to landowners confirming whether their property was within, or outside, the refined study area.

Additional letters were sent to Aboriginal persons and Registered Aboriginal Parties introducing the project and seeking participation in the Aboriginal Cultural Heritage Assessment process.

Flyers, poster displays and other materials

Flyers and posters were provided to local businesses to display at prominent locations, raising awareness of the project, promoting information sessions and outlining ways the community could provide ongoing feedback.

***600** flyers circulated to **25** businesses in **9** towns*

***2,100** flyers delivered to letterboxes in Lockhart, Boree Creek, Urana and Moulamein*

To support other promotional activities three letterbox drops were conducted in areas where landholder and community interest was particularly high.

A Community Card that fits inside a wallet or pocket was developed to promote key project information and act as a ready-reference guide to the project's information channels. The card was distributed at all community information sessions to community members, and to businesses along the route interested in available work packages.

5.2. Communication channels and materials

Providing accessible information and creating multiple engagement opportunities was a key part of the engagement approach. A description of the various communication channels and materials is provided below.

Samples of communication channels and materials are provided in Appendix C.2.

Project communication channels

Dedicated lines of communication were established for stakeholders and members of the community to actively seek additional project information, make enquiries or provide feedback.

124 *community calls and emails responded to via the project phone line and email address*

A toll-free number (1800 49 06 66) is answered Monday to Friday from 9am until 5pm with a voicemail for afterhours calls. Call types range from queries to feedback, information sharing and logistics such as making arrangements to visit landholdings.

A project email address (pec@transgrid.com.au) was also established.

Both the toll-free number and project email address have been promoted in all advertisements and communication materials.

Project webpage

A project webpage was developed to provide stakeholders with an accessible central location for information relating to EnergyConnect.

9,500+ *visits to the project webpage*

The webpage includes:

- a project overview, including project benefits and rationale of why the project is needed
- project updates and a key milestone timeline
- an interactive project map (as detailed in Section 5.3)
- a landowner and community engagement section, providing updates on upcoming engagement activities, support services and details of the Office of the Landowner and Community Advocate
- details of the regulatory and environmental approval processes
- a resource and news repository, including project specific guides and factsheets (as detailed below).

The project webpage also provides the project contact details and an option to subscribe to the project newsletter.

Subscription newsletter

The EnergyConnect e-newsletter has been distributed monthly to around 400 recipients.

The purpose of the newsletter is to provide current information on project activities, timeline, milestones, information sessions, and community partnership program funding opportunities. This has been aligned with stakeholder feedback regarding the frequency and content of the newsletter.

***~400** recipients to a monthly e-newsletter, with an average open rate **2.7x** higher than industry average*

The newsletter also highlights how stakeholders can continue to provide feedback. A dedicated page on the Transgrid website allows visitors to self-subscribe with an option to unsubscribe at any time by clicking a link in the newsletter.

Guides and factsheets

A series of guides and factsheets have been developed as a resource for stakeholders and local community members.

These documents have been utilised across engagement activities including stakeholder briefings, landowner meetings and community information sessions. They are also available online via the project webpage.

***11** guides and factsheets developed specifically for EnergyConnect*

The guides and factsheets cover topics, such as:

- Project overview
- Route selection
- Land access
- Heritage surveys
- Ecology surveys
- Geotechnical investigations
- Transmission infrastructure
- Construction process.

A separate community guide to the NSW-Eastern Section EIS will also be developed and made available.

5.3. Consultation activities

A program of consultation activities was developed in alignment with stakeholder feedback and preferences. These consultation activities included face to face options as well as COVID-safe options to ensure that all stakeholders had an opportunity to provide feedback.

A full timeline of community information sessions with stakeholder ratings is provided in Appendix B, with samples of consultation activities provided in Appendix C.3.

In-person community drop-in information sessions

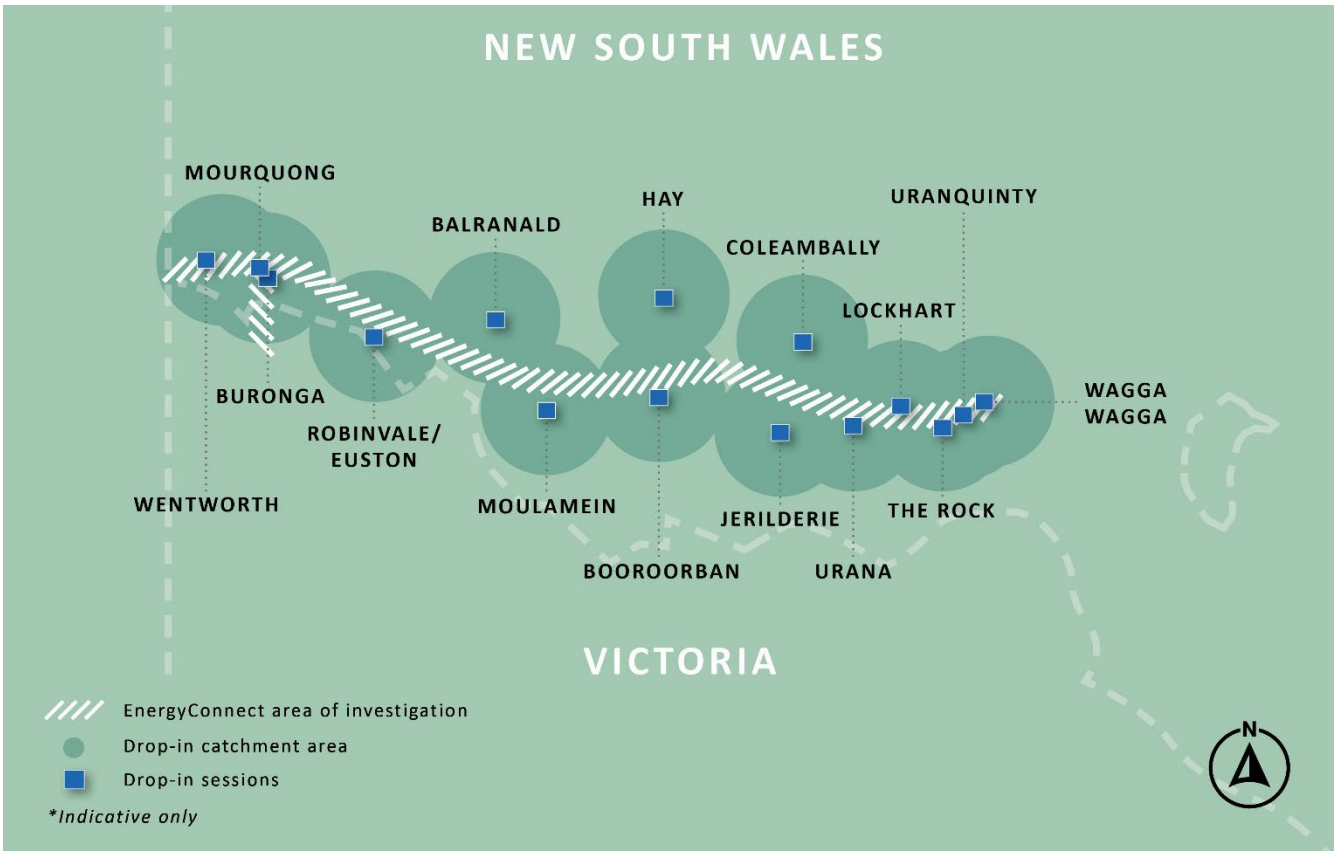
A series of in-person community information sessions were held across the NSW-Eastern Section and areas proximal to the project area. These sessions provided an opportunity for project stakeholders to 'drop-in' at anytime during the session and talk to project representatives and subject matter experts to learn more about the project, ask questions and provide local insights that were taken into account as part of the route refinement process.

***26** face to face drop-in sessions held across **15** local towns and community centres*

The information sessions were extensively promoted (as described in Section 5.1) via local newspapers, letterbox drops, public noticeboards, community-centric Facebook pages and digitally via the webpage and email distribution lists.

Information sessions were held at the following locations:

- Balranald, NSW
- Coleambally, NSW
- Jerilderie, NSW
- Mourquong, NSW
- Uranquinty, NSW
- Booroorban, NSW
- Euston, NSW / Robinvale, Vic
- Lockhart, NSW
- The Rock, NSW
- Wagga Wagga, NSW
- Buronga, NSW
- Hay, NSW
- Moulamein, NSW
- Urana, NSW
- Wentworth, NSW.

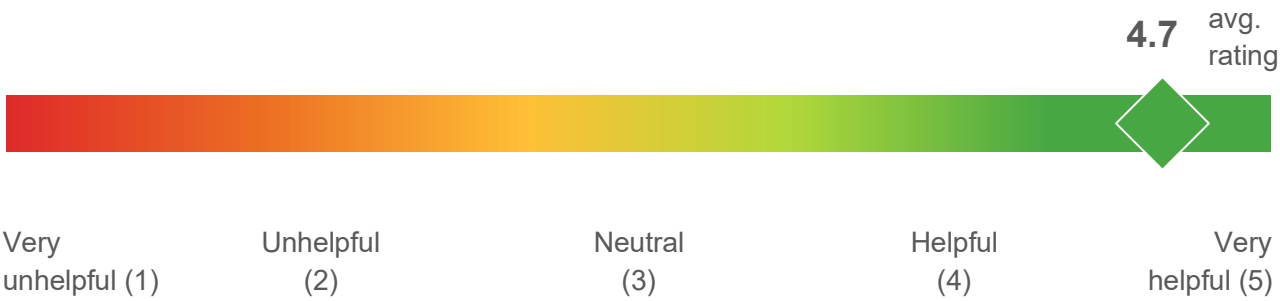


In-person community drop-in information session locations

The sessions were held across various days and times to accommodate a broad spectrum of the community, with sessions held in conjunction with existing community events, where practical.

As part of the information sessions, community members were asked for feedback on the style and efficacy of the engagement activity. The majority of community members who responded noted that they found the information session either helpful or very helpful.

Survey question: How informative did you find the community information session?



Online community information sessions (webinars)

Webinars provided a COVID-safe opportunity for community members and stakeholders to engage with project representatives. Three webinars were held across different days and times to accommodate the varying schedules of stakeholders. These sessions were promoted as described in section 5.1.

3 online community information sessions held, with 171 interested stakeholders and 82 attendees

The online sessions included a consistent presentation covering a project overview, current project activities and timeline, information on the EIS and opportunities for engagements, the current route alignment, an introduction to Transgrid's delivery partner, SecureEnergy, and Transgrid's community partnership program.

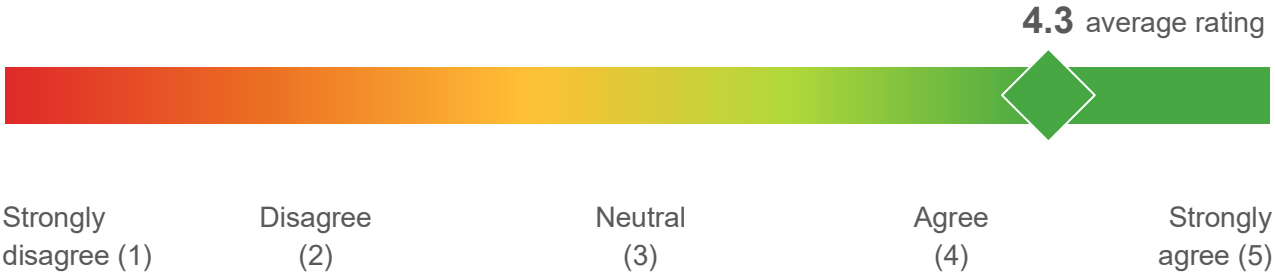
Following the presentation, attendees were invited to participate in a Q&A session that included a panel of project representatives and subject matter experts.

A recording of the presentation section of the session and Q&A document was made available online. The Q&A document included all questions and responses provided across the three sessions. Some questions were consolidated where the same or similar question had been asked.

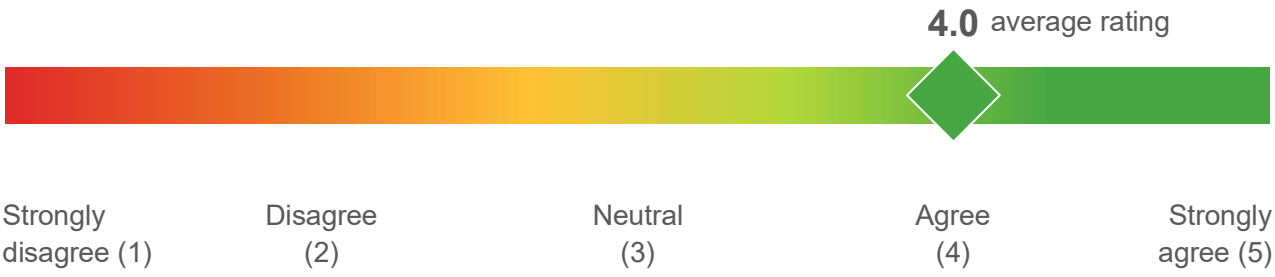
A post session survey was available for all participants to provide feedback. The results of the survey indicated that the attendees found the sessions:

- effective, given the online format for communicating during COVID restrictions
- informative, containing information that was relevant to them
- worthwhile, recommending participation to other stakeholders.

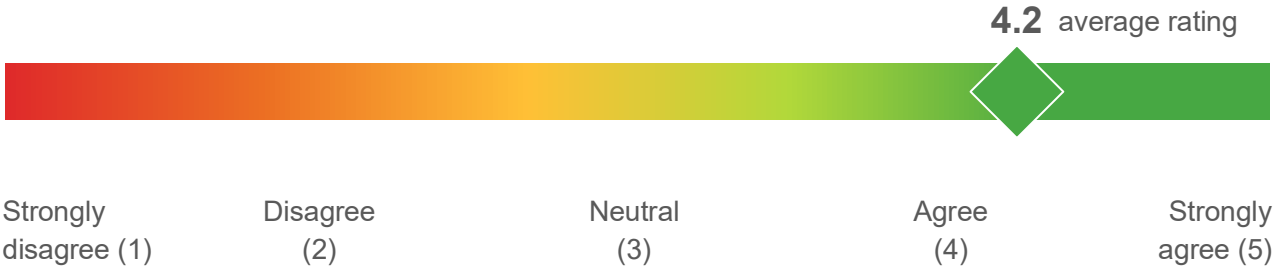
Survey question: I found this online community information session effective for communication during COVID restrictions



Survey question: This session was informative and contained information that was relevant to me



Survey question: I would recommend others to participate in these online community information sessions



Attendees were also able to provide free text feedback. These results were also positive.

> "The simplicity not overwhelming, only what the community needs to know at this stage. Access to company made easy…"

Interactive map

Aligned with key consultation objectives, an online interactive map was available for stakeholders to provide local insights to be incorporated as part of the route refinement process. The map includes information about EnergyConnect, the route selection process and the types of local insights that help in determining a proposed transmission line route.

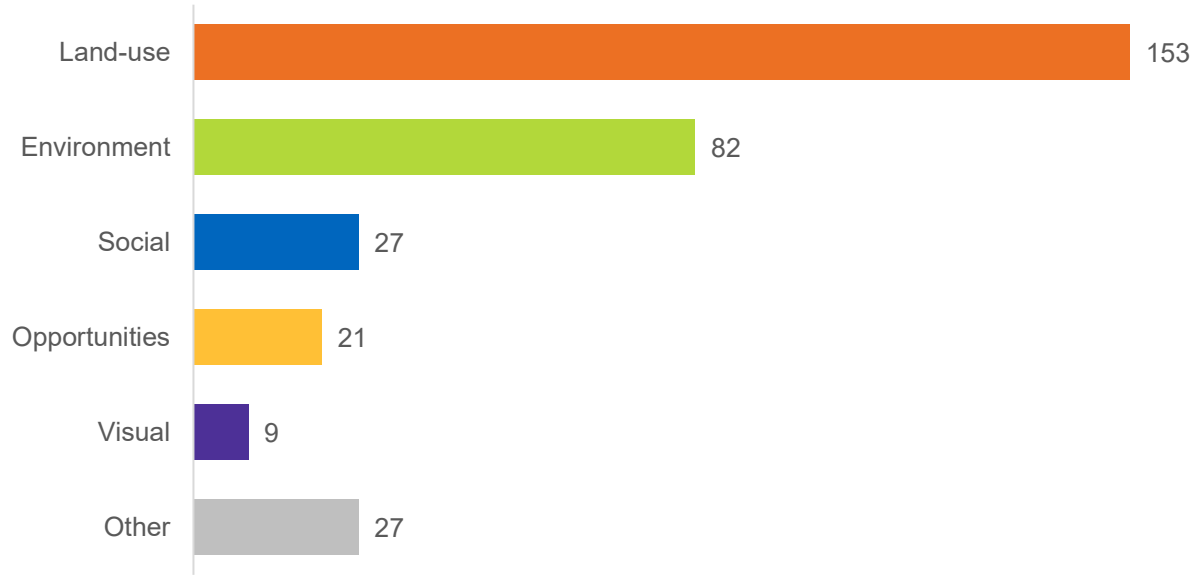
***~9,500** views of the online map, with **319** local insights and feedback provided*

Stakeholders provide feedback by identifying a location within the project area, placing an icon at the location and submitting their comment. Icons were aligned to key factors in the route refinement process and include:

- **Environment**: Environmental values may relate to the physical environment (e.g. soils, hydrology, air quality) or the biological environment (e.g. flora and fauna)
- **Land-use**: Landuse feedback includes existing or planned land use for local businesses, agriculture/viticulture/horticulture, tourism, lifestyle, energy, industrial and community services
- **Opportunities**: Comments regarding existing infrastructure and other opportunities to align the potential route with areas of existing disturbance
- **Social**: Social values include community attributes, lifestyle, cultural heritage values, amenity and services
- **Visual**: Comments about visual amenity values
- **Other**: Comments that don't fall into one of the defined categories.

Comments provided spanned all categories, with land-use being the most prevalent category chosen. Land-use feedback primarily identified agricultural areas, associated infrastructure (sheds) and homesteads.

Local insights and feedback by category



Stakeholder briefings

Generally, there were two types of stakeholder briefings used in the planning phase of EnergyConnect, including overview/update briefings or specific subject matter briefings.

279 *briefings held with key stakeholders*

Overview/update briefings generally encompassed:

- the current status of the project
- the project timeline
- current and upcoming project activities, including community consultation and key project decisions
- project benefits, including community grant opportunities.

Specific subject matter briefings were held to provide targeted information to key stakeholders on various matters. This included matters relating to Aboriginal cultural heritage and biodiversity and conservation.

Stakeholder groups briefed throughout the planning phase include:

- Local Members of Parliament, from both State and Federal levels of government
- Government Departments and Agencies at both State and Federal levels, and regulatory bodies
- Elected representatives and key staff at Local Government Authorities
- Aboriginal Groups and Peoples
- Industry groups
- Local interest groups.

Property-specific meetings

On-site and property-specific meetings were held with landowners, managers and tenants as part of the NSW-Eastern Section consultation activities.

643 *property-specific meetings held*

Project representatives and property stakeholders worked together to develop a holding map for the property. The holding map identified opportunities to minimise potential impacts to the local environment and property operations, and constraints in terms of existing infrastructure or areas of environmental and/or cultural significance. This information ultimately supported the route selection process.

Other property specific meetings included land access discussions to allow site investigation and environmental monitoring. These consents also noted any conditions of entry from the landowner, such as advance notification and biosecurity requirements. Additional discussions were undertaken regarding the easement process and proposed infrastructure.

Facilitated landowner Q&A sessions

In response to landowner requests, a series of question and answer style sessions were held. Participants were invited to attend one of four sessions, which were conducted at different times and on different days to accommodate stakeholder schedules.

These sessions gave landowners the opportunity to gain specific and contextual information about the project from a panel of project representatives and independent subject matter experts.

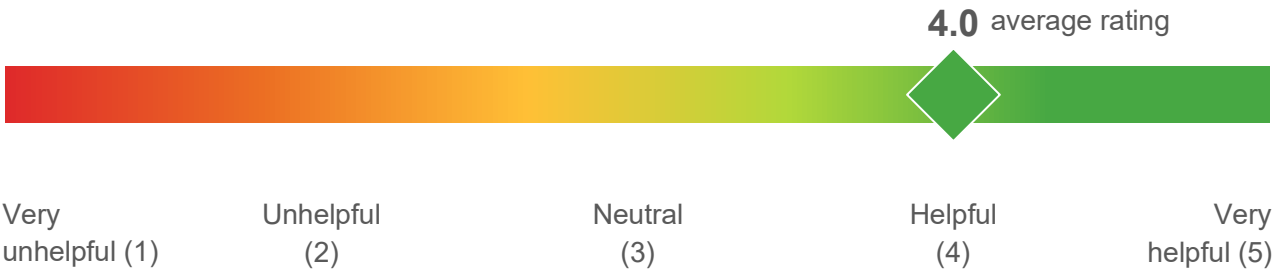
***34** landowners and other community members attended a Q&A session, representing **42** landholdings*

Topics that landowners identified were most relevant to them included:

- general project overview
- route identification and alignment
- valuation and compensation process
- land use and activities within easements
- operations and maintenance of transmission infrastructure
- biosecurity and weed management
- electrical interference (GPS and radio).

For transparency and to provide consistency for all participants, a document was shared that included the questions asked and the answers given in each session. Where the same or similar question was asked in multiple sessions the questions and the respective answers were combined. In addition, where an action was taken to provide reference material the links to these were also included in the document.

Survey question: How informative did you find the Q&A session?



Anecdotal feedback was received from landowners following the distribution of the Q&A document. According to this feedback the sentiment of the sessions and the information provided in the report was positive.

> "The summary of questions from the meetings was useful."

6. Stakeholder discussions and feedback

From the engagement activities undertaken, significant feedback was received from key stakeholder groups, including:

- Local Members of Parliament
- Commonwealth and State government departments and agencies
- Local governments
- Aboriginal groups and representatives
- Industry and interest groups
- Landholders and community members.

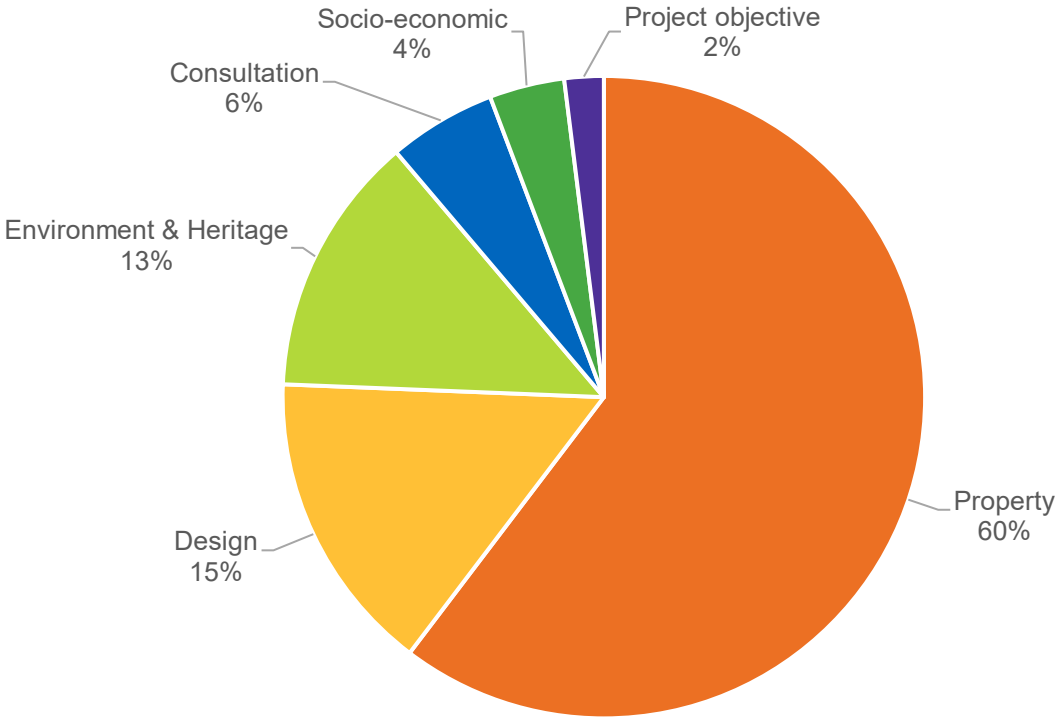
7,550 *engagement activities recorded across key stakeholder groups*

The stakeholders engaged, explored and provided feedback across numerous themes ranging from overarching comments about the consultation process through to detailed questions about longer-term considerations such as operations and maintenance. The overarching themes of discussion have been consolidated into the following categories:

- **Consultation**: the engagement process during the planning phase of EnergyConnect and the potential engagement process during future construction activities
- **Design**: the route refinement process, planning decisions and the design of the physical and structural elements of EnergyConnect
- **Environment & heritage**: Aboriginal and non-Aboriginal cultural heritage, artefacts and sites of significance, bio-diversity (flora and fauna) and bio-security
- **Project objective**: the scope, justification and benefits of EnergyConnect
- **Property**: land management activities associated with private and public lands, including property and easement access, current and future land use and easement acquisition and compensation
- **Socio-economic**: the opportunities and constraints regarding economic development, employment and procurement.

The chart below provides a summary of the key topic areas discussed and feedback received across all stakeholder groups. Cumulatively, the most discussed topics of engagement were property-related matters. This is reflective of the extensive engagements with local landholders that provided detailed information about their property's current and future land use, which were then factored into the route refinement process to minimise any potential impacts.

Topics of discussion



The following sections provide an overview of the engagement outcomes with the key stakeholder groups.

6.1. Local Members of Parliament

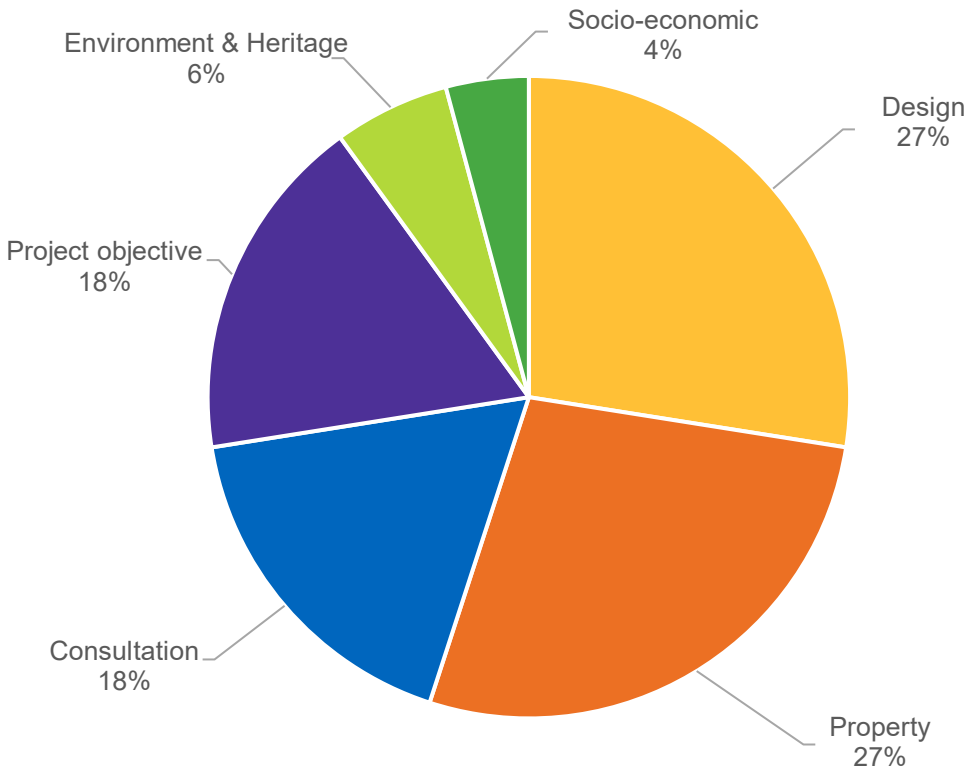
Transgrid engaged routinely with State and Federal Members of Parliament. These interactions provided an opportunity to share information with elected representatives on the EnergyConnect proposal and its benefits. Updates regarding project timelines, approvals and community engagement activities were regularly provided. In turn, local Members of Parliament advised Transgrid of current community views, key concerns and insights regarding the electorate.

180 *engagements with local Members of Parliament, including meetings, project updates and issue-specific interactions*

When engaging local Members of Parliament, the topics of discussion were primarily focussed on providing information about the:

- project design, including factors considered in decision making for a transmission route
- property and easement compensation process
- community consultation process
- project benefits, particularly with regards to energy security and employment.

Topics of discussion



Local Members of Parliament also represented the views of constituents to Transgrid on matters including:

- specific questions relating to the property acquisition and easement compensation process
- potential impacts to agricultural operations
- concerns regarding the proximity of the proposed transmission route to dwellings and natural land features.

Please see section 6.6 for further details on responses to community members.

6.2. Government departments and agencies

There were two key streams of engagement activities with government departments and agencies, which centred on the regulatory consultation process and environmental planning approvals process.

58 State and Federal Government agencies were engaged as part of EnergyConnect

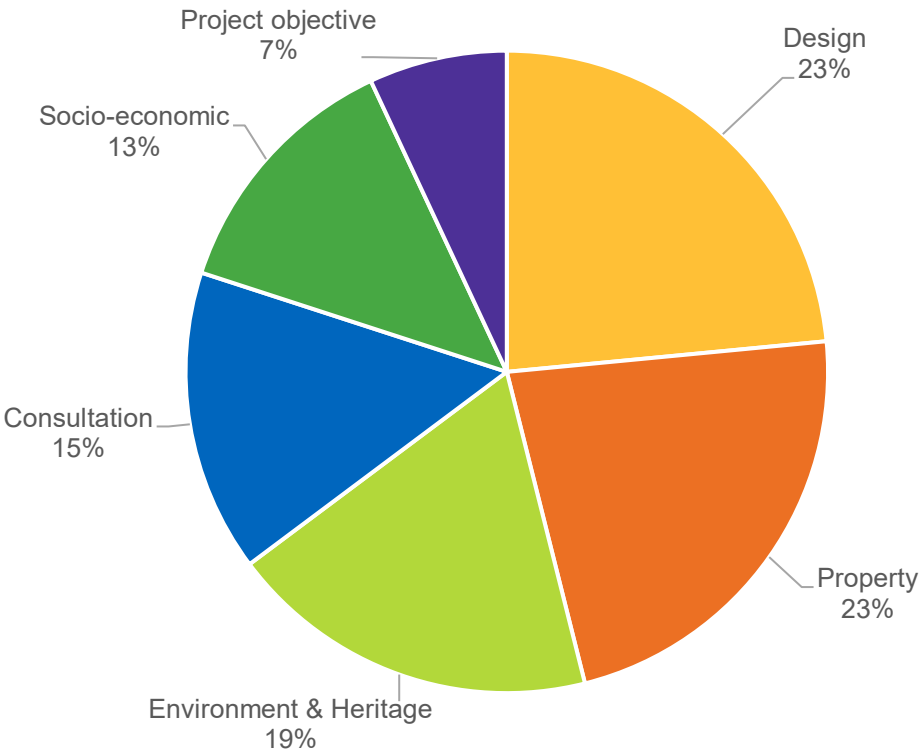
The regulatory consultation process focused on planning of infrastructure investment (RIT-T) and future energy demands to ensure the EnergyConnect development would meet the needs of energy consumers.

In parallel and following the regulatory consultation process, briefings and discussions relating to environmental planning approvals were undertaken. These focused on seeking inputs from decision makers and subject matter experts on project requirements.

Relevant topics discussed included:

- management of local environment and biodiversity, including potential offset strategies
- planning requirements, project applications and ongoing reporting
- engagement on cultural heritage matters
- project development activities.

Topics of discussion



Specific engagements with key government stakeholders are summarised below.

Australian Department of Defence

Transgrid's initial project investigation area overlapped with lands managed by the Australian Department of Defence. The key feedback related to design constraints surrounding the Morundah communications facility.

Theme	Relevant topic of feedback	Response
Design	Land use constraints • Morundah communications facility • Test firing ranges (potential unexploded ordnances).	Transgrid has worked with stakeholders to understand current and previous land use. These concerns have been factored into the proposed route avoiding constraints and minimising potential impacts.

NSW Department of Primary Industries (DPI)

Transgrid engaged with subject matter experts at NSW DPI regarding agricultural land and operations.

Theme	Relevant topic of feedback	Transgrid response
Design	Land use • Potential impacts on productive land and farm businesses	Transgrid has worked with landholders to understand current land use and planned future activities. This has been incorporated into the route refinement process to minimise impact on agricultural operations.

NSW Local Land Services

Transgrid engaged with field officers from NSW Local Land Services regarding environmental protection and biosecurity.

Theme	Relevant topic of feedback	Transgrid response
Environment	Biosecurity and weed management procedures	Transgrid is committed to limiting the impact of its construction and operational activities on local communities. This includes weed management. Transgrid works with relevant authorities and landholders to understand any specific requirements to ensure that weed hygiene and biodiversity risk is prevented, eliminated or minimised.

NSW Department of Planning, Industry and Environment (DPIE)

In addition, Transgrid engaged with subject matter experts within NSW DPIE regarding its biodiversity strategy, environmental matters and the property / easement acquisition process. Divisions engaged included the Biodiversity and Conservation Division, the Environment, Energy & Science Division, and Crown Lands NSW.

6.3. Local governments

The NSW-Eastern Section traverses nine local government areas (LGAs). Transgrid routinely engaged representatives of these local governments including elected Council representatives, senior management and operational staff.

1,072 briefings, project updates, subject matter specific engagements and correspondence with 9 Local Governments directly impacted by the project

Engagements with local governments included:

- Project overview and updates, focussed on project milestones, key announcements, regulatory approvals, funding and community engagement activities, such as community information sessions and community partnership applications

- Route alignment consultation to better understand if and how the project may impact on local communities from an environmental, social and infrastructure perspective. The consultation also considered potential impacts on Council managed assets
- Technical input with Transgrid seeking specialist input from local councils to inform project planning. This included requests for specialist land and environment information, traffic and transport data, and socio-economic data.

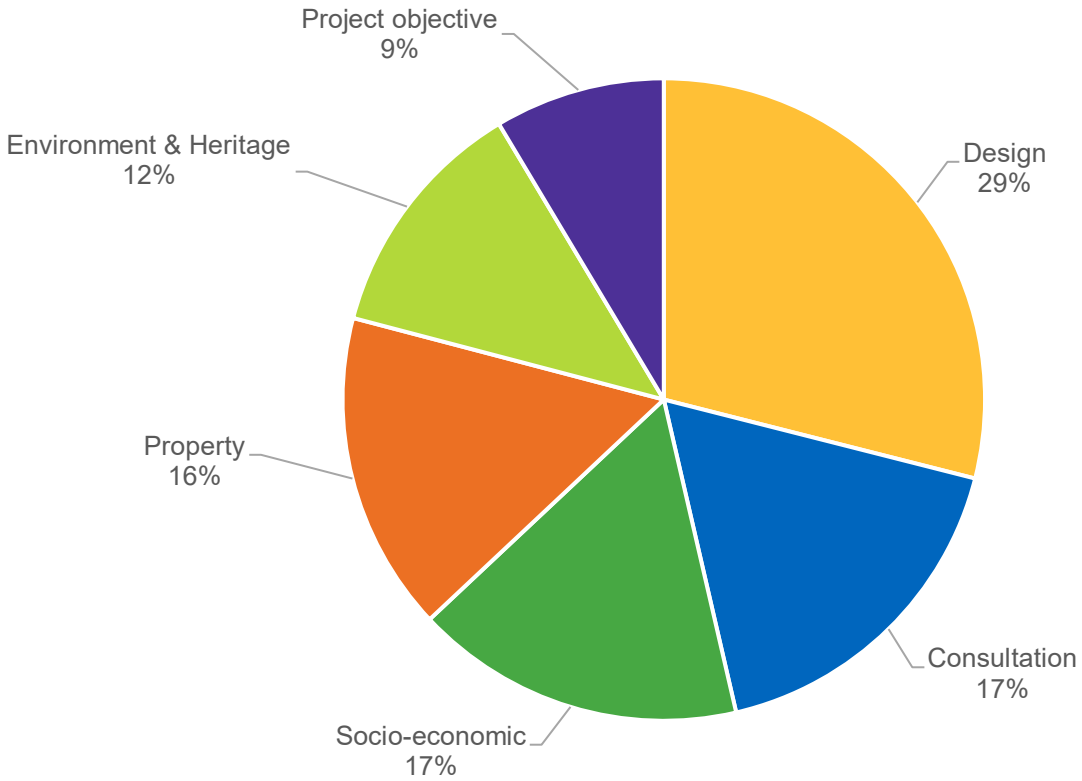
Local councils provided extensive feedback across a number of areas. The key elements of feedback common across all nine councils was the project benefits, with EnergyConnect being seen as an indicator for further investment and development opportunities in the renewable energy sector. Councils also advocated for local employment and supplier opportunities, while looking ahead to a positive, sustained economic development following the completion of EnergyConnect.

Councils supported community engagement activities through active promotion, hosting and/or involvement with Transgrid's community information sessions and community partnerships program. For further information, see section 5.1.

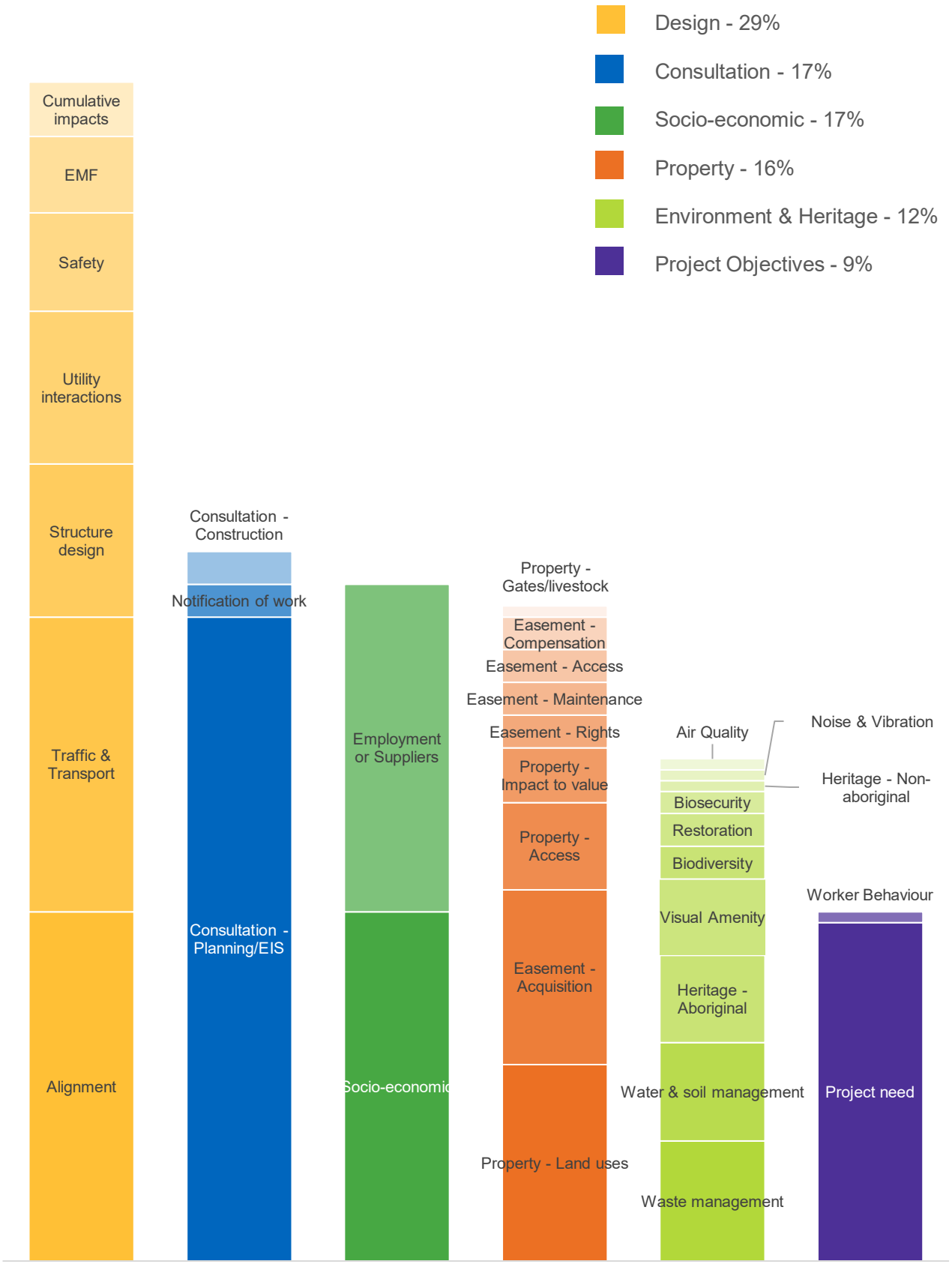
A number of councils suggested the potential to use transmission infrastructure to boost telecommunications (mobile phone) coverage throughout the region. While the resolution of local blackspots to mobile phone coverage is outside the scope of EnergyConnect, opportunities to improve coverage and utilise available infrastructure are being investigated.

The following charts provides a summary of the key topic areas discussed and feedback received across all nine local councils.

Topics of discussion



Detailed topics of discussion



Balranald Shire Council

During engagements, Balranald Shire Council indicated that it welcomes infrastructure investment within the LGA, with EnergyConnect representing an opportunity that may lead to additional local investment.

Council expressed interest in working with Transgrid regarding its community benefits strategy, providing greater focus on improving and/or upgrading existing facilities.

***80** briefings, project updates, subject matter specific engagements and correspondence*

It noted that the local road network is an important asset and any impact to or delays on roads can have detrimental effects on residents, agricultural operations and emergency services.

Theme	Feedback	Response
Design	Potential visual and spatial impact of transmission towers	Transgrid works with stakeholders and landholders to best understand the social, environmental and cultural values held by the community about the local area. Opportunities to co-locate proposed and existing infrastructure is a key aspect of minimising impact to the community and the environment. Transgrid will continue to work with stakeholders to resolve concerns and minimise impacts, as much as possible.
Socio-economic	Local business and supplier opportunities	Transgrid has encouraged local suppliers and businesses to register their interest in helping deliver EnergyConnect. 820 NSW and Australian businesses have registered expressions of interest across multiple work packages.
Socio-economic	Managing local amenity during periods of increased demand from itinerant project workforce	Transgrid recognises potential for the project, SecureEnergy JV and Council to work together on how to avoid or mitigate this issue prior to start of construction.

Edward River Council

The proposed EnergyConnect corridor is expected to have a proportionally small impact on land within the Edward River LGA, with the transmission line located on rural properties at the northern section of the LGA.

While a small footprint, Edward River Council highlighted the importance of environmental and infrastructure assets, with key points of feedback noted in the table below.

***71** briefings, project updates, subject matter specific engagements and correspondence*

Theme	Feedback	Response
Environment	Plains Wanderer habitat and presence of other bird species (e.g. Mallee Fowl)	Transgrid has undertaken ecology surveys and investigations. These activities help identify existing animal and plant species, including their habitats within the local area. These surveys will help us understand the local environment, and identify issues to be taken into account during engineering design and project planning.
Environment	Importance of weed mitigation and management	Transgrid is committed to limiting the impact of construction and operational activities on the communities in which we work, including weed management. Transgrid works with relevant authorities and landholders to understand any specific requirements to ensure that weed hygiene and biodiversity risk is prevented, eliminated or minimised.
Design	Road infrastructure to be maintained	Transgrid will undertake appropriate remediation of roads used by project related vehicles to address any damage and deterioration caused by the construction of EnergyConnect.

Federation Council

Representatives of Federation Council indicated support for EnergyConnect and anticipates flow-on benefits from potential renewable energy developments as it seeks to become energy self-sufficient.

A key engagement with Federation Council focused on the proposed increase in transmission line operating capacity from 330kV to 500kV between the Wagga Wagga and proposed

***120** briefings, project updates, subject matter specific engagements and correspondence*

Dinawan substations, achieving an increase in network capacity in one construction period. Council expressed positive sentiment towards this approach.

Council also provided advice on how the project could engage with the communities within the LGA from an engagement, procurement and benefits perspective, advocating for creating a positive experience.

Theme	Feedback	Response
Socio-economic	Legacy benefit for local community post EnergyConnect	Beyond the potential flow-on benefits from increased economic activity through renewable energy developments, Transgrid is actively investigating opportunities to provide benefits to the community beyond construction.
Socio-economic	Workcamp / workforce accommodation	Transgrid is identifying accommodation solutions, such as workcamps, that would allow project work to continue without placing undue stress on the limited options available in the community.

Hay Shire Council

The project has a small footprint within Hay Shire LGA, limited to an area near its southern boundary. Regardless, Council indicated support for the project as it sees an opportunity to attract renewable energy investment, which aligns with its sustainability goals.

***107** briefings, project updates, subject matter specific engagements and correspondence*

Theme	Feedback	Response
Environment	Management of water resources (including allocations)	Water would be required during construction for a range of activities. Transgrid will engage with key stakeholders regarding the supply of water, complying with the relevant council and utility approval processes.
Environment	Waste management during construction	As part of EnergyConnect, Transgrid aims to avoid unnecessary resource consumption or reuse/recycle resources, wherever possible. This will help minimise waste disposal at local government facilities and help to achieve an Infrastructure Sustainability Council of Australia (ISCA) rating of Excellent.
Socio-economic	Workcamp / workforce accommodation	Transgrid is identifying accommodation solutions, such as workcamps, that would allow project work to continue without placing undue stress on the limited options available in the community.

Lockhart Shire Council

Lockhart Shire Council recognised the economic and employment opportunities that EnergyConnect would deliver to the region. Topics of discussion primarily focused on addressing the concerns of the community in the planning and development of the project, particularly the route refinement process.

164 *briefings, project updates, subject matter specific engagements and correspondence*

The primary concern was the proximity of the area of investigation for the proposed transmission line to the Lockhart township. Council's feedback and representation noted the proposed route had potential impact on future land use planning, with visual amenity, safety, and potential for radiofrequency interference also tabled as related concerns. Transgrid convened a series of Lockhart Landholder Workshops, attended by Council, landholders and local MPs, to better understand those concerns and further identify opportunities and constraints at Lockhart. The outcome of this process was the development of a transmission route which increased distances to identified residential growth area in Lockhart in an effort to address concerns tabled by Council.

Council was also engaged on the proposed increase in transmission line operating capacity from 330kV to 500kV between the Wagga Wagga and proposed Dinawan substations, achieving an increase in network capacity in one construction period.

Theme	Feedback	Response
Design	Proximity of transmission line infrastructure to Lockhart township, and in particular, near residential zoned land.	Transgrid worked with landholders, community members and Council to identify a solution that both meets the project objective while providing future opportunities regarding land use planning near Lockhart township.
Socio-economic	Workcamp / workforce accommodation	Transgrid is identifying accommodation solutions, such as workcamps, that would allow project work to continue without placing undue stress on the limited options available in the community.
Socio-economic	Legacy benefit for local community post EnergyConnect	Beyond the potential flow-on benefits from increased economic activity through renewable energy developments, Transgrid is actively investigating opportunities to provide benefits to the community beyond construction.

Murray River Council

Murray River Council indicated its support for EnergyConnect, and noted positive feedback regarding Transgrid's engagement with landholders and the community.

The EnergyConnect alignment is limited to the northern end of the Murray River LGA, with minimal impact to council-owned infrastructure anticipated.

***70** briefings, project updates, subject matter specific engagements and correspondence*

Council advocated for opportunities such as economic benefits, local employment and potential accommodation to focus on the town of Moulamein. It also noted active interest from renewable energy developers across the region.

Theme	Feedback	Response
Socio-economic	Local business and supplier opportunities	Transgrid has encouraged local suppliers and businesses to register their interest in helping deliver EnergyConnect. 820 NSW and Australian businesses have registered expressions of interest across multiple work packages.

Murrumbidgee Council

Murrumbidgee Council noted the local economic benefits of the project, the positive sentiment of local businesses to be involved and the potential for renewable energy investment in the future.

Council advised Transgrid of the importance of clear communication regarding accommodation strategies in the region to manage expectations with local communities.

***169** briefings, project updates, subject matter specific engagements and correspondence*

Council was also engaged on the proposed increase in transmission line operating capacity from 330kV to 500kV between Wagga Wagga and proposed Dinawan substations, achieving an increase in network capacity in one construction period. Council was generally supportive of this proposal.

Theme	Feedback	Response
Environment	Waste management	As part of EnergyConnect, Transgrid aims to avoid unnecessary resource consumption or reuse/recycle resources, wherever possible. This will help minimise waste disposal at local government facilities and help to achieve an Infrastructure Sustainability Council of Australia (ISCA) rating of Excellent.

Theme	Feedback	Response
Socio-economic	Local business and supplier opportunities	Transgrid has encouraged local suppliers and businesses to register their interest in helping deliver EnergyConnect. 820 NSW and Australian businesses have registered expressions of interest across multiple work packages.
Socio-economic	Indigenous traineeship program	Transgrid published its first *Aboriginal and Torres Strait Islander Engagement and Participation Policy* in May 2020, affirming its commitment to the importance of cultural heritage, creating participation opportunities, developing sustainable relationships and enhancing cultural awareness. Transgrid will continue working with Aboriginal and Torres Strait Islander peoples and communities during the development, delivery, maintenance and operation of EnergyConnect. More information on Transgrid's policy is available online at https://www.transgrid.com.au/customers-community/reconciliation-action-plan

Wagga Wagga City Council

Wagga Wagga City Council was generally supportive of EnergyConnect and noted its alignment with Council's strategic plans to strengthen energy security and drive renewable energy investment in the region.

Similarly, Council noted the opportunities EnergyConnect presents for the wider region, and encouraged ongoing, thorough community engagement during project development and delivery to achieve a positive legacy.

***148** briefings, project updates, subject matter specific engagements and correspondence*

Significant engagement has been undertaken with Wagga Wagga City Council regarding a potential easement on land used by Council at its Gregadoo Waste Management Centre (GWMC). The easement sought by Transgrid coincides with land that Wagga Wagga City Council has earmarked for proposed future use. Transgrid and Council are working together, sharing plans and design information, to understand the extent and implications of the two proposals. These discussions are ongoing and aim to realise the potential future use of the site, negotiate appropriate landholder compensation in line with legislation and reduce or eliminate any conflict between the proposed transmission line and the proposed future GWMC operations.

Council was also engaged on the proposed increase in transmission line operating capacity from 330kV to 500kV between Wagga Wagga and proposed Dinawan substations, achieving an increase in network capacity in one construction period.

Theme	Feedback	Response
Design	Land use • Potential impacts on productive land and farm businesses	Within the area of investigation, Transgrid identifies: • Constraints like social and environmental factors that must or should be avoided • Opportunities to minimise the potential impact on local communities and the environment. Transgrid then refines the potential route in consultation with landholders, identifying local considerations that will assist in informing the proposed route.
Property	Property and easement access	Transgrid seeks agreement with landholders regarding property access. Prior consent is required for entry to a property for site investigations, or an easement is negotiated on the land for the purpose of construction, operation and maintenance of the transmission line. Any specific requirements regarding property access (prior notification, gate security, etc) are recorded during landholder engagements.
Design	Road infrastructure to be maintained	Transgrid will undertake appropriate remediation of roads used by project related vehicles to address any damage and deterioration caused by the construction of EnergyConnect.
Safety	Potential impacts from electro-magnetic frequency (EMF)	Transgrid works to provide safe transmission services across its electricity network, including EMF and ensuring compliance with Australian Standards. Transgrid's EMF fact sheet provides further information on electric and magnetic fields and is available online at https://www.transgrid.com.au/customers-community/community-safety/electric-and-magnetic-fields
Safety	Bushfire management	To comply with Transgrid's safety requirements a range of bushfire management activities will be undertaken, including the establishment of an asset protection zone (APZ). An APZ consists of an area maintained to be clear of all trees and vegetation which may affect key infrastructure during a bushfire. NSW Rural Fire Service and Fire & Rescue NSW have also been engaged as part of the planning process.

Theme	Feedback	Response
Environment	Impact on visual amenity	Factors like visual amenity and land use are taken into account during the route selection process. Opportunities to co-locate proposed and existing infrastructure is a key aspect of minimising impact to the community and the environment. Transgrid will continue to work with stakeholders to resolve concerns and minimise impacts, as much as possible.

Wentworth Shire Council

Wentworth Shire Council was engaged on both the NSW-Eastern and Western sections of EnergyConnect, with the NSW-Western section wholly situated within the Wentworth Shire LGA.

Council noted the local economic benefits the project can provide through construction, employment and other support opportunities.

***143** briefings, project updates, subject matter specific engagements and correspondence*

Extensive engagements have occurred in relation to the Buronga substation, which is the subject of the NSW-Western section planning approval. Specific feedback on the scope of activities for the NSW-Eastern section are noted in the table below.

Theme	Feedback	Response
Environment	Management of water resources (including allocations)	Water would be required during construction for a range of activities. Transgrid will engage with key stakeholders regarding the supply of water, complying with the relevant council and utility approval processes.
Environment	Waste management	As part of EnergyConnect, Transgrid aims to avoid unnecessary resource consumption or reuse/recycle resources, wherever possible. This will help minimise waste disposal at local government facilities and help to achieve an Infrastructure Sustainability Council of Australia (ISCA) rating of Excellent.
Design	Potential impact of the project on roads and Council assets (eg due to construction loads)	Transgrid and Wentworth Shire Council have developed a Road Maintenance Agreement, which will allow Transgrid and its contractors to undertake appropriate remediation of roads used by project-related vehicles to address any damage and deterioration caused by the construction of EnergyConnect.

Theme	Feedback	Response
Safety	Community apprehension regarding COVID spread, particularly within the Aboriginal community.	Transgrid has developed a COVIDSafe Plan for its business which covers the EnergyConnect project. COVIDSafe plans will be developed and implemented for construction sites at the local level. Project workers will also comply with the rules and requirements mandated by the NSW Government.

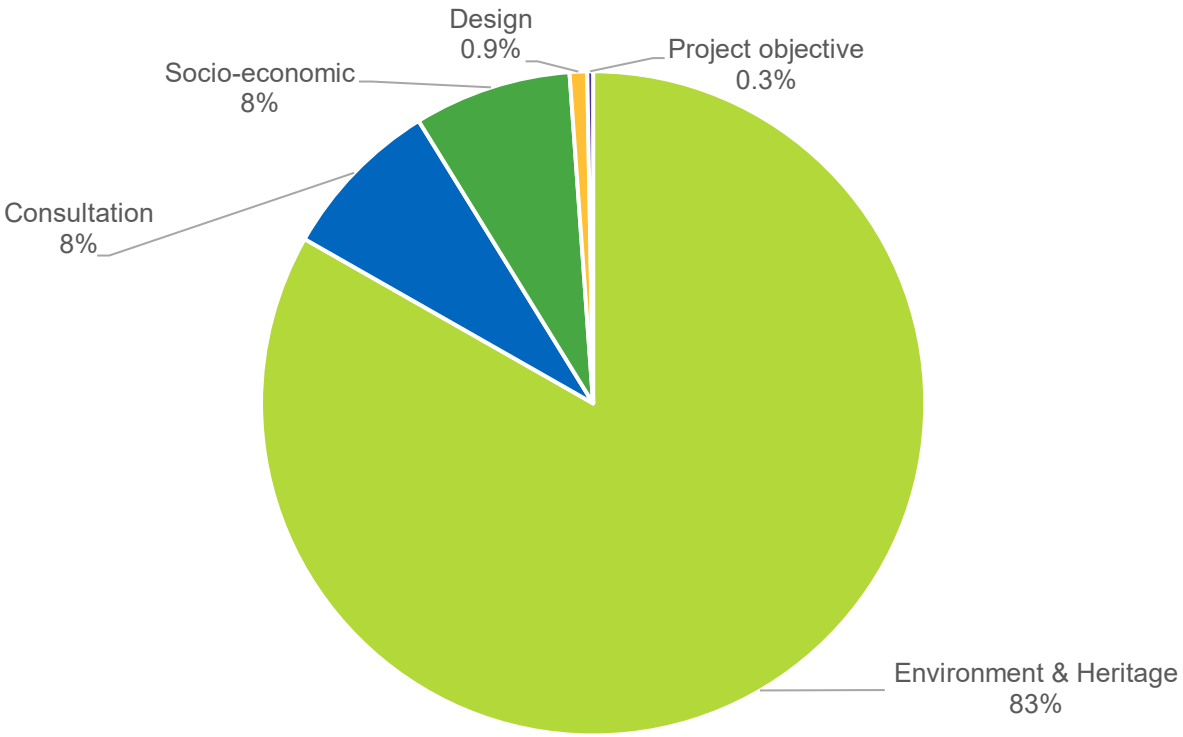
6.4. Aboriginal groups and representatives

Initial meetings with various Aboriginal groups and their representatives was focused on sharing project information and facilitating Aboriginal Cultural Heritage Assessments, including participation in cultural heritage surveys and site supervision during preliminary activities.

***685** engagement activities with **129** individuals, representing **49** Aboriginal groups*

Subsequent engagements included consultation on the methodology to conduct preliminary archaeological subsurface excavations. Representatives also indicated a willingness to continue participating and speaking for Country across aspects of project development (site walkthroughs) and construction activity (such as excavations). From a cultural perspective, groups have advised that Transgrid should implement culturally appropriate ceremonies of recognition aligned with project activity and milestones and look to promote Aboriginal finds and facilitate visits to cultural places on private land, to explore shared values and enhance cultural heritage.

Topics of discussion



Theme	Feedback	Response
Socio-economic	Aboriginal employment / participation (including skills development and training)	Transgrid published its first *Aboriginal and Torres Strait Islander Engagement and Participation Policy* in May 2020, affirming its commitment to the importance of cultural heritage, creating participation opportunities, developing sustainable relationships and enhancing cultural awareness. Transgrid will continue working with Aboriginal and Torres Strait Islander peoples and communities during the development, delivery, maintenance and operation of EnergyConnect. More information on Transgrid's policy is available online at https://www.transgrid.com.au/customers-community/reconciliation-action-plan
Heritage	Protection of artefacts and sites of significance	Opportunities to avoid or minimise potential impacts to heritage items through siting of the towers and other project aspects (including construction work areas) would be explored during finalisation of the proposal design and construction methodology. Where impacts cannot be avoided, a range of mitigation and management measures would be implemented.

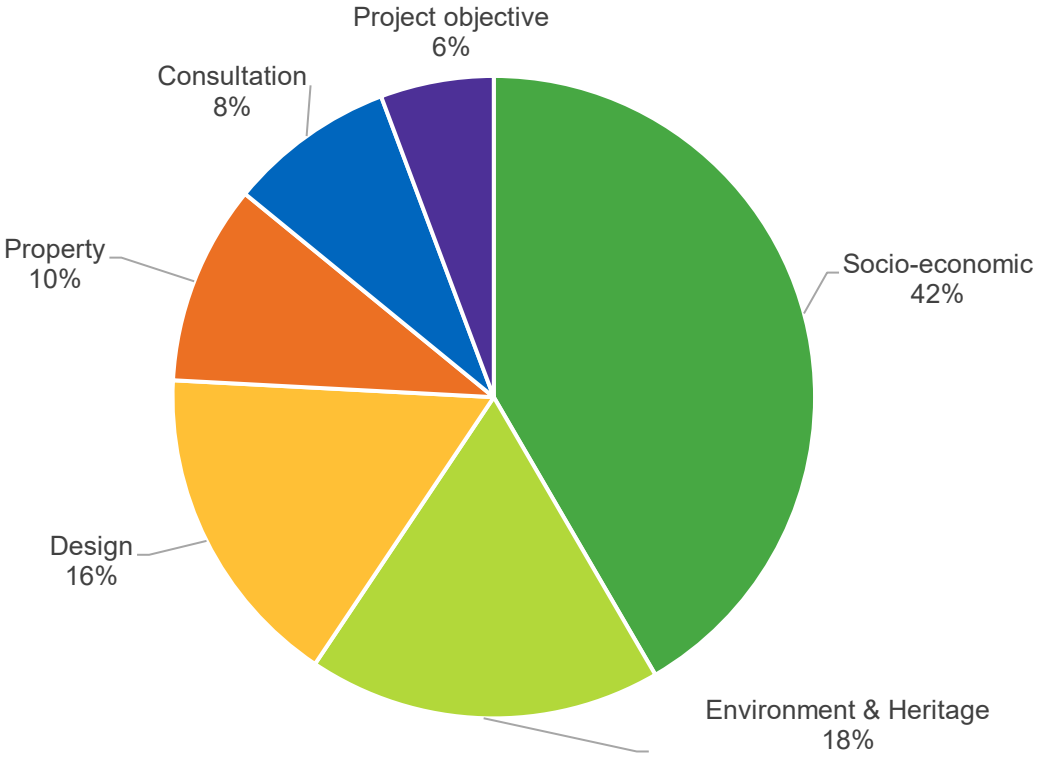
6.5. Industry and interest groups

A broad range of industry and interest group stakeholders were engaged in the preparation of this EIS. Industry briefings particularly focused on the context of EnergyConnect with AEMO's *Integrated System Plan* and the current opportunities and challenges within the NEM. Industry stakeholders were particularly interested in the cost and benefits of EnergyConnect, the impact of potential earlier than anticipated closure of coal and gas electricity generation and noting the social value of increased reliability in energy supply and EnergyConnect's role in supporting this.

844 *engagement activities with*
299 *individuals, representing*
197 *industry or interest groups*

As EnergyConnect progressed, engagements with industry and interest groups tended to focus on opportunities for increased economic activity through local employment and procurement. In addition, matters relating to the environment and design considerations were also key topics.

Topics of discussion



Exploration licence and mineral title holders

Transgrid has provided project materials to the holder of the exploration licences within the project initial study area. Discussions regarding potential impacts, if any, to the operations of the exploration licence are ongoing but feedback to date has been positive.

NSW and Australian businesses

An extensive engagement program to promote local procurement and contracting opportunities was undertaken. This resulted in businesses registering their interest through ICN Gateway across a number of work packages including:

- civil engineering
- concreting
- fencing
- haulage
- logistics
- quarry products
- traffic management
- workforce accommodation.

820 *NSW and Australian businesses have registered an interest to work on EnergyConnect*

Many businesses have also subscribed to receive project updates from Transgrid to stay informed of project progress.

Theme	Feedback	Response
Socio-economic	Prioritising Australian-based procurement	Transgrid has developed an Australian Industry Participation Plan for the project, which will be delegated to the contractor via an Engineering, Procurement, Construction (EPC) Deed.

Other interest groups

Most specific interest groups engaged as part of the proposal were primarily focussed on discussing:

- regional development and economic matters
- agricultural and environmental considerations
- community partnership and enhancement opportunities.

***434** engagement activities with representatives of **122** other interest groups*

Key groups focused on regional development and economic issues included Regional Development Australia (RDA), Riverina and Murray Joint Organisation (RAMJO) and the Wagga Wagga Business Chamber. These stakeholders noted their support for the project and advocated for local employment and procurement opportunities.

Groups focused on agricultural and environmental issues included NSW Farmers Association, Yanco Creek and Tributaries Advisory Committee (YACTAC), Murrumbidgee Landcare and Riverina Noxious Weeds Advisory Group. These stakeholders also acknowledged the importance of EnergyConnect, advocating for consideration of land use and environmental issues in project planning.

Local community outreach and support groups were also engaged as part of Transgrid's existing community partnerships program.

Theme	Feedback	Response
Environment & Property	Importance of biosecurity procedures for agricultural land	Transgrid is committed to limiting the impact of construction and operational activities on the communities in which we work, including weed management. Transgrid works with relevant authorities and landholders to understand any specific requirements to ensure that weed hygiene and biodiversity risk is prevented, eliminated or minimised.

Theme	Feedback	Response
Environment & Design	Native vegetation and wildlife	Transgrid has undertaken ecology surveys and investigations as part of the planning process for EnergyConnect. These activities helped identify existing flora and fauna species, including their habitats within the local area. The outcomes of these surveys have been taken into account as part of the route refinement process to remove or minimise any potential impacts to the native vegetation and wildlife.

6.6. Landholders and community members

Discussions with landholders and community members represented a key focus of the engagement program.

The project team engaged directly with potentially impacted landholders within the initial area of investigation. Landholders were updated during the consultation process and as the area of investigation was refined.

5,017 *engagement activities with* ***505*** *landholders and community members*

Overwhelmingly, landholders displayed a willingness to work with Transgrid to develop the best possible outcome for the proposed transmission line design in coexistence with existing operations and land use. During these engagements, Transgrid received landholders' preferences and/or potential solutions for the proposed alignment to best minimise potential impacts. This included the development of a comprehensive Property Management Plan.

With a refined route alignment, Transgrid continues to engage with directly affected landholders on property matters, including:

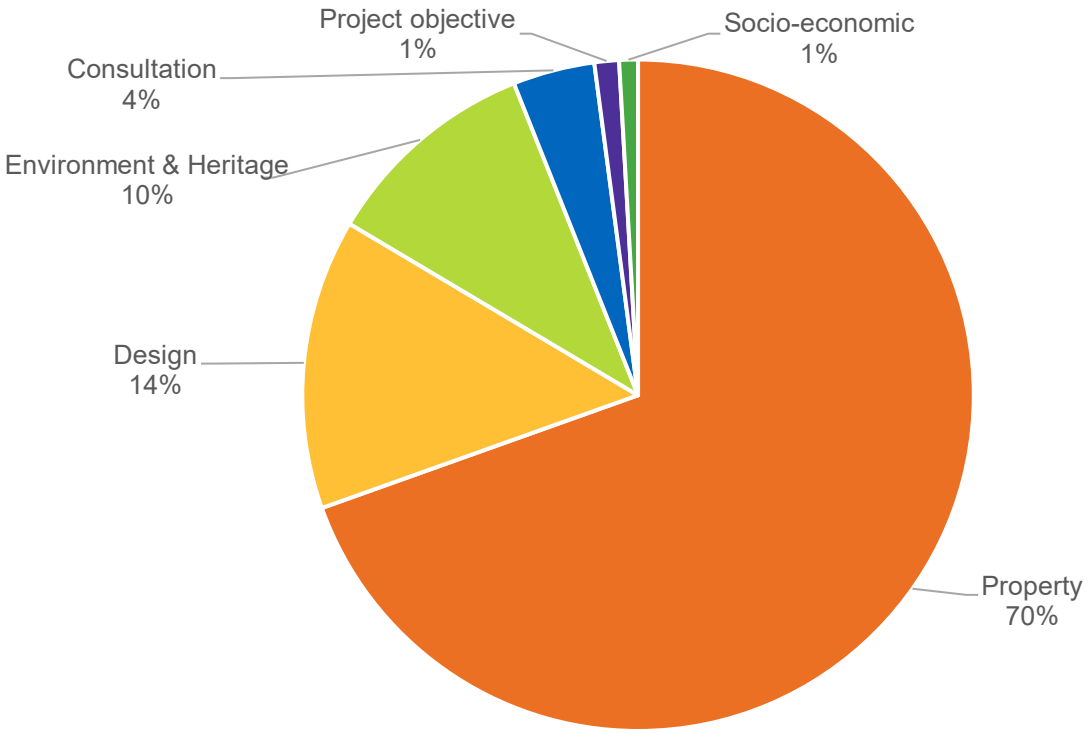
- access for site investigations, including environmental, cultural heritage and geotechnical
- technical matters relating to transmission infrastructure, such as transmission towers, guyed wires and operational capacity
- easement negotiations.

As detailed in Section 5, a key driver in engaging community members was promoting broad awareness of the project and the multiple channels and opportunities for engagement. The majority of feedback from the community related to the route selection and identifying opportunities to minimise potential impacts as much as possible. Key topics of discussion included:

- identifying opportunities and constraints as input to the route refinement process
- potential impacts of the proposal
- visual amenity considerations.

The following chart provides the high-level topics of discussion for all engagements with landholders and community members. This feedback was received from activities including direct engagements with landholders, participation at community information sessions and comments received via the online interactive map.

Topics of discussion

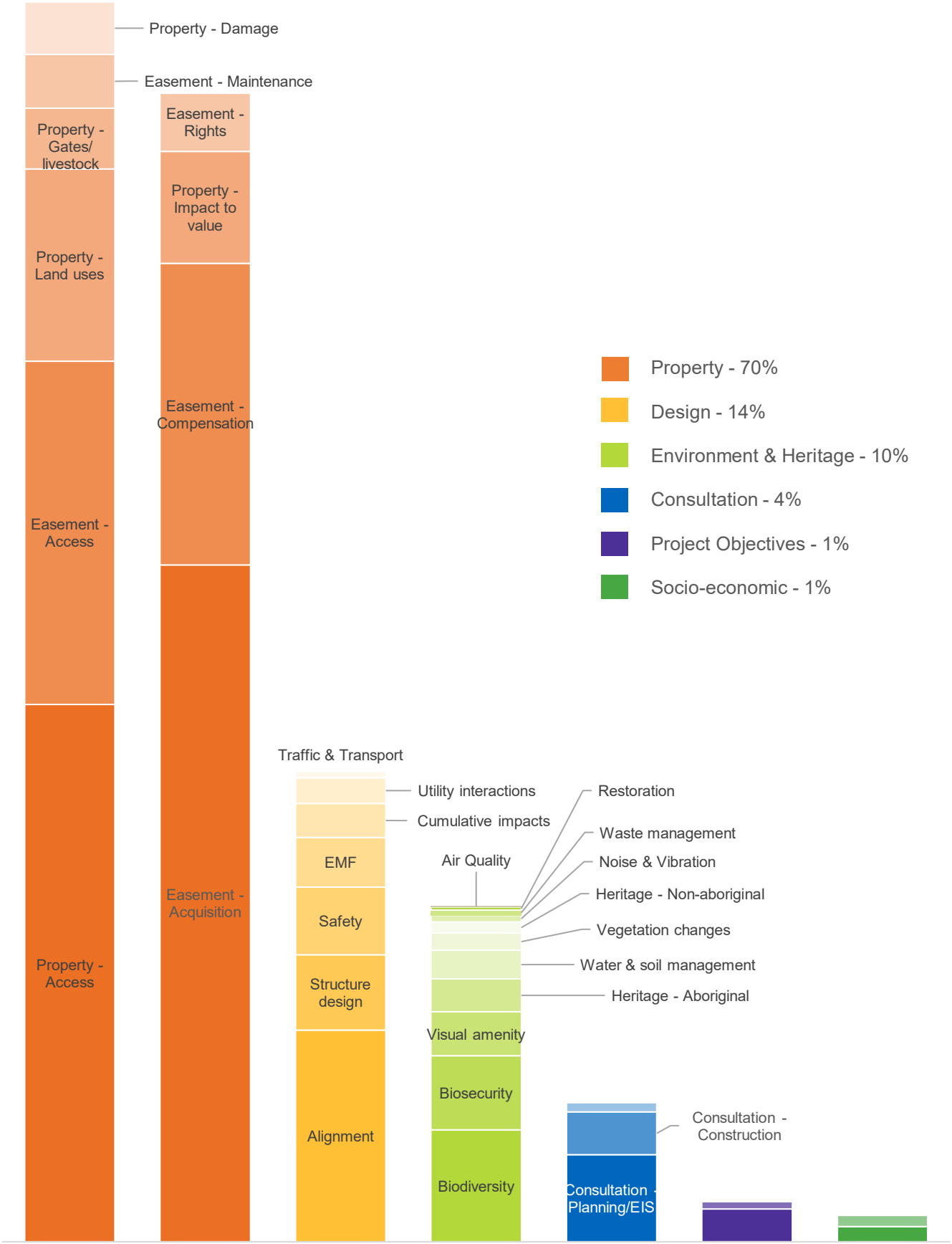


Property related matters were evidently the focus for the majority of discussions. This included engagements about:

- property access for site investigations and studies
- current land use and property operations
- easement acquisition and compensation
- ongoing rights, easement access and maintenance.

Greater detail and granularity on the topics of discussion are provided in the graph and table on the following pages.

Detailed topics of discussion



Theme	Feedback	Response
Design	Proximity of proposal to Lockhart township	Transgrid worked collaboratively with landholders, community members and Council to identify a solution that both meets the project objective while providing future opportunities regarding land use planning near Lockhart township.
Design	Maximise use of existing easements and other property features, such as fence boundaries, road reserves, rail corridors and travelling stock routes	Within the area of investigation Transgrid identified: • constraints like social and environmental factors that must or should be avoided • opportunities to minimise the potential impact on local communities and the environment. As part of the route refinement process, these factors were taken into account to identify the proposed route.
Design	Potential impacts on people, agriculture and the environment from electro-magnetic frequency (EMF)	Transgrid works to provide safe transmission services across its electricity network, including ensuring compliance with Australian Standards related to EMF. Transgrid's EMF Fact Sheet provides further information on electric and magnetic fields and is available online at www.transgrid.com.au/customers-community/community-safety
Design	Potential impacts on GPS enabled equipment and telecommunications devices	Transgrid will design the transmission line to minimise impacts from radio frequency interference (RFI) emissions. The operation of residential, commercial or industrial devices on properties should not be impacted by the RFI emissions from the transmission line, as the devices and the transmission line will generally operate at different frequencies.
Design	Transmission towers	Guyed and self-supporting towers will be used to support the transmission lines for EnergyConnect. To determine which towers are suited to each location, Transgrid will consider many factors including safety, environmental and ground conditions and minimising impacts on existing land use.
Environment	Native vegetation and wildlife	Transgrid has undertaken ecology surveys and investigations as part of the planning process for EnergyConnect. These activities helped identify existing flora and fauna species, including their habitats within the local area.

Theme	Feedback	Response
		The outcomes of these surveys have been taken into account as part of the route refinement process to remove or minimise any potential impacts to the native vegetation and wildlife.
Environment	Biosecurity and weed management procedures	Transgrid is committed to limiting the impact of its construction and operational activities on local communities. This includes weed management. Transgrid works with relevant authorities and landholders to understand any specific requirements to ensure that weed hygiene and biodiversity risk is prevented, eliminated or minimised.
Environment	Visual amenity	Transgrid works with stakeholders and landholders to best understand the social, environmental and cultural values held by the community about the local area. These factors are considered as inputs to developing the proposed transmission route.
Environment	Flood plains	Transgrid has undertaken geotechnical and flood assessments as part of the planning process for EnergyConnect. The outcomes of these assessments have been taken into account as part of the engineering design and route refinement process.
Heritage	Protection of Aboriginal and non-Aboriginal heritage and sites of significance	Transgrid has undertaken cultural heritage surveys and investigations as part of the planning process for EnergyConnect. These activities helped identify artefacts and locations of significance. The outcomes of these surveys have been taken into account as part of the route refinement process and the ongoing management of the project.
Property	Notifications and access	Transgrid seeks agreements with landholders regarding property access. Prior consent is required for entry to a property for site investigations, or an easement is negotiated for the purpose of construction, operation and maintenance of the transmission line. Any specific requirements regarding property access (prior notification, gate security, biosecurity management, etc) are recorded during these engagements.

Theme	Feedback	Response
Property	Land valuations	In seeking to acquire an easement, Transgrid will engage qualified professionals to value the impact of the easement on the land in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991.* The landholder receives written advice outlining the offer. Depending on the circumstances, the offer would cover: • Value of the easement • Incurred costs Any 'special value' as defined by the *Just Terms Act* that may apply.
Property	Easement compensation	The *Land Acquisition (Just Terms Compensation) Act 1991* outlines that compensation paid to a landholder is based on the acquisition of an easement, which provides Transgrid a right to the land in perpetuity. As such, it is assessed similar to the sale of the land, rather than an ongoing payment which would occur in the case of a lease or licence.
Property	Compensation to adjacent landholders	The *Land Acquisition (Just Terms Compensation) Act 1991* identifies compensation to be provided for the land on which an easement is taken. Accordingly, landholders adjacent to an easement (without an easement on their property) would not satisfy the conditions for compensation.
Property	Land use: • Co-existence of transmission infrastructure and agricultural activities • Proximity to property features, like farming infrastructure, equipment and dams	Transgrid has worked with landholders to understand current land use and any planned future activity, to minimise any potential impact and refine the potential route alignment. Guidance on permitted operations, activities and dwellings within proximity of the easement are provided in Transgrid's *Easement Guidelines* https://www.transgrid.com.au/media/3tkdd5lr/easement-guidelines.pdf

7. Conclusions and next steps

The consultation and engagement undertaken to support the preparation of the EIS has ensured the community and all stakeholders identified in the SEARs were made aware of and had an understanding of EnergyConnect and the proposal. It also ensured they had an opportunity to provide feedback on issues and matters of concern.

In addition to stakeholders identified in the SEARs, and in accordance with DPIE's expectations for effective and genuine community consultation, the program of communication and engagement undertaken also provided an opportunity to create broader awareness among a larger range of stakeholders including industry, interest groups and community members.

Transgrid will continue to work with stakeholders promoting participation, updating information and encouraging stakeholders to provide feedback throughout the assessment process and beyond. It is anticipated that the next stage of community and stakeholder engagement will build on relationships already established through early engagement activities and will complement the formal consultation required under planning regulations.

Appendix A – Stakeholder list

Stakeholder group	Stakeholders
Government – Political representatives	• Commonwealth Minister for Energy and Emissions Reduction, the Hon Angus Taylor MP • NSW Minister for Energy and Environment, the Hon Matthew Kean MP • SA Minister for Energy and Mining, the Hon Dan van Holst Pellekaan MP
Energy Regulator / Operator	• Australian Energy Market Commission • Australian Energy Market Operator (AEMO) • Australian Energy Regulator • Energy Security Board
Federal Members	• Member for Farrer, The Hon Sussan Ley MP • Member for Riverina, The Hon Michael McCormack MP
State Members	• Member for Albury, Justin Clancy MP • Member for Murray, Helen Dalton MP • Member for Wagga Wagga, Dr Joe McGirr MP
Local government – Elected officials/ Executive staff	• Albury City Council • Balranald Shire Council • Edward River Council • Federation Council • Griffith City Council • Hay Shire Council • Lockhart Shire Council • Murray River Council • Murrumbidgee Council • Narrandera Shire Council • Wagga Wagga City Council • Wentworth Shire Council
Government – Departmental	• Australian Department of Defence • Australian Energy Infrastructure Commissioner • Australian Government Department of Agriculture, Water and the Environment (DAWE) • Australian Government Department of Education, Skills & Employment • Australian Government Department of Industry, Science, Energy and Resources • NSW Department of Communities and Justice, specifically its divisions Fire & Rescue NSW, NSW Police Force, NSW Rural Fire Service, NSW State Emergency Service • NSW Department of Health, specifically its divisions Far West Local Health District, Murrumbidgee Local Health District and NSW Ambulance

Stakeholder group	Stakeholders
	• NSW Department of Planning, Industry and Environment (DPIE) and its divisions NSW Crown Lands, NSW Environment, Energy and Science (previously referred to as Office of Environment and Heritage (OEH)), NSW National Parks & Wildlife Services and Department of Primary Industries • NSW Department of Premier and Cabinet, and its divisions Aboriginal Affairs NSW and Resilience NSW • NSW Department of Regional NSW including its divisions of Forestry Corporation NSW and NSW Local Land Services • NSW Department of Customer Service (DCS), and its division SafeWork NSW • Riverina Emergency Management Committee, which includes local, state and Federal agencies • Transport for NSW, specifically its division Property Acquisition NSW • Victorian Department of Environment, Land, Water and Planning
Directly impacted landholders (in corridor)	Landholders (owners, occupiers, lease and other interest holders in the corridor)
Traditional Owners and other Aboriginal groups	• Balranald Local Aboriginal Land Council • Balranald Mutthi Mutthi Traditional Owners • Bangerang Aboriginal Corporation • Barkandji Traditional Owners (Native Title Group) • Barkindji Maraura Elders Environment Team (BMEET) • Barkindji Maroura Elders Council (BMEC) • Bidya Marra Consultancy • Bundyi Culture • Cummerajunga Local Aboriginal Land Council • Deniliquin Local Aboriginal Land Council • First People of the Millewa Mallee Aboriginal Corporation • Griffith Local Aboriginal Land Council • Hay Aboriginal Corporation • Hay Local Aboriginal Land Council • Kureinji Aboriginal Corporation • Maliyan Horizon • Merrigarn • Miyagan Culture & Heritage • Murra Bidgee Mullangari Aboriginal Corporation • Murugadi • Nari Nari Tribal Council • Narrandera Local Aboriginal Land Council • National Indigenous Australians Agency (NIAA) • NSW Aboriginal Affairs (Broken Hill) • NSW Aboriginal Land Council • NSW Indigenous Chamber of Commerce

Stakeholder group	Stakeholders
	• NTSCORP • Outback Academy • Wagga Wagga Local Aboriginal Land Council • Wakool Indigenous Corporation • Yalmambirra • Yarkuwa Indigenous Knowledge Centre Aboriginal Corporation • Yorta Yorta Nation Aboriginal Corporation • Other individuals, which are Registered Aboriginal Parties for the proposal
Local land users	Local land users e.g. irrigators and agricultural businesses within the project who are not considered directly impacted or adjacent landholders
Local community	Local communities within Council areas
Local suppliers	Local suppliers within the Murray Riverina region
Other suppliers	NSW and Australian suppliers
Industry groups	• AI Group • Business NSW • Committee4Wagga • Energy Consumers Australia • Energy Users Association of Australia • Industry Capability Network (ICN) • NSW Farmers Association • Primary Producers SA • Public Interest Advocacy Centre • Regional Development Australia • Riverina and Murray Joint Organisation (RAMJO) • Wagga Wagga Business Chamber
Service providers / utilities	• Essential Energy • Telstra
Exploration Licence holders	• Viewmont Gold
Interest groups	Local progress associations, issue-specific interest groups including: • Yanco Creek and Tributaries Advisory Committee (YACTAC) • Murrumbidgee Landcare • Riverina Noxious Weeds Advisory Group
Media	Local, State and National print, radio and television
General public	General members of the public who may take an interest in EnergyConnect (including the proposal)

Appendix B – Community information session timeline

Date	Location	Sentiment rating*
7 May 2019	Wentworth, NSW, Australia	-
8 May 2019	Buronga, NSW, Australia	-
24 August 2019	Wentworth, NSW, Australia	-
25 August 2019	Wentworth, NSW, Australia	-
13 March 2020	Euston, NSW, Australia	4.6 out of 5
15 March 2020	Moulamein, NSW, Australia	4.8 out of 5
17 July 2020	Balranald, NSW, Australia	4.4 out of 5
18 July 2020	Hay, NSW, Australia	4.9 out of 5
19 July 2020	Urana, NSW, Australia	5.0 out of 5
24 July 2020	Coleambally, NSW, Australia	4.4 out of 5
25 July 2020	Lockhart, NSW, Australia	4.8 out of 5
26 July 2020	Wagga Wagga, NSW, Australia	4.6 out of 5
18 September 2020	Booroorban, NSW, Australia	4.5 out of 5
19 September 2020	Uranquinty, NSW, Australia	4.2 out of 5
20 September 2020	The Rock, NSW, Australia	4.6 out of 5
4 November 2020 (am)	Buronga, NSW, Australia	3.0 out of 5
4 November 2020 (pm)	Buronga, NSW, Australia	
5 November 2020 (am)	Wentworth, NSW, Australia	5.0 out of 5
5 November 2020 (pm)	Wentworth, NSW, Australia	
14 September 2021	Online	4.3 out of 5
16 September 2021	Online	4.2 out of 5
17 September 2021	Online	4.4 out of 5
8 November 2021	Jerilderie, NSW, Australia	-
9 November 2021	Wagga Wagga, NSW, Australia	4.0 out of 5
17 November 2021	Urana, NSW, Australia	4.7 out of 5
18 November 2021	Lockhart, NSW, Australia	5.0 out of 5
25 November 2021	Booroorban, NSW, Australia	4.7 out of 5
26 November 2021	Balranald, NSW, Australia	4.7 out of 5
27 November 2021	Mourquong, NSW, Australia	5.0 out of 5

*When asked how informative did they find the session, with a rating being on a scale of “Very unhelpful”, being 1, to “Very helpful”, being 5. Alternatively, if the session was held online the rating refers to how effective did they find the session for communication during COVID restrictions, with a rating being on a scale of “Strongly disagree”, being 1, to “Strongly agree”, being 5.

Appendix C – Communication and engagement materials

C.1 Samples of advertising and promotional materials

dailyadvertiser.com.au Thursday October 28, 2021 THE DAILY ADVERTISER 5

NEWS

Judge considers sentence

BY ANNIE LEWIS

THE tragedy of a fatal crash is that the person responsible will eventually be released from jail, but the victim's family will never get their loved one back, a judge told Wagga court yesterday.

Judge Jon Williams' comments came as Lachlan Landrigan, 24, appeared at Wagga District Court via video link from Bathurst Correctional Facility on Wednesday for sentencing.

The Junee man pleaded guilty to dangerous driving occasioning death, and contravening an apprehended domestic violence order earlier in the year.

Court documents reveal Olivia Clements had been in a relationship with Landrigan when in March 2020, an AVO was taken out against him, ordering that he did not approach her.

On May 31, 2020, Landrigan was driving a utility - owned and registered by Ms Clements, who was sitting in the front passenger seat - when he approached a right bend on Pattersons Road, Harefield. After failing to negotiate the turn, the car came off the road before clipping one tree and hitting another head-on. Landrigan extricated himself from the ute and dragged Ms Clements out of the car before immediately calling triple-0.

The court documents state he was "highly distressed" as he followed the operator's instructions to perform CPR before emergency personnel arrived a short time later and pronounced Ms Clements dead at the scene. Landrigan was taken to Wagga Base Hospital to treat a bruised lung and fractured ribs.

During sentencing proceedings on Wednesday, defence barrister Christine Mendes said that the nature of the matter arose in "tragic circumstances", acknowledging that Ms Clements' family members were in the courtroom. She said Landrigan had asked her to extend his condolences on his behalf to the family.

The defence and prosecution handed up written submissions to Judge Williams, but made short verbal arguments in court.

Ms Mendes noted that her client had already served a large proportion of what his non-parole period sentence would likely be. "It's not a case of abandonment of responsibility ... it's acknowledged there was a degree of inattention that went beyond momentary," she said.

Ms Mendes asked the judge to deal with the contravention of the AVO with a conviction without penalty.

Crown prosecutor Lisa Hanshaw said it was "above momentary inattention".

"It is one [bend] any competent driver paying attention to this road would have been able to negotiate," she said. "He is someone who was disqualified then cancelled then unlicensed ... he is not someone who has ever satisfied anyone that he is a person who is able to hold a driver's licence and drive responsibly."

Ms Hanshaw said Landrigan "simply had no business driving a car at all", adding he was on bail and had an AVO against him, which included an order not to contact the victim.

Ms Mendes said there were no aggravating factors to be found in the case.

"There were also active attempts of the [protected] parties on the order to have it varied," she said. "The driving itself is fairly ordinary ... it's not a matter where speed, alcohol or drugs played a role."

Judge Williams said the sad thing about these cases was while the offender would eventually be released, "the victim's family don't get the victim back ever".

"It's an impossible situation trying to weigh up the value of a person's life to what punishment may be given," he said.

The case returns to court on Friday, where Judge Williams will hand down his sentence.

NSW GOVERNMENT

ABORIGINAL CULTURAL HERITAGE ADVISORY COMMITTEE (NSW) – Call For Nominations

Do you want to make a contribution to Aboriginal cultural heritage management in NSW?

Do you have experience in working with other Aboriginal people to address significant cultural heritage management issues?

The NSW Government is inviting nominations from Aboriginal persons for the appointment of four (4) members to the Aboriginal Cultural Heritage Advisory Committee (ACHAC).

ACHAC advises the Minister and Department on matters relating to the identification, assessment and management of Aboriginal cultural heritage in NSW.

Nominations are invited to fill current and future vacancies that may arise.

Nominees must be

- Nominees of Aboriginal elders groups; or
- Registered native title claimants; or
- Aboriginal owners listed on the register under the *Aboriginal Land Rights Act 1983*.

Your nomination must demonstrate

- your involvement in cultural heritage matters in your local community and
- your understanding of cultural heritage management issues.

Your written consent to the nomination is required for your nomination to be accepted.

To receive an application kit or if you have any enquiries, please contact the Secretariat, Heritage NSW via: Phone: (02) 9873 8579 | **Email:** ACHAC.Secretariat@environment.nsw.gov.au **Website:** heritage.nsw.gov.au

Applications kits may also be downloaded at: heritage.nsw.gov.au/what-we-do/aboriginal-cultural-heritage-advisory-committee/expressions-of-interest/

Application submissions:
By Email: ACHAC.Secretariat@environment.nsw.gov.au.
By Post: Secretariat Unit, Heritage NSW, Department of Premier and Cabinet, Locked Bag 5020, PARRAMATTA NSW 2150

Applications close: 11:59pm Wednesday, 10 November 2021.

ACCESSORIES FOR LESS

Fashion and Accessory coupons, discounts and promo codes available now at

>australiancoupons.com.au<

Transgrid

ENERGYCONNECT

Community Information Session

Transgrid is holding a series of information sessions on the EnergyConnect transmission line proposed for the region. Drop in anytime to ask questions and learn more about the project.

The upcoming drop-in sessions will be held:

Jerilderie
Monday 8 November 2021
2pm – 5pm
Outside the IGA
75 Jerilderie Street, Jerilderie

Wagga Wagga
Tuesday 9 November 2021
Midday – 2.30pm
Lake Albert Hall, Apex Park
Lake Street, Lake Albert

Urana
Wednesday 17 November 2021
2pm – 5pm
Urana Soldiers Memorial Hall
Anne Street, Urana

Lockhart
Thursday 18 November 2021
9am – midday
Lockhart Memorial Hall
71 Green Street, Lockhart

A COVID-19 safety plan will be in place, for everyone's safety.

If you are unable to join in person, visit our project website to see other upcoming drop-in sessions in the region and learn more about the project.

Connect with us

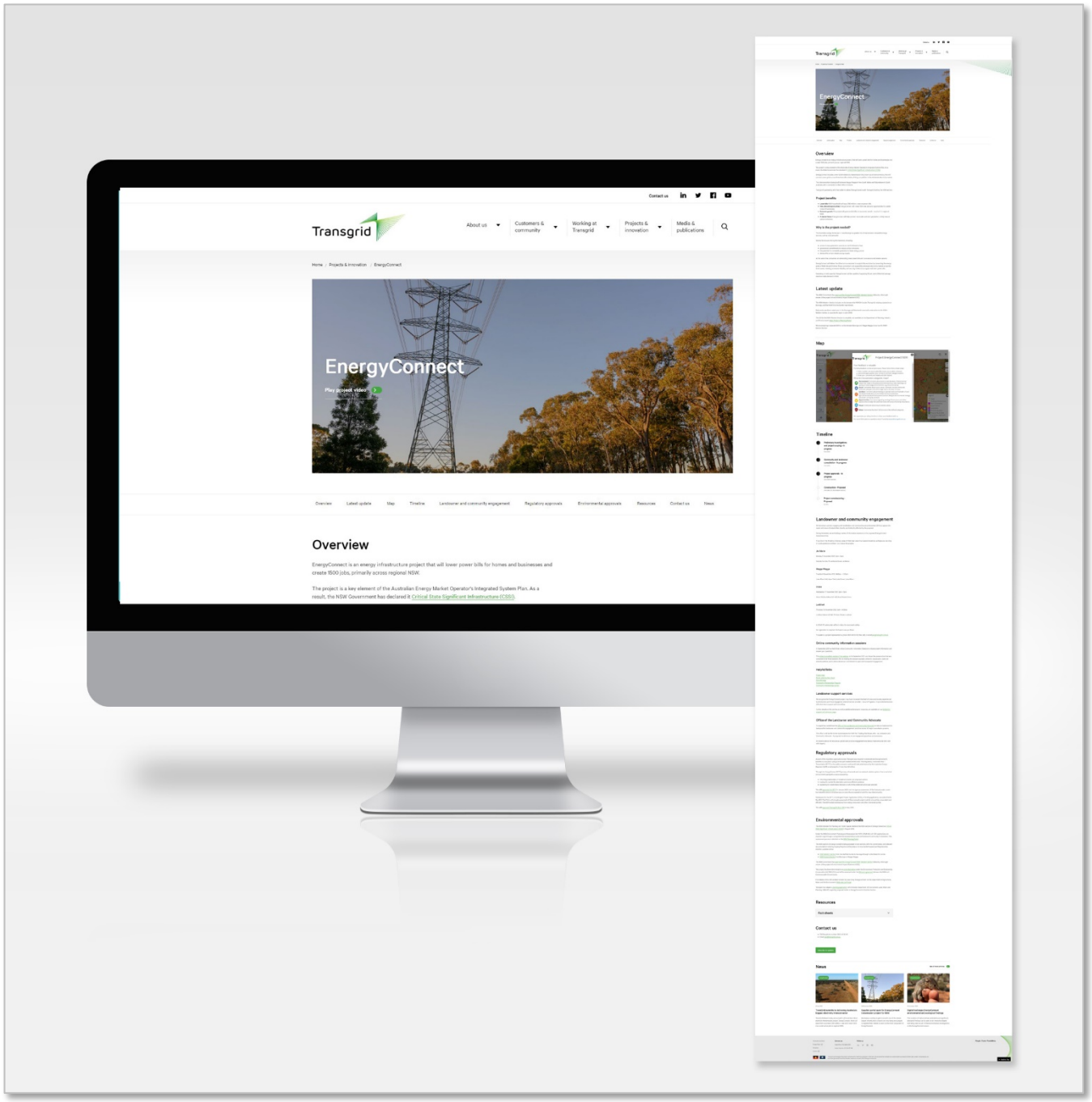
1800 49 08 66 (free call)
pec@transgrid.com.au
transgrid.com.au/energyconnect

People. Power. Possibilities.

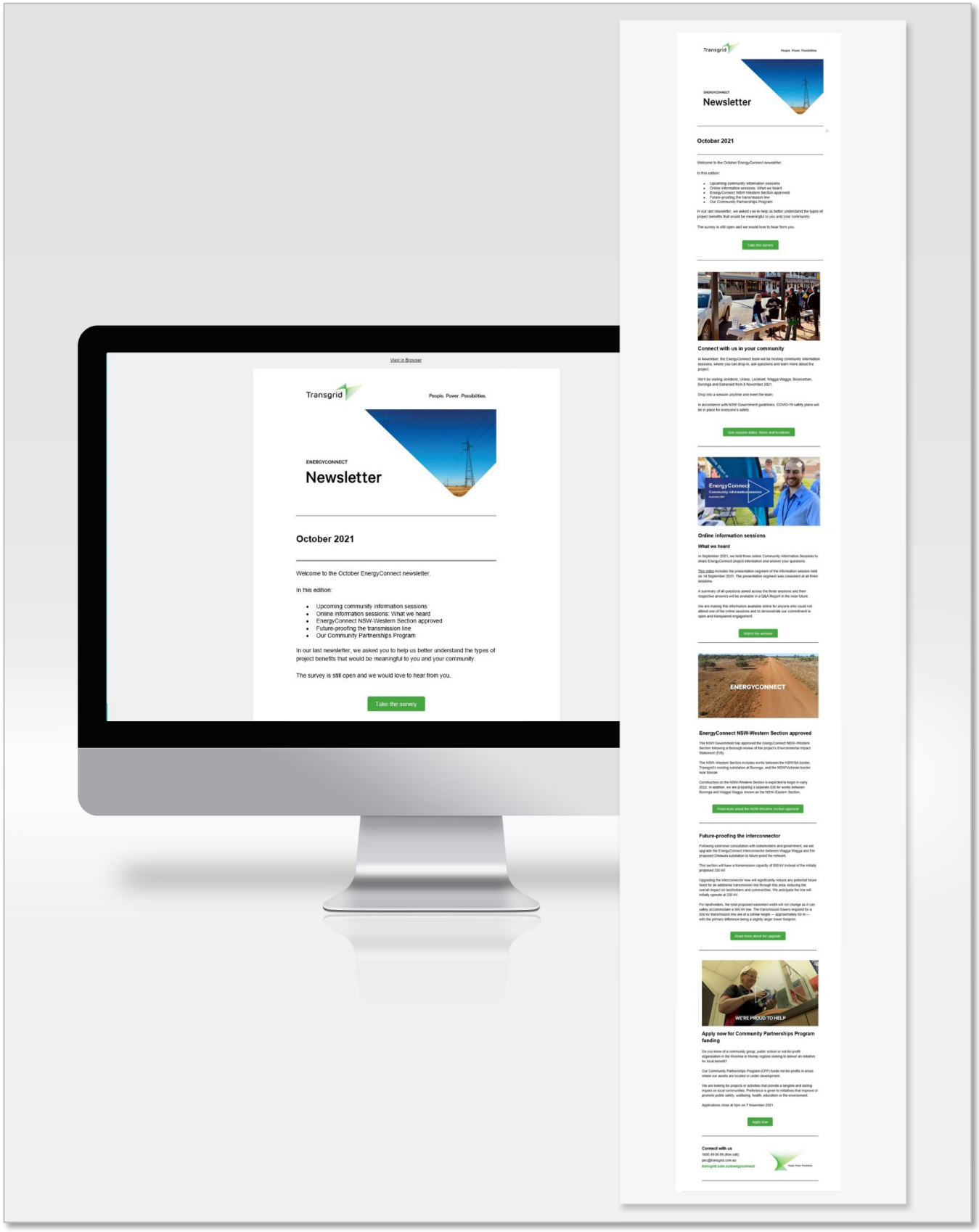
Print advertisement clipping

Social media post screenshot

C.2 Samples of communication materials



Project webpage



Subscription newsletter

EnergyConnect is an energy infrastructure project that will lower power bills for homes and businesses and create 1,500 jobs, primarily across regional NSW.

The project is a key element of the Australian Energy Market Operator's Integrated System Plan. As a result, the NSW Government has declared it Critical State Significant Infrastructure (CSSI).

EnergyConnect includes a new 900 km electricity transmission line, known as an interconnector, that will connect power grids across three Australian states, driving competition in the wholesale electricity market.

The interconnector is being built between Wagga Wagga in New South Wales and Robertstown in South Australia, with a connection to Red Cliffs in Victoria. Supporting infrastructure will also be built or upgraded, including a new substation between Buronga and Wagga Wagga.

Transgrid is partnering with ElectraNet to deliver EnergyConnect, with Transgrid building the NSW section.

Project benefits

- **Lower bills:** NSW households will save $180 m a year on power bills.
- **New jobs and opportunities:** EnergyConnect will create 1,500 new jobs and opportunities for a wide range of businesses.
- **Economic growth:** The project will generate $4 b in economic benefit – much of it in regional NSW.
- **A cleaner future:** EnergyConnect will help connect more solar and wind generation to help reduce carbon emissions.

Why is the project needed?

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. Several factors are driving this transition, including:

- access to new generation sources as coal-fired plants close
- government commitments to reduce carbon emissions
- the potential for renewable generation to lower energy prices
- demand for a more reliable energy supply.

At the same time, consumers are demanding lower power bills and more secure and reliable service.

EnergyConnect will deliver the infrastructure required to support this evolution by connecting the energy grids of NSW, SA and Victoria. These connections will expand the wholesale electricity market across the three states, meaning increased reliability and security of electricity supply and lower power bills.

Operating at total capacity, EnergyConnect will be capable of supplying 8.5 per cent of the total average maximum daily demand in NSW.

People. Power. Possibilities.

Project factsheet (front)

Map of proposed interconnector route

Community engagement

We have been actively engaging with landholders and communities since November 2018 to capture the needs and views of stakeholders directly and indirectly affected by the proposal.

Landholders, community members, local councils and interest groups have been instrumental in providing local insights that have been used to refine the proposed corridor.

Engagement with local stakeholders will continue throughout the life of the proposed project.

Key project dates

- **2018-19** Preliminary investigations and project scoping
- **Late 2018** Community and landholder engagement underway
- **Early 2020** Regulatory Investment Test (RIT-T) approval by the Australian Energy Regulator
- **Late 2020** Western Environmental Impact Statement (EIS) on public exhibition
- **Late 2021** Western construction commencement
- **Early 2022** Eastern EIS on public exhibition
- **Late 2022** Eastern construction commencement
- **By 2023** Project commissioning underway

Connect with us

Transgrid is committed to working with landowners and communities through the construction of EnergyConnect. Please connect with us if you need any information.

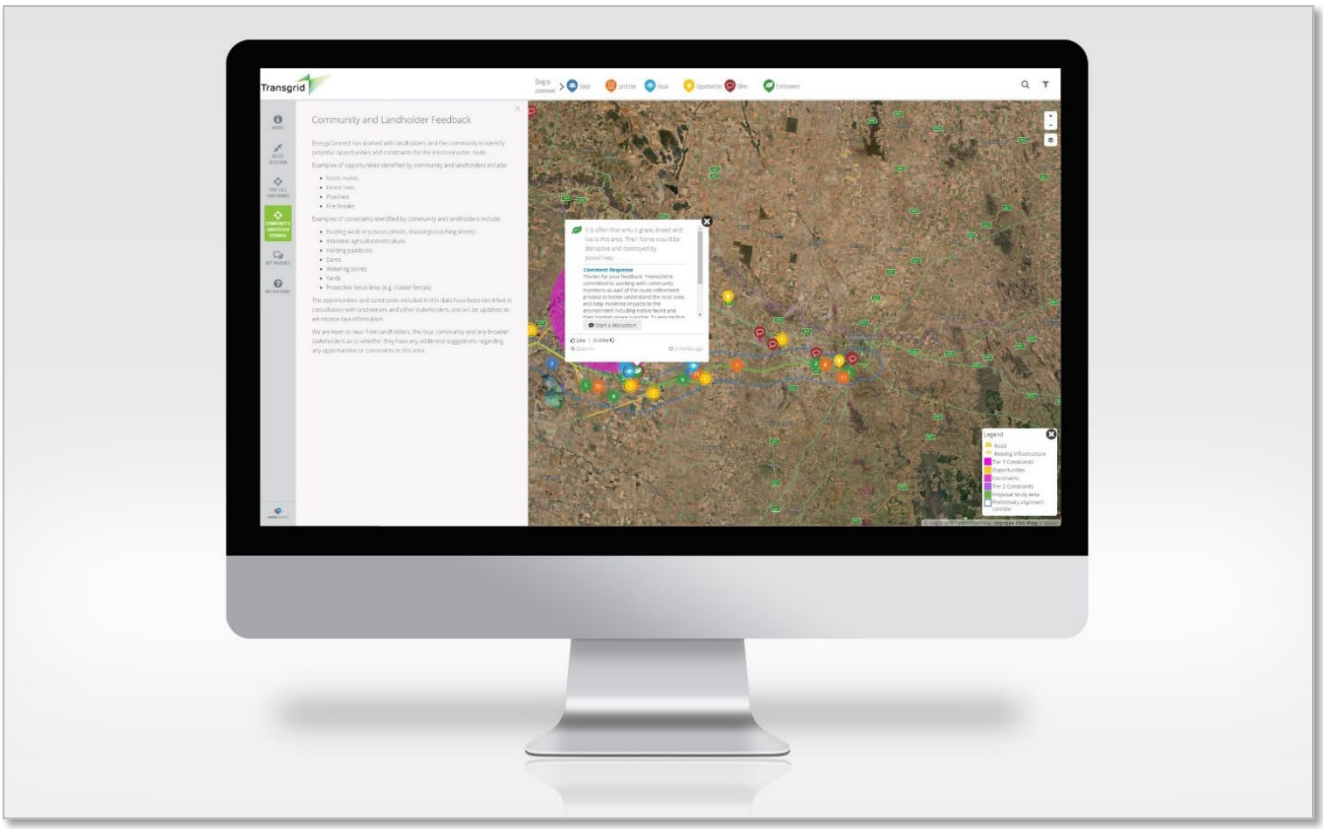
Transgrid

1800 49 06 66 (free call)
pec@transgrid.com.au
transgrid.com.au/energyconnect

Subscribe to our project newsletter at
transgrid.com.au/ecsubscribe

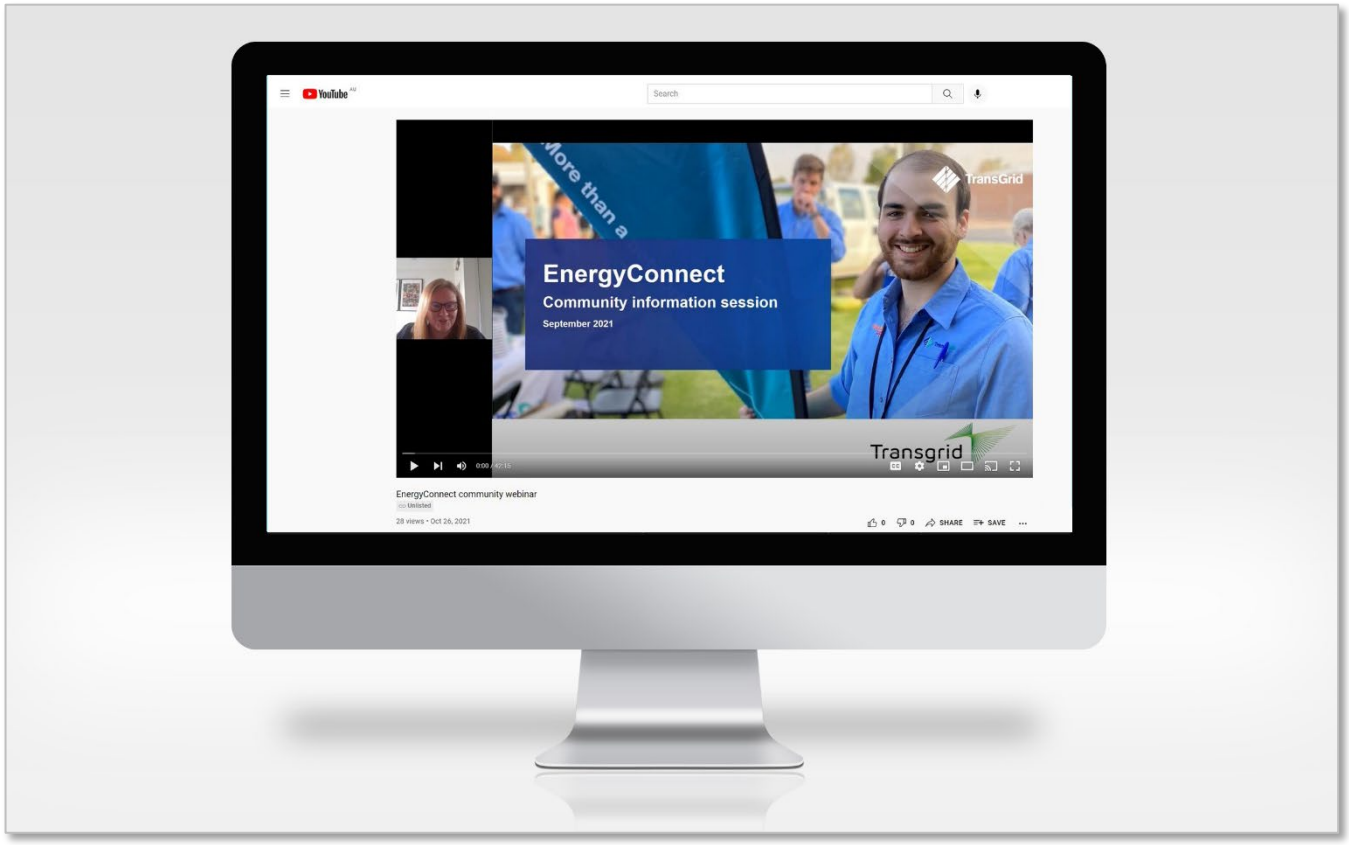
Project fact sheet (back)

C.3 Samples of consultation activities



Interactive map with stakeholder comments

In-person community drop-in information session



Online community information session

Property specific landholder meeting

Appendix E Summary mitigation measures

Table E-1 Summary of proposed mitigation measures

Reference	Mitigation measures	Timing	Application location(s)
Biodiversity			
B1	Impacts to matters of biodiversity conservation significance would be avoided to the greatest extent practicable during finalisation of the design and construction methodology for the proposal. Micro-siting of the transmission line infrastructure and associated construction working areas and other areas of disturbance would occur to avoid impacts wherever practicable. Site features with the highest biodiversity conservation significance, in particular, threatened species recorded and their habitat would be given the highest priority. Spatial data (species polygons for species credit species) and buffered threatened species locations would be provided to the design and construction teams and considered in detailed construction planning. Associated mapping would be included on sensitive area plans and provided to the construction workforce.	Pre-construction	All locations
B2	If refinements to the proposal design and construction methodology or additional field surveys result in changed impacts to biodiversity which are not included in this BDAR, these would be assessed in accordance with the requirements of the BAM by an accredited assessor.	Pre-construction and construction	All locations
B3	Opportunities to locate site offices, compounds and ancillary facilities in areas of limited biodiversity value (e.g. cleared land or areas of native vegetation with vegetation integrity scores of less than 17 in accordance with the NSW Government Biodiversity Assessment Method Operational Manual) would be prioritised during finalisation of the design and construction methodology.	Pre-construction	All locations
B4	Existing tracks and clearings would be used, where possible, to limit the construction of new tracks. Where this is not possible, the design would seek to minimise impacts to native vegetation, including cut and fill, as a priority.	Pre-construction and construction	Transmission line corridor

Reference	Mitigation measures	Timing	Application location(s)
B5	Transmission line structures would be located and constructed to minimise impact to vegetated riparian corridors.	Pre-construction	Transmission line within the riparian corridor as defined by "Guidelines for riparian corridors on waterfront land" (DPI – Office of Water, July 2012) of Murrumbidgee River
B6	Conductor line-marking techniques would be implemented during design refinement to minimise bird strike. Use of bird diverters, most likely consisting of the "flapper" variety, would be implemented. Positioning and exact diverter model would be finalised during design refinement but at minimum these would be used within one kilometre of wetland/riverine habitats to reduce impacts on aerial fauna species from collision and allow safer passage within these areas.	Pre-construction and construction	Transmission line – within one kilometre of wetland/riverine habitats (i.e. Murrumbidgee River)
B7	A series of 20-metre-wide connectivity corridors would be established near tower locations that occur in woodland vegetation. These would occur at strategic locations that would be developed as part of a Connectivity Strategy under the Biodiversity Management Plan, targeting the following locations (wherever practicable): • key riparian crossings • areas of the alignment joining proposed biodiversity stewardship sites and or conservation reserve estate; and • areas of existing dense mallee / belah. These connectivity corridors would involve native vegetation retention up to the 10 metre or 20 metre (for 330kV and 500 kV lines, respectively) wide temporary construction centreline clearing zone to better facilitate woodland connectivity. Vegetation heights to be retained would be determined in accordance with vegetation clearing requirements at each location. Any biodiversity credit liabilities to retained vegetation such as the connectivity corridors would be considered in final BAM calculations (refer to mitigation measures B2 and Section 12.4 of the Biodiversity offset strategy.	Pre-construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
B8	Nest boxes would be provided to provide alternative roosting habitat for threatened fauna displaced during clearing in accordance with a Supplementary Hollow and Nest Strategy. The strategy would include the following requirements: • survey of tree hollows and nests within the proposed clearing extents • identify the size, type, number and location of nest boxes required based on the results of the ecological surveys and active hollow resources in adjacent areas • appropriately sized nest boxes would be installed within the vicinity of hollow-bearing trees (subject to landowner agreement and suitable existing trees being present) no more than two weeks prior to clearing of the tree • nest boxes would also include the re-use of existing hollows salvaged prior to or during clearing where practicable; and • measures to address and manage nests (such as raptor nests) prior to clearing.	Pre-construction and construction	All locations where hollow bearing trees are being removed
B9	Pre-clearing surveys would be completed prior to clearing at each location by a suitability qualified ecologist. The proposed clearing extents would be marked out on site prior to the pre-clearing surveys. During the surveys, the ecologist would: • survey the proposed clearing extent • identify any fauna that would require relocation prior to clearing • confirm the location and mark out the extents of any biodiversity exclusion zones • confirm that hollow-bearing trees within and adjacent to the clearing extents are prominently marked/tagged; and • confirm that nest boxes are in place (where required) in suitable locations adjacent to areas to be cleared, or suitable locations for installation have been identified.	Pre-construction	All locations
B10	The results of the pre-clearing surveys would be used to update and confirm the accuracy of sensitive area maps.	Pre-construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
B11	Biodiversity exclusion zones for retained vegetation would be confirmed by a suitably qualified ecologist and identified as 'No disturbance' zones prior to the commencement of clearing or any site activity that could damage the vegetation within the exclusion zone. 'No disturbance' zones would consider: • identified Plains-wanderer habitat • identified threatened flora populations and • PCTs in disturbance area B that are not of a growth form height that would ever require management. Biodiversity exclusion zones would be physically marked and demarcated, and included on sensitive area maps, prior to clearing.	Pre-construction	All locations
B12	A Plains-wanderer specific protocol would be developed to ensure that all project staff are aware of the sensitivities around this critically endangered species and to ensure that all specific requirements in relation to protection, avoidance, management and observation of individual Plains-wanderers are considered, in association with BCD staff.	Pre-construction	All locations
B13	All relevant project personnel, including relevant sub-contractors would be trained on biodiversity management protocols and the requirements for the project, through inductions, toolbox talks and targeted training, and provided with sensitive area maps (showing clearing boundaries and exclusion zones) and updates as required.	Construction	All locations
B14	The predicted clearing of native vegetation by the proposal would be monitored against the recorded clearing. A revised BAM-C calculation on the project's final project disturbance post construction would be completed and any additional credit liability identified would be met as part of the biodiversity offset requirements within the biodiversity offset package.	Construction	All locations
B15	Shrub or ground stratum native vegetation within vegetated riparian zones (within the definition of *Water Management Act 2000*) of defined riparian areas would be protected to the greatest extent practicable, with vegetation clearing ideally limited to the tree stratum only, with trunk bases being retained in-situ.	Construction	Transmission line within the riparian corridor as defined by "Guidelines for riparian corridors on waterfront land" (DPI – Office of Water, July 2012)

Reference	Mitigation measures	Timing	Application location(s)
B16	Activities within vegetated riparian zones would be managed to minimise impacts to aquatic environments. Riparian areas subject to disturbance would be progressively stabilised and rehabilitated.	Construction	Transmission line within the riparian corridor as defined by "Guidelines for riparian corridors on waterfront land"
B17	A species unexpected finds protocol would be implemented if threatened ecological communities, flora and fauna species, not assessed in the biodiversity assessment, are identified in the disturbance area.	Construction	All locations
B18	Clearing of hollow bearing trees within the mapped PCT 8 and PCT 11 vegetation at the crossing point of the Murrumbidgee River would be undertaken outside of the period between September and December to avoid key breeding periods of the Regent Parrot.	Construction	Murrumbidgee River
B19	Features of high biodiversity conservation significance within the operational easement, including biodiversity exclusions zones identified during construction and retained habitat for threatened species, would be recorded in Transgrid's GIS. The GIS information will be reviewed during the planning of all maintenance or other future activities that could cause disturbance.	Operation	All locations
B20	Develop and implement guidelines and procedures for operation and maintenance of the proposal that address the following: • vegetation clearing and maintenance commitments in the BDAR and EIS • avoiding access and disturbance in biodiversity exclusion zones identified during the construction • avoiding access and disturbance in areas of high biodiversity conservation significance; and • avoiding maintenance of vegetation that does not need to be maintained during operation. Provide training to relevant Transgrid operational personnel and vegetation maintenance contractors regarding the operational and maintenance guidelines and procedures.	Operation	All locations

Reference	Mitigation measures	Timing	Application location(s)
Aboriginal heritage			
AH1	The finalisation of the proposal design and construction methodology, and associated final disturbance areas, would be developed to avoid harm to features/items of Aboriginal heritage significance as far as practical. The objective is to further reduce potential impacts through tower location and design refinement and construction methodology. Avoidance and minimisation of harm to features/items and Potential Archaeological Deposits (PADs) are to be prioritised.	Pre-construction impacts	All locations
AH2	Aboriginal stakeholder consultation would be carried out in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a). Engagement with Registered Aboriginal Parties (RAPs) would consist of the following: • Aboriginal heritage site surveys (AH3) – review of proposed methodologies and involvement in the survey activities in the field (for ground or vegetation disturbance outside of previously surveyed areas) • test excavation activities (AH4) – review of proposed methodologies and involvement in the test excavation activities in the field • review of the draft addendum report/s to the ACHAR (relating to surveys (AH3), test excavations (AH4) and scar trees (AH5)), and consultation on the draft reports • provision of final addendum report/s to the ACHAR to RAPs (AH3, AH4, AH5) • involvement in establishment of Aboriginal heritage exclusion zones prior to construction commencing at each location (AH7). Further cultural information would be gathered during consultation undertaken in association with these activities.	Pre-construction impacts	All locations

Reference	Mitigation measures	Timing	Application location(s)
AH3	Additional assessment would occur in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW* (2010) for areas where ground activities are required in locations outside of the previously surveyed heritage survey area. Where required, additional heritage surveys would be carried out with the RAPs prior to ground disturbing activities occurring in any such areas. If no Aboriginal objects are found or if Aboriginal objects are found and they would not be impacted, then a letter report would be prepared by an archaeologist that documents the findings and gives clearance to proceed. Where Aboriginal objects or area of PAD are located and would be impacted, a draft survey addendum report/s to the ACHAR would be prepared for the survey areas. The report(s) would: • detail findings of the survey activities • detail where test excavation is required in accordance with AH4 • outline any additional mitigation strategies beyond those required by AH4 to AH14 • be presented to the RAPs for comment. Final reports would be provided to RAPs and to Heritage NSW for their information prior to the commencement of ground disturbing activities in these locations.	Pre-construction impacts	All locations (outside of the previously surveyed heritage survey area)
AH4	A test excavation program would be carried out in the parts of any PADs where direct impact is likely. The purpose of the test excavations would be to determine the presence or absence and significance of subsurface archaeological deposits to inform design development and construction planning. Test excavations works would be carried out in accordance with a methodology that is presented to and consulted on with the RAPs. Test excavation addendum report/s to the ACHAR which would detail findings of the test excavation activities.	Pre-construction impact	PEC-E-PAD01 PEC-E-PAD02 PEC-E-PAD03 PEC-E-PAD04 PEC-E-PAD05 PEC-E-PAD06 PEC-E-PAD08 PEC-E-PAD09 PEC-E-PAD17 PEC-E-PAD18 PEC-E-PAD19 PEC-E-PAD20 PEC-E-PAD21 PEC-E-PAD22 PEC-E-PAD23 PEC-E-PAD24 PEC-E-PAD25

Reference	Mitigation measures	Timing	Application location(s)
			PEC-E-PAD26 PEC-E-PAD27 PEC-E-PAD29 PEC-E-PAD35 PEC-E-PAD40
AH5	Harm to scarred trees (including those of cultural significance) would be avoided where possible through design development and construction planning. Scarred trees must only be removed to directly facilitate construction of permanent infrastructure and/or to meet *Vegetation Clearance Requirements at Maximum Line Operating Conditions* (Transgrid, 2003). If the removal of a scarred tree cannot be avoided, the tree would be subject to 3D scanning, followed by salvage of the scarred trunk. The results of this assessment would be reported on in addendum reports. Reports would be provided to RAPs for comment and to Heritage NSW.	Pre-construction impacts	PEC-E-03 PEC-E-42 PEC-E-77 PEC-E-76 PEC-E-17 PEC-E-48 PEC-E-49 Boiling Down Road 1 (AHIMS #56-1-0001) D-B#22; Booroorban (AHIMS #48-5-0022) (confirmation required may already be destroyed)
AH6	All portions of artefact scatters and isolated finds that are to be directly impacted would require surface collection and salvage prior to construction commencement in those areas. Hearths would be the subject of photographic recording and samples taken of hearth material prior to disturbance. Additionally, based on the outcomes of the test excavation, PADs would be subject to surface collection or salvage prior to the commencement of ground disturbing activities within the PAD. The activities would be documented in a salvage report.	Pre-construction impacts	All artefact scatters

Reference	Mitigation measures	Timing	Application location(s)
AH7	Aboriginal heritage exclusion zones would be established to protect sites, including: • known features/items of significance that have been identified to remain in-situ throughout construction (and not subject AH6) • scarred trees that are to remain in-situ. • any portions of PADs that become a known site following subsurface testing and which are identified for no impact. Suitable controls would be identified in the heritage management sub-plan, which may include temporary site fencing and sediment control. Aboriginal heritage zones would be demarcated by a suitably qualified archaeologist in consultation with the RAPs prior to the commencement of construction at each location. PADs in locations where vegetation clearing is required but there would be no ground disturbance would be managed through construction methodologies and would not be delineated as exclusion zones. These methodologies would be developed in the heritage management sub-plan.	Pre-construction impacts	All sites confirmed with the final construction impact area and disturbance areas to not be directly impacted
AH8	Any existing access tracks in areas of PAD that require upgrading for use during construction would not be the subject of direct ground disturbance such as grading. The methodology to be used for the upgrade would be designed to avoid this disturbance and may include laying of geotextile on the surface. If avoidance is not possible then additional test excavation would be required and salvage completed as necessary prior to works commencing (in accordance with AH4 and AH6).	Construction	Locations where existing access tracks are required to be upgraded in areas of sites and PADs
AH9	Construction planning and management would make sure that indirect impacts that could potentially result in a loss of known heritage values due to harm would not occur. Indirect harm could result from physical disturbance from surface water drainage or construction workers driving over sites that are to be protected.	Construction	All locations
AH10	Cultural heritage awareness training would be carried out for all personnel working on the proposal prior to the personnel participating in construction activities. The training shall cover features of heritage significance within and adjacent to proposal locations and proposal protocols that must be complied with to minimise and manage potential impacts to those features.	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
AH11	If at any time during construction, any items of potential Aboriginal archaeological or cultural heritage significance, or human remains are discovered outside of previously recorded sites or PAD, they would be managed in accordance with the Aboriginal heritage unexpected finds protocol (refer to Appendix 3 of Technical Paper 2).	Construction	All locations
AH12	A temporary repository of any retrieved archaeological material and Aboriginal objects would be appropriately secured under the care of the archaeological consultant. The strategy for the long-term conservation of salvaged or collected Aboriginal objects would be determined in consultation with the RAPs.	Construction	As relevant
AH13	Features/items of heritage significance that would remain in-situ within the transmission line easement would be mapped and recorded within GIS systems managed by Transgrid and would be entered on the NSW Aboriginal Heritage Information Management System (AHIMS). Relevant Transgrid systems and procedures would be updated as required with protocols that would be implemented during operation to ensure that impacts to the features/items of significance do not occur during maintenance activities.	Operation	Transmission line
Historic heritage			
NAH1	The final construction methodology would be developed to avoid or minimise harm to heritage items PEC-E-H1 (Survey Marker Tree) and the sheep yards on the Yanga Pastoral Station Complex as far as practicable. If harm to these items can be avoided, temporary exclusion fencing would be installed to protect any elements of these items to be retained during construction. If harm to the sheep yards on the Yanga Pastoral Station Complex cannot be avoided, consultation would occur with NPWS. Where requested, archival recording of the sheep yards would occur, and the records would be provided to NPWS.	Pre-construction and construction	Transmission line
NAH2	The final construction methodology would be developed to avoid ground disturbance within the curtilage of PEC-E-H3 (Bundure railway station dwelling artefact scatter) where practicable. If ground disturbance within the curtilage can be avoided, temporary exclusion fencing would be installed to protect relevant parts of the item from harm during construction.	Pre-construction and construction	Transmission line

Reference	Mitigation measures	Timing	Application location(s)
	If ground disturbance within the curtilage cannot be avoided during construction, the parts of the artefact scatter that could be harmed would be salvaged and analysed and managed in accordance with their determined significance, prior to the commencement of any activity that could harm the heritage items present.		
NAH3	The locations of known heritage items in close proximity to the construction impact area and the relevant protocols to avoid and manage any potential harm to the items would be communicated to all relevant construction personnel prior to construction commencing in that area.	Pre-construction and construction	Transmission line
NAH4	PEC-E-H4 would be subject to heritage survey and assessment when site access is available. If the site is found to contain or has the potential to contain features of heritage conservation significance, the final construction methodology would be adjusted as far as practicable to avoid harm. If harm can be avoided, temporary exclusion fencing would be installed to protect relevant parts of the site during construction. If parts of the site that contain or have the potential to contain features of heritage conservation significance would be subject to ground disturbance during construction, an archaeologist would recommend appropriate measure mitigation/management measures, which might include archaeological excavation and salvage (where appropriate). The archaeologist's recommendations would be implemented prior to the commencement of any activity that could harm the features of heritage conservation significance.	Pre-construction and construction	Transmission line
NAH5	During design refinement, the final location of transmission line structures and construction facilities would be determined with the aim to avoid or minimise impacts on all items assessed as having heritage significance, where feasible and reasonable. Items of moderate or high significance would be prioritised for avoidance or impact minimisation. Where impacts are not avoided, further assessment by an archaeologist would occur and be documented in an addendum non-Aboriginal heritage assessment.	Pre-Construction	All locations
NAH6	If at any time during construction, any items of potential historic heritage archaeological significance, or human remains are discovered, they would be managed in accordance with an unanticipated discovery protocol that is aligned with the protocol in Appendix 1 of Technical paper 3.	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
NAH7	Features/items of heritage significance that would remain in-situ within the transmission line easement and along access tracks would be mapped and recorded within GIS systems managed by Transgrid to reduce the potential for inadvertent impacts to occur during maintenance activities.	Operational	Transmission line and access tracks
NAH8	Relevant Transgrid systems and procedures would be updated as required with protocols to avoid harm to heritage items and implemented during operation.	Operational	Transmission line and access tracks
Land use and property			
LP1	Access tracks (temporary and permanent) would be confirmed in consultation with landholders to minimise impacts on agricultural activities to the greatest extent possible. Where permanent tracks are required, a single access track would be designed to serve both temporary and permanent purposes, where possible.	Pre-construction and construction	All locations
LP2	Transmission line structures (and associated permanent structures or construction compounds) would be located where possible to avoid or minimise impacts, or as agreed with the affected landholder, on: • cropping and irrigated horticultural land • areas used for set up and pack up of agricultural equipment, entry points and turning areas • drainage catchments for farm dams • locations of high biosecurity risk.	Pre-construction	All locations
LP3	To minimise disruption to agricultural activities: • landholders would be consulted regarding any required adjustments to property infrastructure (fences, access tracks, etc) and the proposed timing and location of construction works, especially where some restriction on vehicular or stock movements would be necessary. Appropriate arrangements would be negotiated with the affected parties and put in place prior to any such disruption. • property infrastructure (such as gates) would be managed in accordance with landholder requirements, (provided access is not limited or restricted) • any damage to property infrastructure caused by construction would be repaired promptly • use of existing roads, tracks and other existing disturbed areas would be prioritised. where access is required across open spaces, care would be exercised to ensure that minimum damage is caused to the surface by confining vehicular or plant movement, as far as possible, to one route.	Pre-construction and construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
LP4	Consultation would be undertaken with relevant landowners who utilise aerial farming operations to identify appropriate mitigation arrangements (where feasible) such as the installation of aerial warning markers on the transmission lines.	Pre-construction and construction	Transmission line
LP5	Disturbed areas would be stabilised and appropriately rehabilitated (i.e. back to pre-impacted conditions) as soon as feasible and reasonable following the completion of construction at each location. This would be carried out in consultation with the relevant landowner.	Construction	All locations
LP6	Procedures would be implemented so that potential impacts or conflicts between livestock and construction activities are appropriately managed. Procedures would be developed in consultation with affected landholders and would include management of: • noise intensive activities during sensitive periods within the livestock production cycle (such as lambing and calving) • vehicle movements and other activities within the vicinity of livestock movement of stock away from potential stressors created by construction activities.	Construction	Transmission line
LP7	Biosecurity controls would be implemented during construction to minimise the risk of off-site transport or spread of disease, pests or weeds. Controls would include (but not limited to): • inspections and cleaning of vehicles, machinery, and personnel equipment prior to movement on and off construction work areas or between properties • minimising movements across adjoining farmland including trip numbers and locations • additional measures where localised areas of high biosecurity risks have been identified. The specific controls applicable to a property would be identified in consultation with the affected landholder. The effectiveness of these controls would be monitored in a manner and time interval consistent with the level of risk on each property.	Construction	All locations
LP8	Where present, weeds would be managed in consultation with the relevant landholder. Consultation would also occur with the relevant authority (LLS, the relevant local council, or NSW DPI) in relation to notifiable weeds.	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
LP9	In the event of new infestations of notifiable weeds as a result of construction activities, the relevant control authority would be notified as per *Biosecurity Act 2015* and Biosecurity Regulation 2017.	Construction	All locations
LP10	Fencing and access arrangements, such as locked gates, would be determined in consultation with landholders (where required such as around the new substation and optical repeater sites). Management of access including opening and closing of gates would be done in accordance with landholder requirements. Any damage caused by maintenance activities would be repaired promptly.	Operation	Transmission line
LP11	If landholders indicate adverse effects on agricultural precision farming GPS signals due to operation of the project within 12 months from commencement of operation, the claims would be investigated. Any disruption due to operation of the project would be addressed in consultation with the affected landholder. Where it is identified there is a disruption, Transgrid would investigate and implement mitigation measures (such as signal boosting equipment) in consultation with the affected operator.	Operation	Transmission line
LP12	Biosecurity controls, confirmed in consultation with the affected landholders, would be implemented during operation to minimise the risk of off-site transport or spread of disease, pests or weeds during maintenance activities.	Operation	All locations
LP13	Where present within the operational transmission line easement and associated areas for permanent infrastructure, weeds would be managed in accordance with the *Biosecurity Act 2015*.	Operation	All locations
Landscape and visual amenity			
LV1	Opportunities for the retention and protection of existing trees within the disturbance area would be identified during detailed construction planning. Identified trees of high conservation significance would be retained and protected where practicable.	Pre-construction	Whole of proposal
LV2	Temporary and permanent access would be designed to minimise vegetation removal, changes to landform, and visual impacts where practicable.	Pre-construction	Whole of proposal
LV3	Lighting at construction compounds and accommodation camps would be designed and operated in accordance with AS4282-2019 Control of the obtrusive effects of outdoor lighting	Pre-construction and construction	Construction compound and accommodation camps

Reference	Mitigation measures	Timing	Application location(s)
LV4	The Tree Protection Zone of retained trees within or immediately adjacent to the disturbance area would be managed in accordance with AS4970-2009 Protection of Trees on Development Sites where practicable to minimise the impact of the works on the long-term health of these trees.	Pre-construction	Whole of proposal
LV5	For residences where the project is predicted to have a high or very high visual impact, opportunities for screening vegetation would be investigated. Appropriate visual screening or other options would be confirmed in consultation with the affected landholder and implemented during construction. Vegetative screening would be maintained by the landholder.	Construction	Transmission line
LV6	Lighting at the substations would be designed and operated in accordance with AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.	Operation	Dinawan 330kV substation and Wagga Wagga substation upgrade / expansion
Social			
SE1	A Community and Stakeholder Management Plan (CSMP) would be implemented. This would include: • appropriate communication and engagement tools and approaches to engage with councils, landholders, community groups in service communities, emergency services and the broader community • complaint handling processes in line with the Transgrid Complaints Handling Policy.	Pre-construction and construction	All locations
SE2	Land and Property Access Officers would be appointed for affected landholders to provide direct avenues of enquiry for information and issues management.	Construction	Line affected landholders along the alignment

Reference	Mitigation measures	Timing	Application location(s)
SE3	A Local Business and Employment Strategy would be implemented to guide local opportunities during construction, and where possible, align with existing plans and strategies of regional study area LGAs, and Transgrid's Reconciliation Action Plan. The strategy would be developed in consultation with regional study area councils and would take into account current unemployment trends across the region. The strategy would include initiatives for: • local supplier and labour procurement targets • Aboriginal workforce and business participation • training and upskilling programs for local labour force • transitioning the local workforce following the completion of construction.	Pre-construction and construction	All locations
SE4	A Workforce Management Plan would be developed for each accommodation camp in consultation with relevant councils, social infrastructure managers and community service providers in nearby service communities. The plan would identify potential constraints in local service provision and mechanisms to promote workforce health and wellbeing and integration into the affected service community without affecting access for residents. It would include: • a list of recreation facilities, sports teams and organisations that workers could utilise • social service providers, including medical and allied health providers • local initiatives that facilitate non-resident workforce and community interactions at local venues, events and community projects. The plan would be reviewed every six months in collaboration with councils to identify and manage any emergent issues.	Pre-construction	Service communities – likely Balranald, Hay, Jerilderie, Coleambally, Lockhart and Wagga Wagga
SE5	If proposal construction coincides with the construction of other projects around Wagga Wagga, a workforce accommodation strategy for the proposal would be implemented and would be informed by an additional review of existing housing and accommodation capacity relative to the proposal workforce needs.	Pre-construction	Wagga Wagga LGA
SE6	The long-term rental market in Wagga Wagga would not be used to satisfy short term (less than six months) accommodation needs for the construction workforce in Wagga Wagga.	Construction	Wagga Wagga LGA

Reference	Mitigation measures	Timing	Application location(s)
SE7	Cultural Heritage and awareness training would be provided to all construction workers during the onboarding process.	Construction	Whole proposal
Economic			
EC1	The positive local employment and business opportunities would be maximised via promotion of local workforce participation and the preparation and implementation of a Local Industry Participation Plan and Australian Industry Participation Plan.	Pre-construction and construction	All locations
EC2	The proposal team would collaborate with the local Councils and local chambers of commerce to: • inform local business of the goods and services required of the proposal, the service provision opportunities and compliance requirements of business to be able to secure contracts • encourage local business to meet the requirements of the proposal for supply contracts.	Pre-construction and construction	All locations
Hydrology, flooding and water quality			
HF1	Permanent operational infrastructure and landforms within the transmission line easement would be designed and implemented/formed to minimise any potential scour and erosion risks associated with surface water runoff.	Pre-construction and construction	All locations
HF2	Detailed construction planning would consider flood risk at construction areas. This would include: • identifying measures that would be implemented to not worsen flood impacts downstream and on other property and infrastructure during construction up to and including the five per cent AEP design flood event, and • confirming site layouts to avoid or minimise obstruction of overland flow paths and to limit the extent of flow diversion required. Practicable measures identified to minimise potential flood risks at construction areas would be implemented.	Pre-construction and construction	Transmission line and construction sites within flood prone land

Reference	Mitigation measures	Timing	Application location(s)
HF3	A water quality monitoring program would be implemented to establish baseline water quality conditions at perennial watercourses that the transmission lines would cross, and to facilitate monitoring of any changes in water quality that may be attributable to the proposal during construction. The frequency, location and duration of sampling would be detailed in the monitoring program, but would include: • at a minimum two monitoring locations (one located upstream and one downstream of the transmission line crossing) of the proposal on Colombo Creek • downstream monitoring on the Murrumbidgee River with consideration of existing upstream WaterNSW gauges (including gauge 410130) • monitoring for total dissolved solids, total suspended solids, total nitrogen and total phosphorus. Sampling in the Murrumbidgee River and Colombo Creek would commence at least six months prior to the commencement of ground disturbing activities within the riparian zone at each respective location and then monthly during construction until completion of rehabilitation works in the respective areas. If there are exceedances of water quality criteria, then measures adopted as part of HF5 would be reviewed and revised. Monitoring would continue monthly during construction at each respective location until completion of rehabilitation works in the respective areas.	Pre-construction and construction	Upstream and downstream of the crossing transmission line crossing for Murrumbidgee River, Colombo Creek, Irrigation channel near Dinawan 330kV substation site (between Coleambally Irrigation Area and Yanco Creek)
HF4	Water supply options and management would occur in accordance with agreements between the construction contractor and relevant suppliers.	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
HF5	A Soil and Water CEMP sub-plan would be developed in consultation with a Certified Professional in Erosion and Sediment Control and implemented during construction. The plan would detail the processes, responsibilities and measures to manage potential soil and water quality impacts in accordance with the principles and requirements in: • *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom 2004), and *Volumes 2A and 2C* (DECCW, 2008), commonly referred to as the 'Blue Book' • *Best Practice Erosion and Sediment Control* (IESCA – 2008) • Transgrid's Environmental Guidance Notes • *Guidelines for Controlled Activities on Waterfront Land* (DPI, 2012a). The Soil and Water CEMP Sub-plan would contain appropriate measures (as a minimum) to: • minimise the extent of ground disturbance • divert surface water runoff around construction locations • install erosion controls within construction locations • collect and filter sediment from surface water runoff within construction locations • manage stockpiles to minimise erosion and sediment transport • manage saline and ASS (if present) • minimise the potential of soil and water quality impacts during storage of project wastes and potentially polluting substances • minimise the duration of soil exposure and progressively rehabilitate and stabilised disturbed areas • manage unexpected finds of contaminated materials • manage spills to reduce and address soil and water contamination.	Construction	All locations
HF6	Maintenance works in the vicinity of waterways would be conducted in accordance with Transgrid's Environmental Guidance Notes.	Operation	Transmission lines

Reference	Mitigation measures	Timing	Application location(s)
Air quality			
AQ1	To minimise particulate and gaseous emissions during construction, the following measures (as a minimum) would be implemented where practicable and appropriate: • use of water sprays or surfactants as required for dust suppression • adjust the intensity of dust generating activities based on observed dust levels and weather forecasts • protect stockpiled materials from wind erosion to minimise dust generation and position stockpiles as far as practicable away from any nearby receptors • limit vehicle movements to designated entry/exit routes and parking areas • implement measures to minimise the tracking of dust generating material onto paved roads • inspect and clean paved roads in the vicinity of site access points as required to minimise dust generation (up to 100 metres either side of the access point) • cover the loads of potential dust producing materials • minimise the extent of ground disturbance as far as practicable • stabilise disturbed areas as soon as practicable. The effectiveness of the installed controls would be monitored, and additional controls implemented as required to address any performance issues identified.	Construction	All locations
AQ2	Ensure that all vehicles and machinery are fitted with appropriate emission control equipment and maintained in a proper and efficient manner in line with guidelines contained in the National Environment Protection (Diesel Vehicle Emissions) Measure 2009.	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
AQ3	To minimise emissions from concrete batching plants, the following measures (as a minimum) would be considered and implemented where practicable and appropriate: • store all aggregate and sand in appropriate storage bins or bays to minimise dust generation, and ensure that the material does not exceed the height of the bay • fit cement silos and hoppers with dust filters and emergency pressure alert and automatic cut off overfill protection • fully seal all inspection points and hatches • ensure that all transfer methods adopted address and minimise potential dust generation • transfer of cement from storage to batching using sealed steel augers. The effectiveness of the installed controls would be monitored and additional controls implemented as required to address any performance issues identified.	Construction	Concrete batching plant(s)
AQ4	To minimise dust emissions during screening activities, the following measures (as a minimum) would be considered and implemented where practicable and appropriate: • ensure screen covers are fitted to the screening equipment • control dust emissions from screening activities using water sprinklers, where required and appropriate • inspect the water sprinklers on a regular basis and maintain as required to ensure operational efficiency • where practicable, install wind breaks in appropriate locations adjacent to the dust generating equipment and processes • prior to screening, dampen the rocks during dry weather conditions. The effectiveness of the installed controls would be visually monitored and additional controls implemented as required to address any performance issues identified.	Construction	Dinawan 330kV substation earthworks material site

Reference	Mitigation measures	Timing	Application location(s)
AQ5	To minimise potential odour emissions and impacts from the wastewater treatment plants, the following measures would be considered and implemented where practicable and appropriate: • prevent excessive inorganic material accumulating on the screens by disposing of screened material in waste bins on a regular basis • place waste bins containing screened material and sludge as far away as practicable from the construction compound and accommodation sites • ensure waste bins are fully closed at all times • remove screened material and sludge from site at regular intervals and dispose in an appropriate manner. The effectiveness of the installed controls would be monitored and additional controls implemented as required to address any performance issues identified.	Construction	Cobb Highway, Dinawan and Lockhart construction compound and accommodation sites
AQ6	During atmospheric conditions that are conducive to dust generation, dust generation from project-related traffic movements on unsealed roads and access tracks (routes) in close proximity to sensitive receivers would be visually monitored. Where dust from project-related traffic movements is impacting or has the potential to impact the sensitive receivers, measures to minimise dust emissions and potential associated amenity impacts would be implemented. The following measures would be implemented where practicable and appropriate: • lower the speed of project-related traffic along the routes • apply dust suppression (for example using water carts or the application soil binders) on appropriate sections of the route in the vicinity of potentially affected sensitive receivers. The effectiveness of the implemented controls would be visually monitored and additional controls identified and implemented as required and where practicable such as. • minimise the volume of project-related traffic using the routes • use alternative routes. The measures would remain implemented until more suitable atmospheric conditions prevail or the controls are no longer required to minimise potential dust impacts.	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
Noise and vibration			
NV1	A Construction Noise and Vibration Management Plan (CNVMP) would be prepared by the construction contractor prior to construction works commencing and would (as a minimum) identify: • all noise and vibration sensitive receivers • feasible and reasonable noise mitigation where management levels are likely to be exceeded • feasible and reasonable noise measures to manage traffic noise impacts on public roads where impacts are identified at any sensitive receiver due to proposal-related traffic • feasible and reasonable vibration mitigation where vibration criteria are likely to be exceeded • describe associated noise and vibration monitoring programs • refer to complaint handling protocols for complaints related to construction noise and vibration • outline community consultation measures including notification requirements. This CNVMP would be implemented for the duration of construction.	Pre-construction	All locations
NV2	Where noise from construction is likely to result in noise affected receivers, mitigation and management measures would be implemented where practicable and appropriate. This would include (but is not limited to) the following measures: • select quieter plant and equipment and use alternative construction methods to minimise noise levels • plan and schedule concurrent noisy activities to minimise the number of items of noisy plant operating at one time and cumulative noise levels • install screens or use barriers to mitigate noise from stationary noise sources • maximise the offset distance between noisy plant and orient equipment away from sensitive receivers • use noise source controls, such as residential class mufflers, to reduce noise from all regularly-used plant including cranes, excavators and trucks • use alternative reversing alarms in place of traditional beeper reversing alarms during OOH where noise impacts have been predicted	Pre-construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
	• turn off machinery when not in use • ensure equipment is well maintained and not generating excessive noise • operate machinery in a manner which reduces maximum noise level events, such as shaking excavator buckets, loading trucks from a height, steel on steel contact and dragging materials across hard surfaces • provide awareness training regarding noise mitigation measures to be implemented • notify and consult with potentially affected receivers about upcoming noisy activities • ensure that noise affected receivers outside standard construction hours and highly noise affected sensitive receivers are provided with appropriate respite.		
NV3	Where construction is likely to result in vibration levels that exceed relevant criteria at sensitive receivers, mitigation and management measures would be implemented where practicable and appropriate. This would include (but is not limited to) the following measures: • avoid the use of vibration-intensive plant at distances where human discomfort would result • substitute lower vibration-intensive plant and methods (for example use a smaller machine, lower power settings or alternative equipment) • sequence operations to avoid or minimise concurrent vibration-intensive activities • schedule the use of vibration-sensitive equipment during the least sensitive times of the day • confirm any vibration-sensitive heritage structures that could be impacted by the proposal works. Develop site-specific measures to avoid vibration impacts and implement the measures during vibration-intensive activities in the vicinity • inform and consult with potentially affected receivers about upcoming vibration-intensive activities.	Pre-construction and construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
NV4	Where noise from construction-related traffic is likely to result in road traffic noise increases of more than 2 dB at affected receivers, mitigation and management measures would be implemented where practicable and appropriate. This would include (but is not limited to) the following measures: • minimise proposal-related traffic movements along the route • minimise speeds for proposal-related traffic in the vicinity of affected receivers • avoid compression braking and the use of air brakes in the vicinity of affected receivers • implement driver training and measures to ensure driver awareness, speed limits, driver behaviour and designated routes are effectively communicated • limit traffic movements to daytime periods as far as possible and minimise traffic movements outside standard construction hours.	Pre-construction and construction	All locations
NV5	Activities likely to generate noise levels that exceed applicable noise management levels at sensitive receivers would be scheduled during standard construction hours wherever practicable. Other activities required outside standard construction hours that are likely to generate noise levels that exceed applicable noise management levels at any nearby sensitive receivers would be carried out in accordance with an out of hours works protocol (Mitigation measure NV6).	Construction	All locations, excluding the operation of the accommodation camps

Reference	Mitigation measures	Timing	Application location(s)
NV6	Develop and implement an out of hours works (OOHW) protocol that details how the proposal would identify, assess and approve out of hours works outside standard construction hours that are likely to generate noise levels that exceed the relevant noise management levels at sensitive receivers. The protocol would include provisions to: • carry out additional assessments for works proposed outside standard construction hours to confirm predicted noise levels • minimise noise levels outside standard construction hours • carry out the noisiest activities as early as possible in the work shift where practicable • identify appropriate respite for noise affected receivers (where required) • notify and engage with potentially affected receivers about upcoming works outside standard construction hours and address any associated complaints. The OOHW protocol would not apply to the operation of the accommodation camps. Prior to works outside standard construction hours, engagement and consultation would occur with potentially affected receivers regarding various mitigation and management measures. Based on this consultation, appropriate mitigation and management options would be considered and implemented where feasible and reasonable to minimise the impacts.	Construction	All locations, excluding operation of the accommodation camps
NV7	Where residences or other sensitive receivers/structures are within the minimum working distances for vibration, different construction methods with lower source vibration levels would be investigated and implemented, where feasible attended vibration measurements would be undertaken at the start of the works to determine actual vibration levels at the structure. Works would cease if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.	Pre-construction and construction	All locations
NV8	Prior to the commencement of blasting, a Blast Management Strategy would be developed. The strategy would describe the process that would be used to design each blast (depths and Maximum Instantaneous Charge for each location etc) to comply with relevant noise and vibration criteria at any nearby sensitive receivers. The strategy would also detail noise and vibration monitoring and landholder notification requirements for blasting. The strategy would be implemented for all blasting.	Construction	Blasting locations

Reference	Mitigation measures	Timing	Application location(s)
NV9	Investigate any complaints regarding construction noise and vibration to determine if actual noise and vibration levels are as predicted and that appropriate mitigation measures have been implemented. Where required, identify and implement appropriate additional mitigation measures.	Construction	Blasting locations
NV10	For each residence where potential operational noise levels are predicted to exceed project trigger levels, noise monitoring to confirm actual operational noise levels would be carried out: • within six months of the commencement of operation (where meteorological conditions permit); and • at the request of the landowner of the residence at any time within two (2) years after the commencement of operation. The noise monitoring would occur during weather/atmospheric conditions conducive to generating the corona effect. For residences where the monitoring identifies operational noise level in excess 35 dB(A) LAeq,15min and internal noise levels in excess of 25 dB(A) as a result, consultation would occur with the landowner of the affected residence to identity if treatment is required and, if so, confirm appropriate treatments. Once appropriate treatments have been confirmed in consultation with the landholder, the treatments would be implemented within 12 months. For the 500kV line between Dinawan 330kV substation and Wagga Wagga substation this assessment would be required to occur once the line is operational at the initial 330kV voltage and subsequently once the line is increased in operational capacity to 500kV (at a point in the future following the required additional network upgrades).	Operation	All locations
Traffic and access			
TA1	A traffic and transport management sub-plan would be developed and implemented. The sub-plan would detail how potential proposal-related traffic and access impacts during construction would be minimised and managed. This plan would be prepared in consultation with the local councils and Transport for NSW.	Pre-construction and construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
TA2	The traffic and transport management sub-plan would outline the process for obtaining road occupancy licences, and preparing and implementing traffic management plans and traffic controls plans, as required by the relevant roads authority, for road works. Road occupancy licences would be obtained prior to any such occupancy.	Pre-construction and construction	All locations
TA3	Any permits required under the National Heavy Vehicle Law for oversized and overmass vehicle movements associated with the proposal would be obtained from the National Heavy Vehicle Regulator. Permit applications would be supported by a Vehicle Movement Plan prepared to identify the proposed heavy vehicle route(s). The plan would consider activities of adjoining land uses and safety of the public, particularly when entering urban areas from rural highways.	Pre-construction and construction	Construction haulage routes, access/egress points to access tracks and main construction compound and accommodation camps.
TA4	Measures that are required to address potential road safety issues associated with proposal-related use of access routes would be identified in consultation with the relevant roads authority. Any road upgrade works to facilitate construction of the proposal would be designed in accordance with Austroads guidelines as relevant. The traffic and transport management sub-plan would include a program for monitoring road safety along proposal access routes and addressing any construction-related issues identified.	Pre-construction	Construction haulage routes, access tracks, main construction compound and accommodation camp accesses
TA5	A Driver Code of Conduct would be developed and implemented. The code would define acceptable driver behaviour for proposal personnel to promote road safety and ensure that the impacts of construction-related vehicle movements on local roads and the local community are minimised.	Construction	Construction haulage routes, access tracks, main construction compound and accommodation camp accesses
TA6	Consultation with rail authorities (operators) would occur for all proposal activities required in active rail corridors. The consultation would confirm authority requirements (such as track occupancy authorisations) and necessary requirements for staff working within the rail corridor (accreditations). All works in active rail corridors would occur in accordance with the identified requirements.	Pre-construction and construction	Where the transmission line requires access within the rail corridor.

Reference	Mitigation measures	Timing	Application location(s)
TA7	Road condition surveys would be carried out for all local roads that would be used as construction haulage routes, in consultation with the relevant roads authority. The surveys would be carried out prior to the road being used by heavy vehicles to support construction of the proposal. A road condition monitoring and maintenance program would be developed in consultation with the relevant roads authority for all local roads used as construction haulage routes and implemented for the duration of construction. Post-construction road condition surveys would be carried out for local roads used as a construction haulage route when use by construction vehicles ceases. Damage to the roads that is attributed to the proposal would be addressed in consultation with the relevant roads authority. Roads would be reinstated to equivalent or better condition.	Pre-construction and construction	All sealed local roads (within the vicinity or 200 m of the proposal) and/or all unsealed roads on haulage routes.
TA8	A community communications strategy would be developed and implemented to manage communications in order to engage and notify local communities of major works that could disrupt the road network. The communication strategy would be developed in conjunction with the traffic and transport management sub-plan to detail the methodology, frequency and response measures in relaying information to the community and for addressing community concerns. All affected communities would be notified in advance of any disruptions to the transport network. This may be in the form of variable message signs, website notices, public notices in local publications and personal correspondence.	Pre-construction and construction	All locations
TA9	Road Occupancy Licence(s) would be sought for all temporary lane closures (as required) with the relevant roads authority prior to construction. Any road closures with significant impact, such as short-term full road closure and long-term temporary lane/road closures would be assessed on a case-by-case basis, and approval sought from the relevant road authority. Where feasible, temporary road closures are to be planned outside of the traffic peak periods to minimise impact to the road network.	Construction	All roads that intersect with the transmission line alignment (for stringing of transmission lines) or on haulage routes.

Reference	Mitigation measures	Timing	Application location(s)
TA10	Vehicle Movement Plans would be prepared as part of the traffic and transport management sub-plan and implemented for all proposal heavy vehicle routes. The plans would identify the allowable heavy vehicle routes and include travel directions, permitted intersection turning movements, speeds, approved parking and lay-up areas, maximum allowable types/size of trucks and any traffic control required. The requirements of Vehicle Movement Plan would be communicated to all construction heavy vehicle drivers.	Construction	All roads on haulage routes, as identified in Table 4.4 of Technical paper 4.
TA11	Significant traffic generating developments in the vicinity of the proposal would be identified. Consultation would occur with those developments and the relevant roads authority regarding proposal-related vehicle movements and road works. Measures to address any potentially significant cumulative traffic and access impacts would be identified and implemented.	Construction	All locations
TA12	The appointed Construction Contractor would coordinate and appropriately manage movements on the alternative route options and communicate the changes to the affected residents and the council as part of the communication process of the traffic and transport management sub-plan. This would be implemented should local road closures be required and alternative route provided.	Construction	Local roads as identified in Table 4.4 of Technical paper 4.
TA13	A Fatigue Management Plan would be developed and implemented for proposal that addresses driver fatigue and associated regulatory requirements. This plan is to be implemented during construction.	Construction	All roads on haulage routes, as identified in Table 4.4 of Technical paper 4.
TA14	Road and surface conditions and the traffic controls implemented at each proposal site access/egress point from the sealed road network would be monitored during construction. Any identified issues would be rectified.	Construction	Access/egress points to access tracks and the main construction compound and accommodation camps
TA15	Construction access tracks would be retained for operational access, where required and practicable in consultation with the relevant landholder.	Operation	Access tracks

Reference	Mitigation measures	Timing	Application location(s)
Hazards and risk			
HR1	The proposal would be designed and constructed in accordance with the *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz) – 100 kHz)* (ICNIRP, 2010) The design would meet the EMF exposure guidelines set out in Table 19-2 of the EIS and worst case scenarios within Transgrid's *Transmission Line Design Manual – Major New Build*.	Pre-construction	All locations
HR2	A minimum 50-metre-wide managed APZ would be provided to the hazard perimeter of the fixed construction equipment and camp site buildings unless an alternative fire protection approach that achieves the same level of bushfire risk management is identified by a suitably qualified specialist. Any APZ would be regularly maintained to provide a maximum grass height of 100 millimetres - 150 millimetres during the prescribed Bushfire Danger Period and when the grassland fuel reaches 70 per cent cured. Vegetation inside the main construction compounds and accommodation camp sites would be regularly maintained to a maximum height of 75 millimetres.	Pre-construction and construction	Main construction compounds and accommodation camps
HR3	Buildings within the construction compound and camp site would be constructed to comply with Section 3 and Section 5 (BAL 12.5) of *Construction of Buildings in Bushfire Prone Areas – AS 3959:2018* (Standards Australia, 2018). The sub-floor space of each building would be enclosed with stainless steel flymesh securely fixed to the external wall(s) and buried into the ground, unless an alternative fire protection approach that achieves the same level of bushfire risk management is identified by a suitably qualified specialist.	Pre-construction and construction	Main construction compounds and accommodation camps
HR4	Water for fire-fighting operations would be confirmed prior to during construction with consideration to occupancy density and site layout. This would include onsite static water supply and fire-fighting hose reels when working in areas where vehicles may travel through environments such as areas of: • known rocks where equipment such as bulldozers and excavators may create sparks • long cured (dry) vegetation (grass and crops). All weather access having a minimum width of four metres would be provided to the static water supply tanks.	Pre-construction and construction	Main construction compounds and accommodation camps

Reference	Mitigation measures	Timing	Application location(s)
HR5	Appropriate construction methods and protection measures for crossing of the high-pressure gas transmission pipeline west Olympic Highway would be confirmed in consultation with APA Group and implemented during construction activities in the vicinity.	Pre-construction and construction	High-pressure gas transmission pipeline crossing, west of Olympic Highway
HR6	Security measures would be implemented to minimise the risk of ignition leading to bushfire(s). Sources of potential ignition would be secured at the end of each shift or as sites are left unattended.	Construction	Main construction compound and accommodation camp sites
HR7	Consultation with emergency services (the NSW Rural Fire Service and Fire and Rescue NSW) would be undertaken prior to construction to ensure emergency access provisions are provided during operation.	Construction	All locations
HR8	Prior to occupation of the construction camps and offices, all bushfire protection and mitigation measures would be certified as compliant with relevant regulatory requirements by a suitably qualified bushfire consultant.	Construction (prior to camp occupation)	All locations
HR9	Controls to minimise potential ignition of vegetation would be implemented and a water supply (suitable extinguisher) and trained operator on hand during all outdoor hot works/grinding activities, and during vegetation slashing within and adjacent to the construction compounds and accommodation camps. No outdoor hot works would be undertaken during periods of Total Fire Ban and Catastrophic Fire Weather Days unless there is a suitable fire suppression unit present on site and only with prior agreement with local fire services.	Construction	All locations
HR10	To reduce the level of risk of ignition of the surrounding vegetation Transgrid would need to engage appropriate measures to ensure fire-fighting resources are available before blasting occurs.	Construction	All locations blasting proposed
HR11	All chemicals, fuels or other hazardous substances would be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of any bunded area shall be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s shall be shown on the site plans.	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
HR12	Equipment would be checked in accordance with Australian Standard requirements for potential electrical faults, including faulty power leads and generators.	Construction	All locations
HR13	Dangerous goods and hazardous substances would be transported in accordance with relevant legislation and codes, including the *Dangerous Goods (Road and Rail Transport) Act 2008*, Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998 and the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2018).	Construction	All locations
HR14	Appropriate spill containment equipment would be provided and located at strategic, accessible locations.	Construction	All locations
HR15	Security measures would be implemented to minimise the risk of arson within and adjoining construction areas. The location of appropriate security measures would be determined using a risk-based approach.	Construction	All locations
HR16	All chemicals or other hazardous substances at the Dinawan 330kV substation and existing Wagga Wagga substation would be stored in bunded and weatherproof facilities away from drainage lines, and in accordance with supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of the bunded area would be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s would be shown on the site plans.	Operation	Dinawan 330kV substation
HR17	Emergency spill procedures would be implemented to avoid and manage accidental spillages of fuels, chemicals or fluids during operation and maintenance activities in accordance with the Transgrid's HSE Guideline. Environmental spill kits would be provided at strategic, accessible locations, and staff would be trained in spill response procedures.	Operation	All locations
HR18	The Wagga Wagga substation Emergency Response Manual would be updated to include the new proposed design and required revised emergency response procedures.	Pre-operation	Wagga Wagga substation
HR19	An Emergency Response Manual would be prepared for the proposed Dinawan 330kV substation and include emergency response procedures.	Pre-operation	Dinawan 330kV substation

Reference	Mitigation measures	Timing	Application location(s)
HR20	The proposal would be designed, operated and maintained in accordance with Transgrid's Bushfire Risk Management Plan. This includes reduction in fuel loads, management of APZs and inspections of infrastructure.	Operation	All locations
Soils, contamination and groundwater			
SCG1	Construction materials would be selected to withstand high saline soil and groundwater environment (where applicable).	Pre-construction and construction	Locations mapped as moderate to high-risk salinity.
SCG2	Disturbance to areas of medium risk of contamination would be avoided or minimised where practicable during construction. Disturbance to these areas refers to intrusive work, such as excavation. Where disturbance cannot be avoided, potential impacts would be minimised during finalisation of the design and construction methodology where practicable. Areas of medium risk of contamination that would be disturbed by construction activities would be further investigated including completion of a site inspection. Based on the outcome of the site inspection, where considered to be required, a Phase 2 investigation would be completed in accordance with National Environmental Protection Measure 2013. Additional mitigation measures identified through further investigation would also be implemented.	Pre-construction	Cleared agricultural land, potential quarry and PFAS sites.
SCG3	Direct impacts to registered bores would be avoided, where possible. If the bores are: • not required to be removed during construction, then they would be clearly demarcated with a 5 by 5 metre construction exclusion zone • are to be removed during construction or unavoidably damaged, then make good provisions would apply in consultation with the registered bore owner.	Pre-construction and construction	Registered bores (refer Table 21 7)
SCG4	Prior to carrying out any blasting, a desktop assessment would be carried out to identify any high potential GDEs and registered bores in the vicinity that might be affected. Potential impacts to the GDEs and bores would be assessed using the latest available location data. The assessment would identify any necessary measures to mitigate any potential significant impacts. The measures would be implemented during the blasting. Where the assessment identifies potentially significant impacts to high potential GDEs and bores due to blasting that cannot be mitigated, alternative lesser impact construction methodologies or engineering solutions would be investigated and implemented.	Construction (prior to blasting)	Finalised blasting locations if within 50 metres of high potential GDEs

Reference	Mitigation measures	Timing	Application location(s)
SCG5	Construction materials, spoil and waste would be suitably stored to minimise the potential for soil, groundwater or water quality impacts.	Construction	All
SCG6	Prior to ground disturbance in areas of PASS occurrence (e.g. in low lying areas surrounding former or current lakes and river beds), testing would be carried out to determine the presence of actual and/or potential ASS. If ASS are encountered, they would be managed in accordance with the *Acid Sulfate Soil Manual* (ASSMAC, 1998) and Transgrid's HSE Guideline.	Construction	All areas identified as potential ASS.
SCG7	Prior to ground disturbance, a visual inspection would be undertaken for the presence of saline soils. Areas of known or suspected salinity would be subject to further testing as required. If salinity is confirmed, excavated soils would be managed in accordance with *Book 4 Dryland Salinity: Productive use of Saline Land and Water* (NSW Department of Environment and Climate Change, 2008b) and the *Salinity Training Manual* (DPI, 2014) to manage salinity impacts. Erosion controls would be implemented in accordance with *The Blue Book* (Landcom, 2004).	Construction	All
SCG8	All chemicals, fuels or other hazardous substances would be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of any bunded area shall be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s shall be shown on the site plans.	Construction and operation	All (construction) Dinawan and Wagga substations (operation)
SCG9	The discovery of previously unidentified contaminated material would be managed in accordance with an unexpected contamination finds procedure.	Construction	All

Reference	Mitigation measures	Timing	Application location(s)
SCG10	A site-specific risk assessment would occur for locations where there is a risk of encountering UXO. The risk assessment would be carried out prior to any activities that could interact with UXO. This would include field verification to validate the historical assessment of UXO contamination and identify appropriate mitigation practices. The risk assessment would occur with input from an appropriate UXO specialist and would identify if and when an explosives engineer is required during site activities. An unexpected finds procedure would be implemented. The procedure would specify the actions that site personnel must take to minimise the risk to and from any UXO encountered. The management actions identified in the risk assessment would be implemented prior to and during all relevant site activities. All personnel conducting intrusive works within an identified UXO area would be provided with appropriate safety and awareness briefing(s) prior to the participating in the intrusive works.	Pre-construction and construction	All
SCG11	If groundwater is encountered during piling or excavations, and dewatering is required, any dewatering volumes would be recorded by the contractor (and made available to the relevant authority – such as DPIE or DPI – upon request).	Construction	All locations
SCG12	Environmental spill kits containing spill response materials suitable for the works being undertaken would be available at the proposed Dinawan and Wagga substations with extras available to be carried in vehicles for use at maintenance work sites.	Operation	Dinawan and Wagga substations
Waste management and resources			
WM1	The proposal would achieve an Infrastructure Sustainability Council verified 'Design' and 'As-built' rating of Excellent under v1.2 of the IS rating tool.	Pre-construction and construction	All locations
WM2	Measures to minimise excess spoil generation would be investigated at finalisation of the proposal's design and construction methodology. This would include a focus on optimising the design to minimise spoil volumes and the reuse of material on-site.	Pre-construction	All locations
WM3	Opportunities to re-use or recycle construction and demolition waste would be investigated during finalisation of the proposal's design and construction methodology.	Pre-construction	All locations
WM4	All waste would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
WM5	Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities.	Construction	All locations
WM6	All waste generated and surplus spoil to be removed from the construction of the proposal would be transported to appropriately licensed waste disposal or transfer facilities or other facilities lawfully able to accept materials.	Construction	All locations
WM7	Waste during operations would be managed in accordance with Transgrid's existing Environmental Management System and processes for the identification, classification, handling and management of waste.	Operation	All locations
WM8	All waste would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).	Operation	All locations
Cumulative impacts			
CI1	Consultation with relevant roads authority would occur in relation to road use.	Construction	All locations
CI2	Consultation with relevant local councils and other water supply operators would occur in relation to the proposal's water supply strategy to ensure there is effective management of these demands during construction and operation.	Pre-construction	All locations
SE5	If proposal construction coincides with the construction of other projects around Wagga Wagga, a workforce accommodation strategy for the proposal would be implemented and would be informed by an additional review of existing housing and accommodation capacity relative to the proposal workforce needs.	Pre-construction	Wagga Wagga LGA
TA11	Significant traffic generating developments in the vicinity of the proposal would be identified. Consultation would occur with those developments and the relevant roads authority regarding proposal-related vehicle movements and road works. Measures to address any potentially significant cumulative traffic and access impacts would be identified and implemented.	Construction	All locations

Appendix F Project description and construction mapping

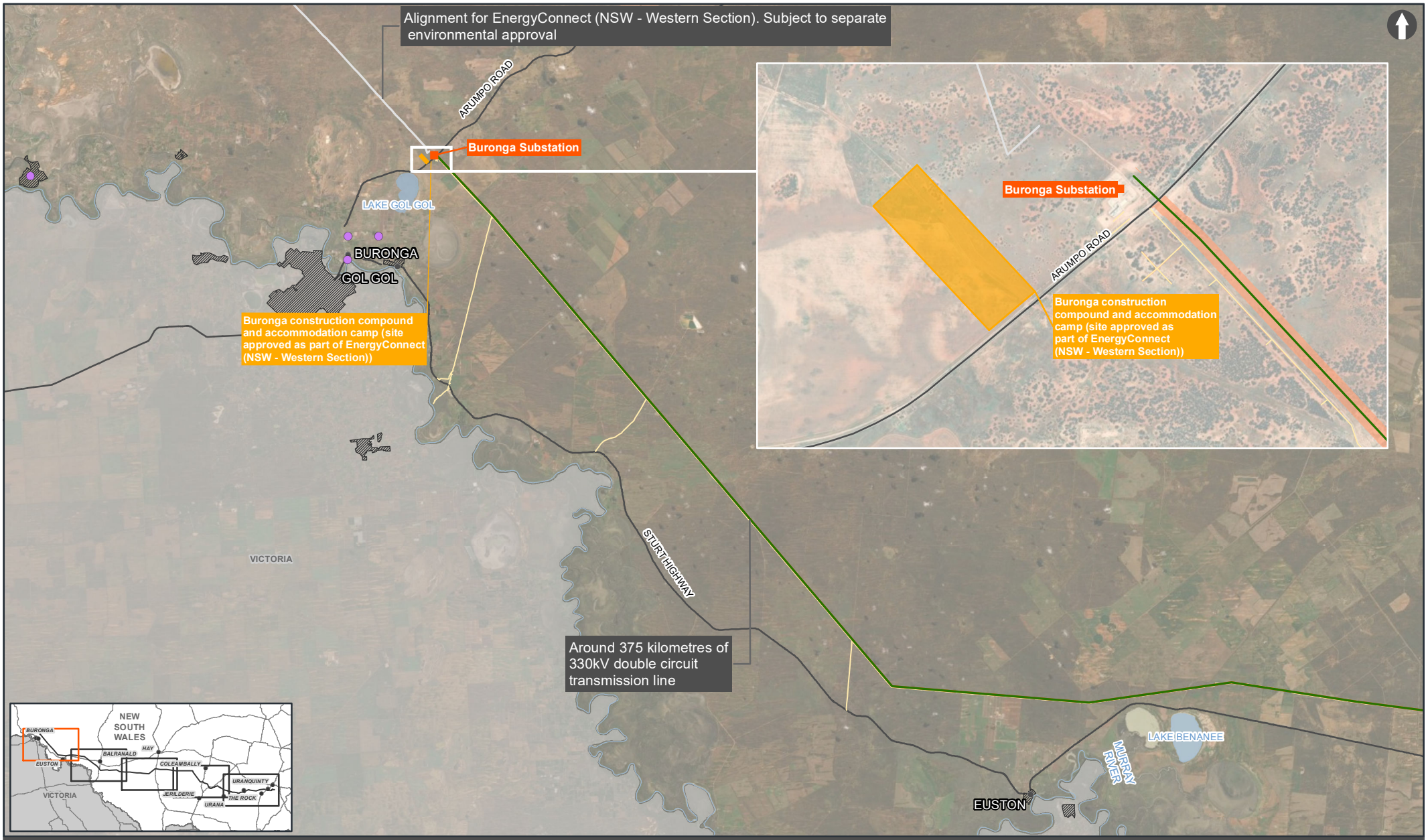


Figure F-1

Detailed proposal and construction elements

- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Greenfield)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Greenfield)
- EnergyConnect (NSW - Western Section)
- Existing Substation
- Existing Railway
- Existing Roads
- Built Up Areas

Construction Impact Area Components

- Construction Impact Area (transmission line component)
- Water Fill Point
- Access Tracks
- Main Construction Compounds and Accommodation Sites

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Source: NSWSS, ESRI, Transgrid, WSP

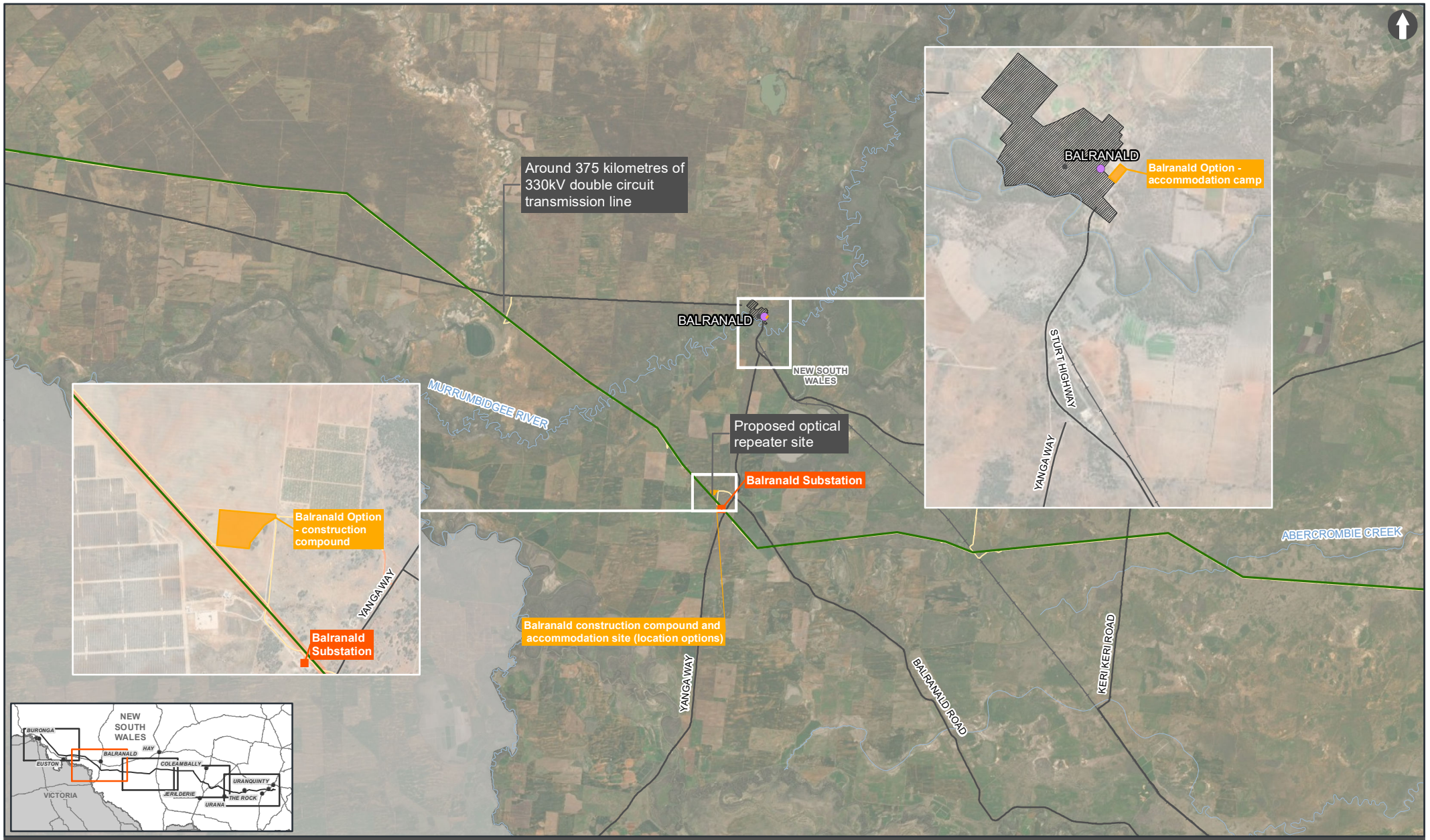

Figure F-2

Detailed proposal and construction elements

- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Greenfield)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Greenfield)
- EnergyConnect (NSW - Western Section)
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- Existing Railway
- Existing Roads
- Built Up Areas

Construction Impact Area Components

- Construction Impact Area (transmission line component)
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- Access Tracks
- Main Construction Compounds and Accomodation Sites

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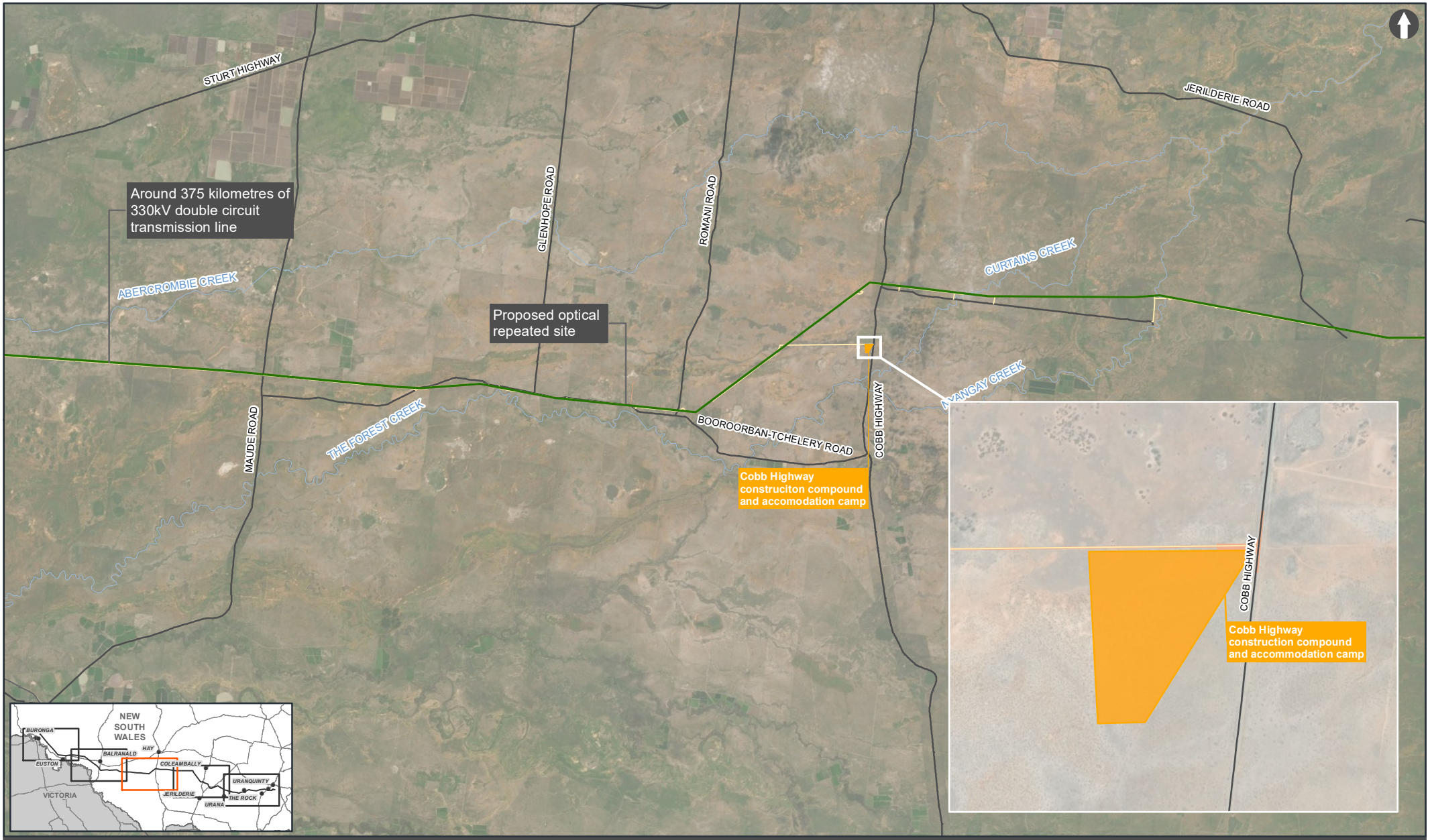

Figure F-3

Detailed proposal and construction elements

- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Greenfield)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Greenfield)
- Existing Substation
- Existing Railway
- Existing Roads
- Built Up Areas

Construction Impact Area Components

- Construction Impact Area (transmission line component)
- Water Fill Point
- Access Tracks
- Main Construction Compounds and Accommodation Sites

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Source: NSWSS, ESRI, Transgrid, WSP

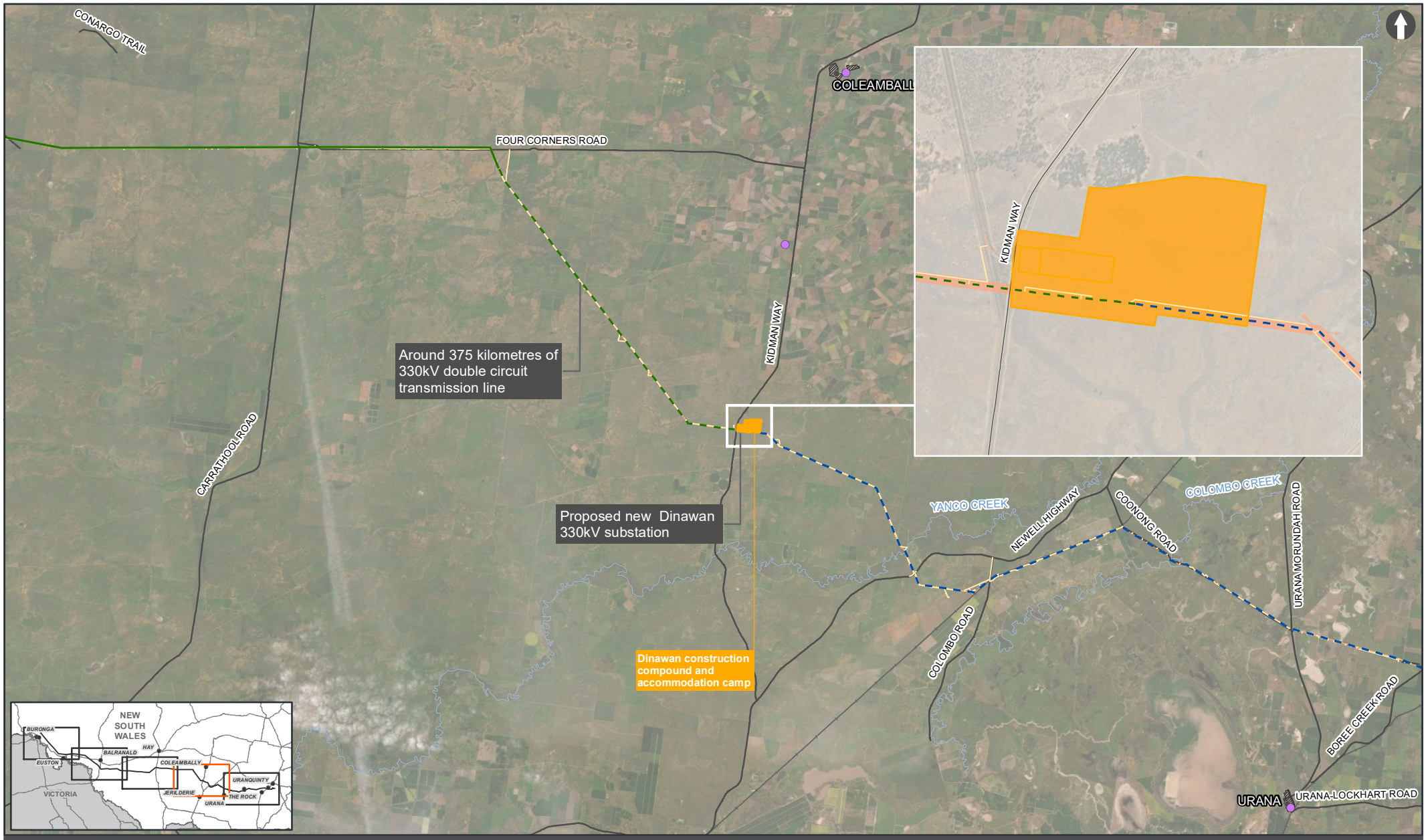

Figure F-4

Detailed proposal and construction elements

- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Greenfield)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Greenfield)
- Existing Substation
- Existing Railway
- Existing Roads
- Built Up Areas

Construction Impact Area Components

- Construction Impact Area (transmission line component)
- Water Fill Point
- Access Tracks
- Main Construction Compounds and Accommodation Sites

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Source: NSWSS, ESRI, Transgrid, WSP

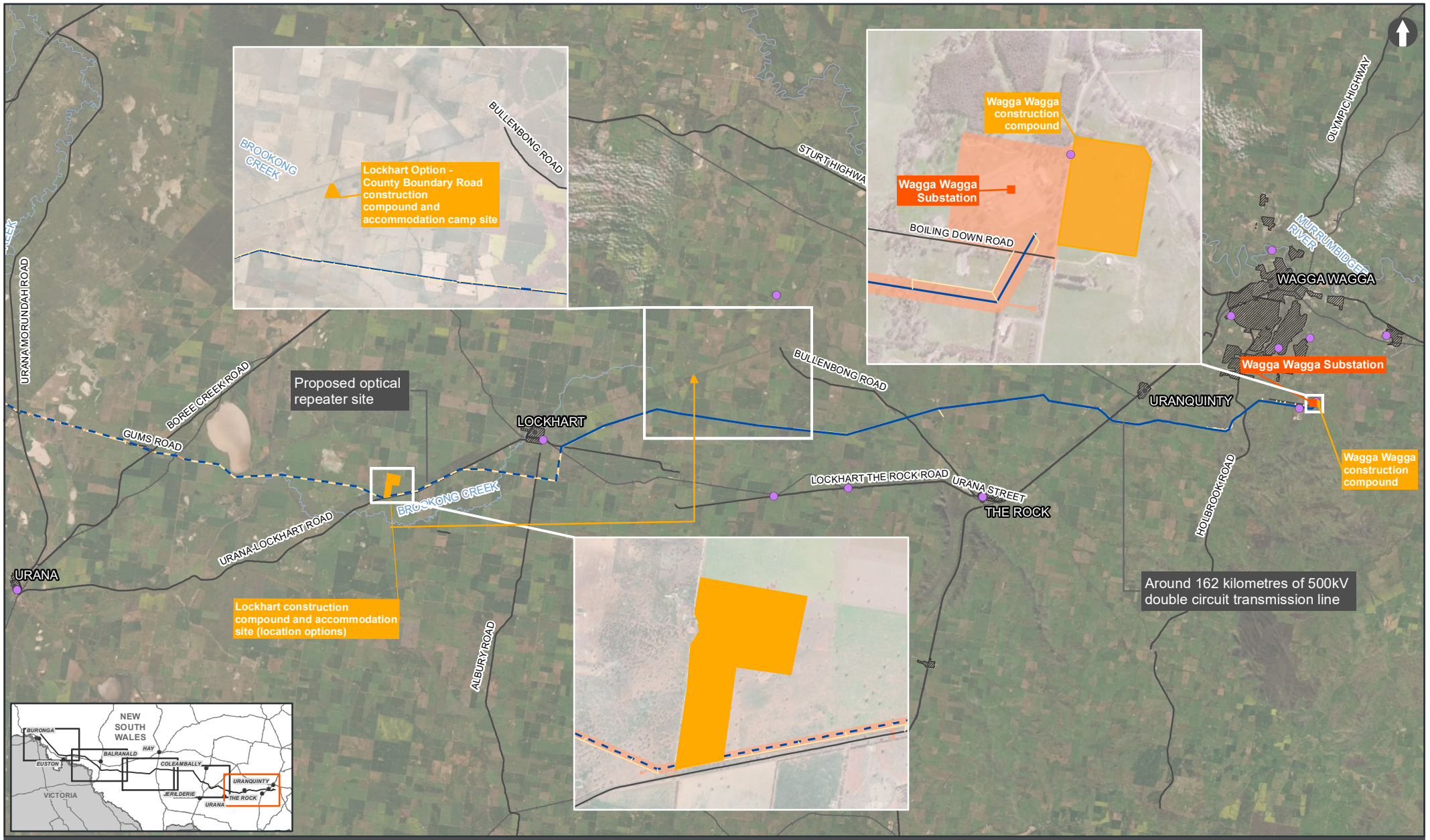

Figure F-4

Detailed proposal and construction elements

- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Parallel)
- EnergyConnect (NSW - Eastern Section) 330kV transmission line (Greenfield)
- EnergyConnect (NSW - Eastern Section) 500kV transmission line (Greenfield)
- Existing Substation
- Existing Railway
- Existing Roads
- Built Up Areas

Construction Impact Area Components

- Construction Impact Area (transmission line component)
- Water Fill Point
- Access Tracks
- Main Construction Compounds and Accommodation Sites

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Source: NSWSS, ESRI, Transgrid, WSP